

## Business case for Electronic Blood Management Systems (EBMS)

Transfusion step	Safety/cost/efficiency gains	Comments/caveats
<b>Sample collection and labelling</b>	<p>Patient safety - Handwritten request forms and samples are at risk of transcription errors resulting in rejected samples.</p> <p>Staff efficiency - EBMS provides an effective and safe process for electronic labelling of transfusion samples can reduce the rate of sample rejection by more than 50%<sup>1</sup>. Cost of sample rejection estimated at approximately £16 per sample<sup>**</sup>. The additional cost for increased length of stay due to rejected blood test from A&amp;E has been calculated as £10,538.54 for Hb sampling<sup>11</sup>.</p> <p>Patient safety- Wrong blood in tube (WBIT) is caused by failures in positive patient identification and failures to label the sample at the patient side<sup>2</sup>. EBMS enforces scanning of the patient ID band within a defined time frame reducing the risk of WBIT<sup>1</sup>.</p> <p>Staff efficiency - Cost of investigation of SABRE/SHOT reportable events, including WBIT, estimated at £2000 per event<sup>4</sup>.</p> <p>Staff efficiency - EBMS can remove the requirement for a 2-sample policy, reducing staff time and additional phlebotomy event for the patient.</p>	<p>Misuse of EBMS for sample labelling, such as scanning ID bands that are not attached to the patient, can still result in WBIT<sup>3</sup>.</p> <p>Failures in equipment set up and maintenance can result in label misalignment and sample rejection<sup>3</sup>.</p> <p>Misuse of EBMS should be considered and risk assessed if removing a 2-sample policy.</p> <p>Needs process for system downtime events that is simple and known by all staff.</p>
<b>Laboratory component delivery</b>	Where LIMS are unable to provide a process for accepting electronic delivery notes (EDN) for components supplied by the blood service, EBMS can support this functionality.	Need process for EDN failure and system downtime events.

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	<p>Staff efficiency - Manual acceptance of blood components includes scanning of 4 barcodes on the components. Manual entry of antigen negative attributes is at risk of transcription error. Manual process may not identify where components are missing from the delivery.</p> <p>Patient safety and staff efficiency -EDN includes scanning of 2 barcodes on the component, all antigen negative requirements (except HT negative) are electronically transmitted in the EDN.</p> <p>Patient safety - Failure to provide red cell units with correct antigen attributes is externally reportable to SABRE/SHOT. Staff efficiency - Cost of investigation of SABRE/SHOT reportable events, including WBIT, estimated at £2000 per event<sup>4</sup>.</p> <p>Staff efficiency savings for component delivery processing. Patient safety improvement by removing transcription errors in manual transcription of component attributes.</p>	
<b>Temperature monitoring of blood fridges</b>	<p>Staff efficiency - EBMS linked to smart fridges provides electronic display of the blood fridge temperature at the fridge and in the laboratory system. This removes the requirement for paper charts and manual checking of blood fridge temperatures. Storage of paper charts required presenting challenges with retention of records.</p> <p>EBMS retains all temperature readings in graph and excel format for audit and investigation purposes.</p> <p>EBMS provides audible and visual alert in the laboratory system in the event of a temperature excursion.</p>	<p>EBMS may not provide an escalation process for temperature excursions, therefore a third-party system may be required for provision of escalation and action.</p> <p>EBMS must comply with BSH IT guidelines<sup>5</sup>, including back-up, maintenance, and disaster recovery.</p> <p>When setting up alarms, consideration must include potential for alert fatigue on staff. All alerts and alarms must have clearly defined actions appropriate to alert.</p>

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	<p>Staff efficiency savings where remote blood fridges need to be checked daily to provide assurance of temperature and weekly for replacing paper charts. This can be calculated locally by activity follow or equivalent study.</p> <p>Regulatory improvement in terms of record retention of blood fridge temperatures.</p>	<p>Check if the system will re-alarm should an alert not be cleared and if not ensure you have save processes to cover this eventuality.</p>
<b>Accessibility to patient sample validity and eligibility for electronic issue information</b>	<p>Staff efficiency - EBMS can provide visibility of patient sample validity and eligibility for electronic issue for clinicians.</p> <p>Sample validity and testing results on LIMS and Electronic Patient Record (EPR) may not provide information that tells the clinical team if a sample is valid for crossmatch and/or electronic issue. This can result in telephone calls to the laboratory for confirmation for patients requiring transfusion and those being prepared for surgery.</p> <p>Staff efficiency savings by reducing the number of telephone calls to the laboratory.</p>	<p>Some staff efficiency on clinical side but need to consider time taken to access the EBMS.</p> <p>EBMS may not be integrated into EPR, consideration given to training requirements to ensure staff know how to access the system.</p> <p>Clarity must be given when samples are available, but blood is not easily accessible e.g., presence of antibodies, samples referred to reference centres for further testing</p>
<b>Laboratory component labelling</b>	<p>Patient safety - EBMS provides a process for label verification (if this is not available within existing LIMS functionality) that confirms that the correct compatibility label has been applied to the component prior to release.</p> <p>Patient safety - EBMS ensure that the component cannot be placed into the blood fridge (or other storage device) for collection until the label verification process has been completed.</p>	<p>Needs process for system downtime events that is simple and known by all staff.</p> <p>When alerted to labelling errors, this should incorporate a 'start from beginning' alert to ensure appropriate safety checks are completed</p>

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	<p>Patient safety - Transposition of component compatibility labels is SABRE/SHOT reportable. Errors in component labelling can result in collection and administration of the wrong unit to the patient<sup>2</sup>.</p> <p>Staff efficiency saving where laboratories are using a double independent check for component labelling prior to release. EBMS provides quick and effective second checking process, releasing staff time<sup>4</sup>.</p> <p>Patient safety improvement by reducing labelling errors<sup>4</sup>. Estimated cost of investigating SABRE/SHOT reports at £2000 per event.</p>	
<b>Collection of components</b>	<p>EBMS provides a system for ensuring that blood components are only collected by staff that are trained and competency assessed to perform this role, in accordance with the Blood Safety and Quality Regulations<sup>6</sup>.</p> <p>Where collection documentation is in paper format this requires regular audit to provide assurance that collections are being undertaken by trained staff. EBMS allows audit to be limited to certain staff groups to ensure appropriate use of access cards, providing staff efficiency gains. Staff efficiency of collection process – time spent doing manual collection process reduced by 66% with EBMS.</p> <p>Patient safety - EBMS provides visual and audible alert to the user (and the laboratory) where the incorrect component has been taken out of the storage area and scanned. The rate of incorrect collections is difficult to identify with manual paper records but</p>	<p>Needs process for system downtime events that is simple and known by all staff.</p> <p>Access to EBMS controlled blood fridges needs to be simple but safe to avoid delays in transfusion.</p> <p>Access to emergency group O red cells (or major haemorrhage packs) needs to be simple but safe to avoid delays in transfusion.</p> <p>EBMS with standard blood fridge at risk of no-scan events (user takes the component from the blood fridge but does not scan to confirm it is the correct component). These require investigation at the time of the event, staff time and distraction from service provision. Smart fridges alert the lab to no-scan but assurance that the correct unit has been taken.</p>

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has been reported to equate to 0.45% of collections when EBMS used with standard blood fridge<sup>7</sup>. EBMS with smart fridges ensures that only the component labelled for patient on pick-up slip can be removed from the blood fridge.

EBMS provides alerts where user attempts to remove a component for the patient and there is a component with a shorter expiry date available. EBMS with smart fridge ensure that components can only be removed in expiry date order. Improvement gains for stock management.

Patient safety - EBMS quarantines components that have passed their expiry date, or dereservation date, and prevents collection from blood fridge. Where standard blood fridges are used access may still be granted if non-expired units are available for the patient, expired unit may be taken in error. EBMS with smart fridges ensure that expired, or past dereservation date, components cannot be accessed by the collector.

Patient safety - EBMS provides a process for laboratory staff to remotely quarantine components in blood fridges. Where EBMS is used with smart fridges there is no requirement for staff to immediately retrieve the component from the fridge as it is not accessible. Staff efficiency improvement gains.

Patient safety - EBMS provides a process that ensures that red cell that have been out of controlled storage for more than 30 minutes and are not required for transfusion cannot be placed back in a blood fridge for collection at a later time.

Process must be in place to ensure that pick-up slips are discarded at the blood fridge to reduce risk of using incorrect pick-up slip.

Consideration of process for major haemorrhage where it may be reasonable to use the same pick-up slip for multiple collections of red cells (or other blood components), must ensure that pick-up slip is disposed at the end of the event.

EBMS must ensure that only the component type detailed on the pick-up slip can be collected.

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	<p>Patient safety – EBMS provides a process for compliance with cold chain, with alert to laboratory staff where a component has been out of controlled storage for longer than the stipulated time. Assurance that the component cannot be returned to stock and released for another patient.</p> <p>Patient safety - EBMS provides a system that ensures that components cannot be placed into the wrong type of storage device (e.g., platelets, cryoprecipitate and granulocytes cannot be put into a fridge).</p> <p>Staff efficiency – gains in reduction of time spent investigating errors in collection (SABRE/SHOT estimated at £2000 per event), cold chain and component retrieval. Gains increased where smart fridges are used with EBMS.</p>	
<b>Administration of components</b>	<p>Staff efficiency - For organisations using a double independent poor compliance has been reported<sup>4</sup>. EBMS provides patient safety improvement by providing an electronic second check. Reported that time spent on administration check is reduced by 30% annually by EBMS<sup>4</sup>.</p> <p>Patient safety - EBMS provides patient safety improvement by enforcing a check against the patient ID with time out function, check includes compatibility label and unit details<sup>4</sup>. EBMS alerts to user and laboratory system where there have been attempts to transfuse the component to the wrong patient. Reported near miss rate with EBMS in place 0.09% of red cell transfusions per year, however this is difficult to quantify with no EBMS in use<sup>4</sup>.</p>	<p>Needs process for system downtime events that is simple and known by all staff.</p> <p>Requires monitoring of non-compliance with use of the EBMS at this step, with feedback and improvement actions</p>

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	<p>Patient safety - EBMS provides visual information relating to component time out of storage and when the transfusion should be completed.</p> <p>Patient safety – EBMS can be used to record patient observations during transfusion.</p> <p>Staff efficiency - Estimated cost of SABRE/SHOT reportable event is £2000, cost of ABOi never event will be much higher.</p>	
<b>Component wastage</b>	<p>EBMS provides automated cold chain information, removes requirement for checking paper documentation, challenges with missing information and reduces component wastage.</p> <p>Red cell wastage reduction estimated at approximately 70% per year with introduction of EBMS<sup>4</sup>.</p> <p>Red cell wastage reduced by £9,790 per annum in organisation receiving approximately 12,000 red cells per year<sup>4</sup>.</p>	Needs process for system downtime events that is simple and known by all staff.
<b>Remote issue of red cells</b>	<p>Patient safety - EBMS combined with LIMS and smart fridges provides a safe, rapid, and effective process for remote issue (RI) of red cells without involvement of laboratory BMS staff<sup>7</sup>.</p> <p>Staff efficiency – gains in clinical and laboratory setting as red cells can be released for transfusion by non-registered staff. Cost gains have been reported as registered clinical staff costs approximately 55p per red cell unit compared to 30p for non-registered staff. RI can also be incorporated into laboratory process where it has been estimated that EI by registered laboratory staff costs</p>	Needs process for system downtime events that is simple and known by all staff.

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	approximately £1.40 compared to 32p for RI by non-registered staff <sup>10</sup> .	
<b>Traceability</b>	<p>BSQR expectation for 100% traceability, challenges with paper records, missing records, access to patient notes and positive confirmation of transfusion.</p> <p>EBMS provides confirmation of transfusion to the patient with no requirement for return of paper traceability records.</p> <p>Staff efficiency – time spent on traceability reduced by over 99% per year<sup>4</sup>.</p>	Needs process for system downtime events that is simple and known by all staff.
<b>General</b>	Staff efficiency – reductions in staff time for collection, administration, incident reporting and traceability amounted to an estimated cost saving of £61,321 per annum in organisation transfusing approximately 11,000 red cells per year <sup>4</sup> .	Interoperability between systems is encouraged to maximise potential of systems. Where this occurs, IT teams must liaise with transfusion teams when software upgrades of equipment replacements are planned, to ensure continuity and potential revalidation of the systems.

### References:

1. Davies, Piper, Khan, Wisely, Ferguson and Kerr. Wrong blood in tube errors – does electronic labelling reduce the risk? (2019), Abstracts-Poster Sessions. Transfusion Med, 29: 25-67. <https://doi.org/10.1111/tme.12636>
2. S Narayan (Ed) D Poles et al. on behalf of the Serious Hazards of Transfusion (SHOT) Steering Group. The 2022 Annual SHOT Report (2023). <https://doi.org/10.57911/wz85-3885>
3. Davies, Cowan and Kerr. Digital transfusion – panacea or tar pit? (forthcoming)
4. Davies, Piper, et al. Electronic Blood Tracking – realising the safety and efficiency benefits using the Haemonetics BloodTrack system (2017), Abstracts-Poster Sessions. Transfusion Med, 27: 24-70. <https://doi.org/10.1111/tme.12471>
5. BSH guidelines for IT (2024)(forthcoming)
6. BSQR. The Blood Safety and Quality Regulations ISBN 0110990412 (2005).



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7. <http://www.legislation.gov.uk/ukxi/2005/50/contents/made> Electronic remote blood issue supports efficient and timely supply of blood and cost reduction: evidence from five hospitals at different stages of implementation. Staples, S., Staves, J., Davies, J., Polley, N., Boyd, J., Lukas, M., Popovsky, M., Frank, S., Ness, P. and Murphy, M. Transfusion, 2019
8. Murphy MF, Addison J, Poles D, et al. Electronic identification systems reduce the number of wrong components transfused. Transfusion 2019;59(12):3601-3607. <https://onlinelibrary.wiley.com/doi/10.1111/trf.15537>
9. Davies et al. Near Miss Blood Product Events - technology complacency or were we really that bad? BBTS presentation 2018 (2018), Abstracts-Speaker Sessions. Transfusion Med, 28: 3-25. <https://doi.org/10.1111/tme.12557>
10. Davies et al. Remote issue of red cells by non-registered staff BBTS 2022 TM abstract (2022), Poster session: Blood donation (including donor safety). Transfusion Medicine, 32: 20-55. <https://doi.org/10.1111/tme.12910>
11. Bodansky DMS, Lumley SE, Chakraborty R, Mani D, Hodson J, Hallissey MT, Tucker ON. Potential cost savings by minimisation of blood sample delays on care decision making in urgent care services. Ann Med Surg (Lond). 2017 Jun 16;20:37-40. doi: 10.1016/j.amsu.2017.06.016. PMID: 28702185; PMCID: PMC5491485.  
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5491485/#:~:text=Sample%20rejection%20resulted%20in%20a,high%20proportion%20of%20lost%20samples>

\*\* reference to follow

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