



## Recommended

This has been highlighted as a potential high-impact change by our peer review process

# Electronic blood transfusion systems

Provided by: Oxford Radcliffe Hospitals

## Summary

Oxford Radcliffe Hospitals have successfully implemented an electronic blood transfusion system. This has improved quality by reducing transfusion errors and the time taken to deliver blood. Productivity has improved by reduced blood usage, wastage and staff time.

## Evidence summary

- Yes** The intervention has been successfully implemented
- Yes** The intervention has been successfully replicated
- Yes** The intervention is linked to standards or guidance
- Yes** The intervention is supported by one or more national organisations
- Yes** An evaluation of the effects of the intervention has been carried out
- Yes** There are publications relating to this intervention

## The proposal

### Proposal description

The proposal is to 're-engineer' hospital transfusion services (which are well known to be prone to error) using new technology:

1. Redesign of hospital blood transfusion incorporating barcode patient identification and bedside handheld computers to prompt staff through every step and verify that the correct blood is transfused.

The electronic transfusion system uses two-dimensional barcodes on patient wristbands, blood samples and blood units, within which is encoded the patient core identity data. By scanning the barcodes using a handheld computer, the patient is identified by the staff member who is prompted through the key steps of the transfusion process, ensuring that the correct protocol is followed and that patients receive the right blood. Staff are also required to identify themselves on the system by scanning barcodes on their identity badges.

2. Use of an automated system for the collection of blood from blood fridges, enabling accurate blood tracking and a complete audit trail, and a remote issue function at the fridges

# Quality and Productivity

for the collection of previously unallocated blood, speeding its delivery to patients.

3. The process requires linking the transfusion laboratory with other IT systems, providing robust documentation and data transfer of information relevant to transfusion practice at all stages of the transfusion process, at blood sample collection, laboratory testing, blood unit collection from fridges and transfusion of blood to the patient, ensuring full documentation at every stage with return of all data to a laboratory transfusion management system.
4. An additional module was developed to provide doctors with real-time blood counts via a wireless link from the laboratory systems to the bedside handheld computers or ward PC. Algorithms incorporated in the handheld blood prescription guide, based on the patient's recent results, will be used to promote adherence to guidelines for the appropriate use of blood and will reduce costs.
5. A next step would be to link blood transfusion records between Trusts to provide access to historical information regarding the patient's blood group, antibodies, transfusion reactions and any special transfusion requirements. This has been shown to improve transfusion safety and efficiency in Quebec and Pittsburgh.

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## Purpose of change

There are two main purposes behind the change:

1. Addressing poor performance of clinical blood transfusion procedures as documented in incident reports to the Serious Hazards of Transfusion (SHOT) scheme, for example blood sample mislabelling, poor patient identification and mismatched transfusions, and minimising the resulting clinical risks.
2. Improving the efficiency of hospital blood transfusion, e.g. more rapid availability of blood for urgent cases, reduced staff time in checking blood, less wastage and reduced usage of blood.

An 'end-to-end' electronic clinical and laboratory transfusion process has already been developed and implemented in one large, multi-site Trust, and there is an opportunity for scalability to others, perhaps throughout a strategic health authority region.

There are opportunities for using a similar approach and the same equipment for other clinical bedside procedures.

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## Pathway group

Support services

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## Type of change

Service redesign using new technology.

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# Quality and Productivity

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## Related standards and guidance

1. The National Patient Safety Agency, which in 2006 adopted this solution as the only technology-based system for further exploration to reduce 'wrong transfusion' incidents.

*Right patient, right blood: advice for safer blood transfusions.* DH Gateway 9652, 2006.

<http://www.nrls.npsa.nhs.uk/resources/?entryid45=59805>

2. Connecting for Health (CfH), which in 2006 provided our Oxford group with funding of £70,000 as part of the 'Do Once and Share' initiative to develop a national specification based on our electronic process on behalf of the Chief Medical Officer (CMO)'s National Blood Transfusion Committee, SHOT and the National Patient Safety Agency (NPSA) for transfusion.

*Electronic clinical transfusion management system.*

<http://www.nrls.npsa.nhs.uk/resources/?entryid45=59805>

This is now being piloted at Mayday Hospital, Croydon (Mike Murphy is the Chair of the NPSA / CfH Steering Group for the pilot).

3. The 'NHS Live' initiative. The Chief Executive of the NHS referred to it as the best example of a joint NHS / commercial project in NHS Live, and as a model for national haemovigilance.
4. The UK CMOs' initiative set out in *Better Blood Transfusion: Safe and Appropriate Use of Blood* (Health Service Circular 2007 / 001) recommends the development of electronic systems to improve transfusion safety and monitor the appropriate use of blood.

[http://www.dh.gov.uk/en/Publicationsandstatistics/Lettersandcirculars/Healthservicecirculars/DH\\_080613](http://www.dh.gov.uk/en/Publicationsandstatistics/Lettersandcirculars/Healthservicecirculars/DH_080613)

5. Standards for hospital transfusion laboratories from SHOT, the National Blood Transfusion Committee, professional societies and the Royal College of Pathologists. Chaffe B, Jones J, Milkins C, et al. UK Transfusion Laboratory Collaborative: Recommended minimum standards for hospital transfusion laboratories. *Transfusion Medicine* 2009;19:156–8.

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## Other information

The rationale for the change is to:

- improve transfusion safety in hospitals – fewer errors;
- reduce the inappropriate use of blood – cost savings;
- improve compliance with regulatory requirements; and
- improve the efficiency of hospital transfusion, the rapid availability of blood for those patients who need it urgently, less wastage and improved use of staff time.

## Evidence of implementation

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Organisations where the proposal has been implemented

*Oxford Radcliffe Hospitals*

1. We demonstrated that re-engineering a clinical process using appropriate technology works in practice, improves patient safety, saves staff time and saves money.
  2. We took a project from conception through to full local implementation and on from project status to the routine way of working for all our staff.
  3. We worked well as a multidisciplinary team, and engaged successfully with both commercial suppliers, local hospital management, our Strategic Health Authority, professional organisations involved in blood transfusion, the NPSA and CfH.
  4. We have published our work in the premier international transfusion journal.
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Effect on quality of care

Through all stages of the pilots, we re-evaluated practice after each stage to demonstrate the benefits and identify any problems. Following full implementation throughout the Trust, we continue to monitor the correct usage of the system and its benefits.

### *Safety*

The safety of the hospital transfusion process was improved, i.e. fewer errors:

- Pre- and post-implementation audits showed improvement from 11.8% to 100% of staff following the process for correct patient identification at the bedside.
- The electronic system provides a simple mechanism for compliance with UK regulatory requirements for the traceability of blood and the documentation of transfusion and training.

There have been no serious transfusion errors in the Trust involving mis-identification since the system was fully implemented.

### *Effectiveness*

- Before the implementation of electronic remote blood issue from electronically controlled blood fridges, the median time to deliver urgently required red cell units to patients from the time of the telephone request was 18 minutes (range 5 to 47 minutes). After implementation, red cell units were obtained from the blood fridges in a median time of 45 seconds (range 30 seconds to 2 minutes).
  - Rejected blood samples due to inaccurate, incomplete or illegible labelling have decreased to 0.1%, reducing greatly
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# Quality and Productivity

- the need for patients being re-bled.
- Wastage of blood has been reduced.
  - Blood usage has reduced, producing a patient benefit of reduced inappropriate blood use and cost savings.

## *Patient experience*

Feedback from patients was positive. None objected to a barcode on their identification wristband.

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<b>Effect on productivity</b>	<ul style="list-style-type: none"><li>• Cost savings in relation to reduced use of blood (£400,000 / annum).</li><li>• Reduced number of rejected samples also decreases laboratory staff time (estimated as costing £20,000 / annum) and wastage of consumables (estimated as costing £1,000 / annum).</li><li>• Savings due to reduced wastage of blood (£20,000 / annum).</li><li>• Estimated cost savings in relation to reduced nursing time (£500,000 / annum).</li></ul>
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<b>Timescales for realisation of benefits</b>	The implementation through the Oxford Radcliffe Hospitals Trust was completed by September 2007, and so the Trust-wide benefits have been realised since then.
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Pilots of the electronic process were carried out successively in key clinical areas, beginning with a day-case haematology unit in 2001, and benefits were realised earlier in those areas.

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<b>Additional costs</b>	The current costs for the Oxford Radcliffe Hospitals for the electronic transfusion management system are £350,000 / annum in a managed service contract with our supplier for the hardware, including bedside handheld computers, software, and some support with troubleshooting, training and monitoring of the correct use of the system. In addition, the Trust employs a senior manager to ensure the correct day-to-day running of the system.
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## Evidence of replication

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<b>The proposal has been replicated</b>	<b>Yes</b> In the NHS <b>No</b> Other UK <b>No</b> International
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<b>Details of replication</b>	We successfully developed a business case for our Strategic Health Authority to fund electronic blood tracking in its other hospitals, and this was implemented in 2006 / 07. Many other hospitals in the UK have partially or fully implemented electronic blood tracking through blood fridges and a few have partially implemented the bedside process, but none have a comprehensive system as in Oxford.
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Some countries, such as Ireland and Denmark, are planning to

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implement the system throughout all their hospitals. Some regions in Canada and the United States are beginning to implement our electronic system for blood fridges and at the bedside.

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**Results of replication**    **Yes** A consistent cash-releasing saving or productivity gain was achieved  
**Yes** A consistent gain in the quality of services was achieved

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**Supporting evidence**    Consistent >95% use of the electronic process at the Oxford Radcliffe Hospitals for blood sample collection and pre-transfusion checking at the bedside. Currently >98% usage for both processes.

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## Further evidence

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**Evaluations**    Through all stages of this work, we re-evaluated practice after each stage to demonstrate the benefits and identify any problems and endeavoured to set the evaluations in a rigorous research framework. However, we are not yet aware of any evaluations of the implementation of our system elsewhere.

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**Related publications**    Murphy MF, Staves J, Davies A, et al. How do we approach a major change program using the example of the development, evaluation, and implementation of an electronic transfusion management system. *Transfusion* 2009;49(5):829–37.

Staves J, Davies A, Kay J, et al. Electronic remote blood issue: a combination of remote blood issue with a system for end-to-end electronic control of transfusion to provide a ‘total solution’ for a safe and timely hospital blood transfusion service. *Transfusion* 2008;48(3):415–24.

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**Support from national organisations**    CMO’s National Blood Transfusion Committee, SHOT, NPSA, CfH (see above).

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## Implementation advice

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**Implementation guidance**    We have learnt a lot from the trust-wide implementation of the electronic transfusion management system in Oxford in terms of infrastructure requirements for the IT, training and a staged approach to its implementation, with regular monitoring of progress, and then in supporting the implementation of the electronic blood fridge system in the trusts in the Thames Valley.

Murphy MF, Staves J, Davies A, et al. How do we approach a major change program using the example of the development, evaluation, and implementation of an electronic transfusion management system. *Transfusion* 2009;49(5):829–37.

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# Quality and Productivity

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No wider, co-ordinated implementation has yet been attempted.

A national implementation may be too ambitious at this stage. A better approach may be to develop and complete an integrated electronic transfusion system throughout the acute trusts in a single strategic health authority as a first step.

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## Further considerations

Purchasing the hardware for the system and expecting existing transfusion staff to implement and maintain it is unrealistic.

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## Contacts and resources

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