

# Enhancing safety and effectiveness in blood transfusion

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Professor Mike Murphy, a finalist in the Health and Social Care Awards 2005, describes a project using IT that has shown promising potential to reduce errors in blood transfusion.

**B**lood transfusion is a high-volume activity in the NHS. Two million units of red cells, 220,000 units of platelets, and 400,000 units of frozen plasma components are transfused to about 800,000 patients a year in about 280 NHS and 75 private hospitals in England. Transfusion is a complex process involving the collection, processing and testing of donor blood by the National Blood Service (NBS) and hospital procedures.

Current challenges for blood transfusion services include patient safety, effective use of blood, robust audit trails and documentation, and rapid availability.

Although the risk of transfusion-transmitted infection is probably the greatest public concern, the administration of the wrong blood is a greater risk. The Serious Hazards of Transfusion (SHOT) incident reporting scheme has documented 221 ABO-incompatible transfusions due to errors in hospital transfusion procedures in seven years, resulting in 13 deaths and 75 instances of major morbidity<sup>1</sup>. Many of these errors involved patient misidentification and failure to carry out well-defined clinical procedures correctly.

There have been recent, essentially unfunded, initiatives to promote the appropriate use of blood and the avoidance of transfusion<sup>2</sup>, and the Chief Medical Officer made some practical recommendations in his 2003 annual report<sup>3</sup>. It appears these efforts are having some effect. The demand for blood in England and North Wales, which steadily increased during the 1990s, has fallen by 1%, 1%, and 6% respectively over the past three years. However, it is likely that blood usage could be further reduced without compromising patient safety.

Robust audit trails and documentation are needed for "look-back" exercises, for example when a donor subsequently develops a disease transmissible by blood transfusion. Local and national audits have shown that the documentation of transfusion is poor, using manual paper-based systems.

Timely provision of blood for patients needing urgent transfusion is sometimes a problem, particularly for patients in hospitals with no blood transfusion laboratory.

## How to improve transfusion practice?

Better use of IT has the potential to address all the challenges outlined above. In the past, a variety of other approaches has been used in hospitals to reduce the risk of transfusion errors, such as increasing the complexity of checking procedures, increasing monitoring of staff or using specially trained nurses to carry out transfusions. None of these methods is ideal, in that they are impractical in routine practice, have not been shown to be effective in preventing transfusion errors or are costly. The solution to the problem of ABO-incompatible transfusions lies with developments in technology to minimise human errors.

## Barcode patient identification project, Oxford

For four years, in work funded by the NBS, we have been developing a barcode patient identification system involving handheld computers

for blood sample collection and the administration of blood. Audits of practice were carried out before and after its introduction in two clinical settings. The first baseline audit in day-case haematology revealed poor practice, particularly in patient identification. Significant improvements were found in the procedure for the administration of blood following the introduction of barcode patient identification, including an improvement from 11.8% to 100% in the correct verbal identification of patients<sup>4</sup>. Staff found the barcode identification system easy to operate, and preferred it to standard procedures.

The process involving barcode patient identification for transfusion (see box) compelled staff to adhere to certain actions, for example the checking of patient identification wristbands. During the baseline audit, it was observed that individuals were frequently distracted and interrupted while checking blood, for example interrupting a procedure to answer the telephone or to respond to questions from patients and colleagues.

Was the positive impact on compliance with policy a direct result of the technology or of the allied education and training? Could a comparable result be achieved with training alone, which may or may not be a cheaper option? An additional audit was conducted to compare compliance with policy before the provision of training, after training and then again after the barcode patient identification system was implemented. It was found that education and training had a positive impact on compliance with policy (from 5% to 40%), but that this was improved to 100% compliance following the introduction of the barcode identification system<sup>4</sup>.

The same system was introduced into cardiac surgery<sup>5</sup>. Revisions were made to the software to allow rapid checking of units for urgent transfusions. Control of blood collection from blood refrigerators was added, providing electronic control of the transfusion process from sample collection through the laboratory, blood collection and the administration of blood.

In addition, a novel automated system for remote issue of blood has been developed using an electronic link between the blood-bank computer and distant blood fridges. This allows printing of compatibility labels for the allocation of blood to patients at blood fridges – previously this could only happen in the blood transfusion laboratory. This provides rapid access to blood for patients requiring it urgently, and has the potential to reduce blood wastage because units of blood in blood fridges are available for any patient with the same ABO and RhD group, rather than for only one patient for whom the blood has been labelled in the blood transfusion laboratory.

Complete documentation of each transfusion episode is increasingly important, and is a requirement of recent EU regulations<sup>6</sup>. Robust documentation is very difficult with manual systems. In the system we have developed, information on the handhelds can be downloaded into the blood transfusion laboratory computer so that a complete record of the transfusion episode is documented, including that the right patient received the transfusion, when it was transfused, along

with the bedside checks, observations, and the identification of the staff carrying out each step. In addition, we are developing links from the haematology computer to the handhelds to provide recent blood-count data to facilitate electronic requesting and prescribing of blood, and to facilitate better compliance with local and national guidelines for the use of blood.

### What challenges were overcome?

There were some initial challenges, mainly associated with the absence of interfaces between different computer systems, but these were rapidly overcome and the technology was found to work as intended. A number of minor changes were made to the software after initial testing to guide the user more easily through the transfusion process.

Staff and patients were immediately receptive to the concept of the new process, and quickly grasped how to carry it out. The design of the barcode patient identification system is such that the user is compelled to abide by certain actions, for example the checking of patient identification wristbands. The use of the barcode patient identification system appeared to dissuade individuals from becoming distracted and interrupted. The reason for this is not clear. There is no time limit for the completion of the procedure, but its simplicity seems to encourage staff to complete it once they had started.

Maintenance of the equipment, for example charging of batteries for the handhelds and loading wristband kits and report labels, was an extra demand in busy working environments, but staff accepted these tasks because of the overall benefit of the new process.

### Outcomes and benefits for staff and patients

The main outcomes are a reduction in the complexity and improvement in the performance of the transfusion process, resulting in fewer errors and improved patient safety.

It was unrealistic to expect to document a reduced number of wrong blood incidents because of the relatively small scale of the project. Surrogate measures were used to determine better performance of the transfusion process. However, in the second year of the project, a wrong blood transfusion was prevented where the wrong blood was collected from a (non-automated) blood fridge in cardiac surgery. The system identified the error and gave a visual and audible alarm that prevented the transfusion.

Patients were interested in the new technology. Some were initially alarmed to hear that errors occur in transfusion, but they developed confidence in the new technology once they understood it. One patient commented: "If it makes the procedure more accurate then the safer it is for all of us." No patients objected to wearing barcoded wristbands.

Staff preferred the "automated" system as the handhelds provided a prompt for each step. Comments included: "It provides a good, safe and logical system", and "makes me think more about what I'm doing".

The time for the whole transfusion process was nearly halved (131 to 81 minutes). We estimated that full implementation would result in personnel savings of around £600,000 per annum for our trust, based on 35,000 transfusions a year.

Sustainability has been excellent. At the end of the initial project in haematology, staff were offered a return to the standard manual process or continuation with the new process but with less support, as the project team were moving to cardiac surgery. The staff chose the new process and have managed successfully for two years.

The system has been demonstrated to many other NHS trusts, and some have identified funding to implement it. Our trust has approved in principle a proposal to progress to trust-wide implementation, and we have been asked to review Connecting for Health's specification for transfusion.

### Conclusions

Computerised transfusion aids cannot eliminate human error, but the less complicated and more user-friendly the procedure is, the less scope there is for error. Their introduction should be accompanied by

## THE ESSENTIAL STEPS OF THE PROCESS

1. Patients are provided with a wristband with eye-readable and barcoded identification details (ID). Two-dimensional barcodes contain more data than linear barcodes, and are used for all the ID required in transfusion guidelines – that is, patient surname, first name, date of birth, gender and hospital number.
2. The identification of staff is logged at every step using a barcode on the staff identification badge.
3. For blood sample collection, the patient's ID is confirmed by scanning the wristband barcode with a handheld computer and comparing the details with those stated verbally by the patient. A sample label is printed at the bedside by connecting the handheld computer to a small portable printer.
4. The blood bank uses the barcode on the sample label to enter the patient's ID into the laboratory computer. After compatibility testing, a two-dimensional barcode with the patient's ID is printed on the compatibility label attached to the blood bag, and the unit number is also included in the barcode.
5. At the bedside, the handheld computer prompts the nurse through the process including scanning the barcodes on the patient's wristband, the compatibility label and the unit number on the blood bag to check they match. The handheld computer draws attention to any mismatch, and is also used to record the time of the start and completion of the transfusion, routine observations and any reactions.
6. A report is printed for the patient's notes after the transfusion, and information is downloaded to the blood-bank computer to complete the audit trail.

comprehensive education, training and continued support. There is the potential to facilitate audit of and compliance with standards for transfusion, and drive necessary improvements in practice.

Patients benefit from increased safety through a reduction in the risk of receiving the wrong blood and in the risk of being given an inappropriate transfusion. Staff benefit from a simpler transfusion process, reduced paperwork, increased confidence in giving the correct blood and increased concentration leading to fewer interruptions. Financial benefits derive from reduced resource requirements (such as using one nurse rather than two), less reworking ("right first time") and process improvement (the time to check transfusions is halved). Reduced blood usage and wastage will result in the future, from better tracking of blood through blood fridges and improved prescribing.

The implementation costs for a hospital mean that, to become accepted, the technology is likely to have to be multi-functional for other procedures requiring patient identification and known to be prone to error. This could produce benefits not only in transfusion practice, but for many other clinical processes requiring patient identification including drug administration. HCRB

### References

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