8. Errors Related to Information Technology (IT)

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This chapter covers transfusion adverse events that relate to laboratory information management systems (LIMS) as well as other information technology (IT) systems, and related equipment, that are used in the delivery of hospital transfusion services.

The cases are drawn from the other chapters of this report as shown in Table 8.1. Cases selected include events where IT systems may have caused or contributed to the errors reported, where IT systems have been used incorrectly and now includes cases where IT systems could have prevented the errors but were not used.

Table 8.1 Source of cases included in this chapter

Error	
Incorrect blood component transfused (IBCT)	30
Special requirements not met (SRNM)	28
Right blood right patient (RBRP)	5
Inappropriate and unnecessary or under/delayed (I&U)	4
Handling and storage errors (HSE)	7
Total	**74**

In 2011 there were 74 reported incidents of errors related to IT systems (see Table 8.2), compared with 56 in 2010, 61 in 2009 and 44 in 2008.

In the 2011 data, 65/74 of these incidents originated in the transfusion laboratory. A total of 58 cases involved red cells, 5 both red cells and platelets, 6 platelets only and 5 related to plasma components.

Seven of the 74 cases occurred in children (2 were infants below the age of one year).

Most events, 72% (53/74), occurred during core working hours and 88% (65/74) were due to errors involving the laboratory staff or laboratory systems. In relation to the requests, 43 of the transfusions were considered routine, 16 urgent and 11 were emergencies. In 4 cases the urgency of the request is not specified.

Table 8.2
Categories of IT system errors

Error	Reports	Wrong blood component	Component transfused where special requirements were not met				Wrong group after HSCT	Unit expired or out of temp. control	Inappropriate and unnecessary (including delays)
			Not irradiated	Not CMV neg	Not CMV neg or irradiated	Antigen positive unit			
Failure to consult or identify historical record	6	2				3	1		
Failure to link, merge or reconcile computer records	6	1	2			3			
Warning flag in place but not heeded	12	3	3	3	1	2			
Warning flag not updated	5	1				1	3		
Failure to use flags and/or logic rules	14	8*	2		1	2	1		
Computer or other related IT system failure	9	5				2		1	1
Errors related to computer system	4	2	2						
Errors related to electronic blood management systems	11	4						6	1
Incorrect result entered or accessed manually	7	3				2			2
Total	**74**	**29**	**9**	**3**	**2**	**15**	**5**	**7**	**4**

** includes 2 cases where blood component is non-MB-FFP given to a child*

Deaths

There were no transfusion-related deaths where IT systems contributed.

Potential for major morbidity

There was 1 case where IT systems contributed to a potential for major morbidity.

A woman of childbearing age was given K positive blood because of the failure to use warning flags to prevent this. She developed anti-K and anti-E.

Errors due to availability or inaccuracy of historical record n=12

This year there were 12 cases where failure to use historical transfusion records resulted in an error of which 6 cases were due to failure to consult the historical record and a further 6 cases occurred because historical records were unavailable because they were not merged or linked.

Failure to consult the historical transfusion record on the LIMS led to the selection of the wrong group of fresh frozen plasma (FFP) in 1 case and on 2 other occasions resulted in inappropriate electronic issue of red cells. Two transfusions took place where antigen-negative blood was not selected for patients with previous alloantibodies. A patient with HbSC disease, with no alloantibodies, would have received extended phenotyped blood, had the clinical history and red cell phenotype been known. Another patient with beta thalassaemia should have been flagged to receive phenotyped blood but the diagnosis was not communicated by the clinicians.

Merging or linking of historical records on the LIMS failed in 2 cases where non-irradiated components were provided for patients at risk of transfusion-associated graft versus host disease (TA-GvHD). One patient transferred to another hospital site within the same organisation and the LIMSs were not linked. Another case had a new computer record set up that was not linked to the record containing details of previous purine analogue therapy. Three transfusions took place where antigen-selected blood was not provided for patients with historical, but currently undetected, antibodies. This information was located in duplicate and unlinked computer records and therefore inaccessible.

These cases demonstrate the importance of access to historical computer records as well as the need to have robust systems for searching for these records with first and last names, date of birth, hospital number and NHS number (if available). This search strategy should be made clear in laboratory standard operating procedures (SOPs), taking account of the way the LIMS has been configured.

Case 1

Failure to find important clinical information because a historical record was not linked to the current episode

A post-partum transfusion was administered to a patient who had transferred from another hospital. The LIMS had no record of the patient's requirements on the current sample, so no alerts were generated. It was subsequently noted that the patient had sickle cell disease and had historical transfusion records. These had not been linked to the current record because the patient's name had changed.

Case 2

Failure to transfer antibody information to a new LIMS

A patient with two clinically significant alloantibodies was flagged in the old LIMS, although the antibodies at that time were not detectable in routine laboratory tests. On the first occasion when the patient was to be tested using the updated LIMS the sample was rejected as 'not acceptable for testing'. The next time a sample was tested the old LIMS system was not accessed because it was assumed that the historical data for this patient would have had been imported on the previous occasion, although it had not. Testing showed the antibody screen was negative and unscreened compatible units were issued for transfusion. One of the original antibodies was detected a month later, thought to be a new antibody, and antigen-negative units were issued for transfusion. Two years later the patient produced an antibody card for both original antibodies, which was when the error was detected and investigated.

This case shows the importance of validation and testing of new IT systems against a number of scenarios and having a robust system for transfer of data from legacy systems.

The strategy for linking and merging records should also be clear. Sometimes new records are created because current demographic data does not match the available historical record and, if these are not searched or linked, important clinical information can be missed.

An unusual error occurred because a biomedical scientist (BMS) used a 'sample ID' search to see if a crossmatch sample was available. The BMS, who did not usually work in the transfusion laboratory, was unaware that this was against the laboratory policy. The sample was available, but no longer valid and was used to issue blood electronically despite the fact that a transfusion had taken place in the interim period. This information would have been available had the search been done using the patient ID.

One patient, with a historical but not currently detectable anti-Fy^{a}, was given antigen-unselected blood because the historical record was not available. This resulted from the BMS not being able to complete the full search of historical records because access rights to all the relevant IT systems were not kept up-to-date. In another case, the historical record was under a different hospital number so the history of anti-M and positive direct antiglobulin test (DAT) was missed as the current antibody screen was negative and blood was inappropriately issued by electronic issue (EI).

Errors due to failure of warning flags or logic rules n=31

This was the commonest category of IT errors this year with 31 cases where warning flags or logic rules failed to prevent errors. In 12 cases a warning flag was in place but was not heeded. In 5 cases the warning flag was inaccurate or had not been updated to reflect the current need. A further 14 cases were identified where the use of a warning flag, or some form of 'logic rules' system, would have prevented errors, had such a system been implemented.

Warning flags are set up in the LIMS to alert the operator when undertaking pre-transfusion testing and selecting blood components for issue. The way the warning flags are configured depends on the LIMS in use; some use warning screens, others messages that have to be acknowledged and others are able to prevent issue of components using algorithms based on logic rules.

In 2 cases a warning flag was ignored when issuing platelets of a different group although both were for routine transfusion to adult males. In 1 case, a thawed sample was used to crossmatch for an urgent request despite a warning that the sample was not suitable.

In 7 patients requiring cytomegalovirus (CMV) negative (3 cases) irradiated (3 cases) or both CMV negative and irradiated (1 case) components, these were not provided because the warning flags were not heeded. In 3 further cases the LIMS warning flags were not set up, with the result that 2 patients had non-irradiated blood and 1 non-CMV negative red cells and platelets. Additional errors by the clinical staff requesting these components also contributed. No adverse outcomes were reported in any of these cases.

Two women of childbearing age were each transfused a single unit of K positive red cells despite warning flags highlighting these units as unsuitable. One woman developed anti-K as a result and but it is not known if the other was sensitised. One hospital, that has now implemented a warning flag to give K negative blood, reported that they identified a patient given one K positive unit out of a four unit transfusion for a post partum haemorrhage 5 years ago but fortunately no antibodies have developed.

It is important that warning flags are set up accurately and reflect the current situation. Two haemopoietic stem cell transplant (HSCT) patients were given the red cells and platelets of the wrong group because the agreed transplant protocol was either not put on the LIMS or had been changed at the last minute and had not been updated in a timely way. In another patient, the transfusion department was not informed of the HSCT two months previously and had not updated the computer records to reflect this. All of these errors arose in routine situations and within normal laboratory hours. The cases also demonstrate that computer systems can only prevent errors if effective communication between the laboratory and the clinicians takes place.

One laboratory failed to select antigen-negative blood for a patient with a recently detected antibody because the appropriate flag had not been set up on the LIMS. The red cells were issued without a serological crossmatch, although subsequently shown to be antigen-negative. In another case the results of a (negative) antibody investigation and recommendation of suggested (own) red blood cell (RBC) phenotype for transfusion were not added to the computer and therefore these instructions were not followed when crossmatching red cells.

In 2 paediatric cases of 14 cases where warning flags or logic rules were not used, their use could have prevented non-methylene blue (MB)-FFP being given. In a recent clarification of the Advisory Committee on the Safety of Blood, Tissues and Organs (SaBTO) advice, children born after 01/01/1996 should be given pathogen-inactivated components so the logic rules and flags should be set up to reflect this, not just the age of the patient, as is the case with some systems.

In 1 renal transplant patient, being prepared for an ABO-incompatible renal transplant, the information about the required FFP group was kept on a notepad rather than setting up a special requirements flag with the result that 1 unit of the wrong group of FFP was issued for plasma exchange before the error was identified and replaced with the correct group.

Case 3

Special requirement flag removed in error

A patient required irradiated blood because of previous chemotherapy. The transfusion laboratory had received notification of this special requirement and added the information to the LIMS. The special requirement flag was subsequently removed from the LIMS in error. From the time the flag was removed to the time it was discovered, the patient had received 15 units of red cells and 5 units of platelets that had not been irradiated.

In some cases the computer software is configured in a way that creates problems. Either because events cannot be flagged or because the way it handles historical groups is inconsistent with preventing wrong blood issue. In one case an incorrect RhD group in a historical record became the default group when entering a manual or abbreviated group from the current sample. This required a software change that had to be completely revalidated.

Laboratory errors arising from manual data entry where electronic transfer of data would have been safer n=5

Although laboratory information management systems (LIMS) control many processes, they remain dependent on manual steps such as entering antibody and phenotype information from tests done by reference laboratories, the requirement for irradiated or CMV-tested blood based on clinical decisions.

There are 5 laboratory errors reported in this category. Errors have occurred despite the presence of warning flags and logic rules because incorrect data has been entered manually and therefore the error is not detected. One example is given below.

Case 4
Wrong phenotype transfused due to multiple errors, including incorrect manual entry of phenotype data
Eight units of extended phenotype and HbS negative blood were requested for an exchange transfusion in a patient with sickle cell disease. An error by the Blood Service meant that one of the units did not meet the requested specification. A member of laboratory staff manually entered the phenotype of the units onto the LIMS and did not notice this error so entered the expected, rather than the actual, phenotype. When the blood was issued the BMS issuing the blood for transfusion did not check the phenotype on the blood bag label.

The electronic delivery note (EDN) provided by Blood Services downloads phenotype information for each donation as the stock delivery is recorded on the LIMS. This reduces the potential for transcription errors and would have prevented this error.

In one case a manual group was incorrectly interpreted and entered manually onto the LIMS. ABO incompatible blood was issued for a patient by overriding the flag that warned the blood group was not authorised. This case is discussed in more detail in the laboratory IBCT section, Chapter 7.

There are further 3 cases where a manual step is required to mark a patient as unsuitable for EI. An automated system to exclude edited or inconclusive groups from EI could have prevented these errors.

Case 5
Failure to add patients to electronic issue (EI) exclusion list results in inappropriate EI
Three patients were inappropriately issued blood by EI rather than serological crossmatch by the same laboratory where the system in place requires the manual addition of patients to an EI exclusion list, which then applies an algorithm on the LIMS to prevent EI. In both cases this manual data entry step was omitted.
The first exclusion was because of an inconclusive RhD group under investigation and the second was a baby with a weak reaction in the control well which was edited to negative. The baby was subsequently found to have a positive direct antiglobulin test (DAT). The third case was an edited group and the BMS did not know it had to be excluded from EI.

In one case, the historical record was under a different hospital number so the history of anti-M and positive DAT was missed as the current antibody screen was negative and blood was inappropriately issued by EI.

Learning points

- Laboratory information management systems (LIMS) logic rules and warning flags that prevent issue of the wrong component should be set up where available.
- New computer systems should be specified to include the capacity to flag existing special requirements and have the flexibility to change to reflect current guidance.
- Each laboratory should have clear policies stating where historical data is held and how it should be accessed, with clear understanding of the way the LIMS stores the data and therefore of the limitations of the search strategy.

Errors due to computer downtime or failure of other systems n=13

Safe blood transfusion relies on interoperability of the LIMS with other systems such as Patient Administration Systems (PAS) and Electronic Blood Management Systems (EBMS) as well as with laboratory analysers and refrigerators. Interoperability relies on robust interfaces and transfer of information with barcode technology where possible. Manual systems are less robust and prone to error.

There were 7 laboratory errors where IT systems were unavailable and manual back-up procedures failed.

Problems during LIMS downtime have resulted in two situations where wrong blood was issued. One was during a major computer system downtime when red cells for a routine transfusion were supplied to a patient with a known antibody without a full crossmatch although the units were antigen-negative. The other was when platelets were issued beyond their expiry date/time during an episode of unplanned LIMS downtime.

One unusual case where there was a delay in provision of blood cites one of several contributing factors being the change from British summertime to wintertime resulting in difficulty accessing the LIMS.

In 1 case blood was transfused before compatibility testing was complete because the electronic blood release system was off-line It is important that all staff know what the downtime procedures are if any part of the system is down. In the laboratory this means reverting to downtime procedures but when remote issue is in place and these systems fail, only emergency blood should be accessible. This case was an emergency.

In 2 cases a temporary loss of power caused equipment failure. In 1 case, the analyser failed and manual testing missed a weak positive antibody screen which was detected when the automation was reinstated. The error would not have occurred if the usual automated procedures were in place. The second case is outlined below.

Case 6

Importance of robust back-up procedures during IT downtime

The laboratory was unable to print compatibility labels for blood bags because the LIMS system lost its connection to the label printer following a power failure elsewhere in the hospital. The back-up application also failed. As a result, 3 digits were omitted from the donor number when handwriting the compatibility labels for an emergency transfusion. This was noticed after the unit had been connected to the patient.

A new online blood ordering system (OBOS) has been implemented by NHSBT with a number of useful features. In one case the wrong component code was used and the wrong component delivered and transfused to two patients. This component was large volume irradiated neonatal red cells therefore there was no risk to the adult recipients.

The error in the final case would have been prevented by the use of an electronic delivery note (EDN) where information is transferred directly into the LIMS rather than by barcode scanning individual information, or entering it manually if the barcode scanners are not working.

Case 7

Failure of barcode reader leads to the wrong component being transfused

Cryoprecipitate was booked into the laboratory system as FFP without the use of a barcode scanner, because this was not working. This unit was stored in the FFP freezer and when a request was made for FFP, the cryoprecipitate unit was issued as FFP.

Learning points

- Contingency plans should be in place for computer or equipment downtime.
- Where possible, manual processes should be kept to a minimum.
- Data should be transferred electronically where possible including the use of on-line ordering and electronic delivery information but training to use these systems should be adequate.

Errors using IT systems outside the laboratory

Electronic blood management systems n=11

This section looks at the errors where the electronic blood management systems (EBMS) should have prevented transfusion of wrong blood, time expired components or components out of temperature control. For the purposes of this summary, only electronic 'blood-tracking' systems are discussed. These record the movement of blood components in and out of blood refrigerators and platelet incubators. A recent IT survey on behalf of the National Blood Transfusion Committee (NBTC)[38] shows that 47% of responding NHS Trusts in England and North Wales have implemented blood-tracking through refrigerators and platelet incubators.

In 2011 there were 11 reports in this category; 6 cases relate to handling and storage errors, 1 incorrect blood component transfused, 3 'right blood right patient' events and 1 delay in provision of blood.

Of the 6 errors where refrigerator tracking failed to prevent transfusion of components that were time expired or out of temperature control, 5 cases involved red cells and 1 case a platelet transfusion. Half of these errors took place outside normal working hours and all except 1 were errors made by staff working outside the laboratory. In half of the cases the transfusion was said to be 'urgent' or 'emergency'. There were no adverse effects on the recipients of these transfusions.

Using a recently implemented refrigerator-tracking system, warning screens were ignored in 3 cases; 1 resulted in transfusion of expired red cells, in another transfusion of red cells that had been out of temperature storage for more than 30 minutes and in a third the wrong red cells were removed and transfused to a patient, fortunately of the same blood group. The staff who overlooked these warning screens had been recently trained but were not sufficiently familiar with the system and further support was provided.

There were two instances of errors where the system had been used incorrectly by staff who were not trained but had gained access by using access cards belonging to others.

Case 8

Other person's access card

A temporary member of staff removed 2 units of red cells from the refrigerator without checking the patient's identifiers or undertaking any checks on the blood component. He was asked to collect the blood by a staff nurse, who gave their access card to the member of staff who was not allowed to collect blood, having had no training or competency assessment.

There was one case where the use of electronic blood tracking was reported to cause a delay in provision of blood. The safety features of these electronic blood management systems are designed to only release blood that is suitable for transfusion. The system was configured to quarantine blood when it was retrospectively crossmatched which is what happened in this emergency situation.

Case 9

Electronic blood-tracking system results in delay of emergency blood

In a major haemorrhage call for a ruptured aortic aneurysm, 6 units of emergency blood were put in the main issue refrigerator using an electronic blood-tracking system. These were then removed and taken to the theatre where 2 units were used immediately and the remaining 4 put in the satellite refrigerator, also under control of the blood-tracking system. When theatre staff tried to remove these, the system displayed a message stating that there was no blood in the refrigerator for that patient. Although the laboratory was contacted and remotely opened the refrigerator, there was a delay during which blood was not available for the patient. The manufacturers reconfigured the blood-tracking system so that this situation would not arise again.

Learning points

- There should be adequate resources to train staff to use the electronic blood management systems.
- If the staff ID passes used to gain access to blood refrigerators are linked to successful training and competency assessment they must not be shared.
- Lack of familiarity with electronic blood management systems can cause delay in an emergency.

Clinical systems for viewing laboratory results

In previous reports there have been inappropriate and unnecessary transfusions because the wrong haemoglobin (Hb) result was acted upon. This year there were 2 such cases. One case occurred due to a 'transcription error', presumed to arise because the wrong Hb result was copied into the notes and a transfusion prescribed and administered to a patient with a normal Hb. The second case of unnecessary transfusion resulted from the doctor accessing the wrong patient's Hb on the IT system. On both occasions the error was detected quickly and no more than one unit was given. There were no adverse effects.

Direct transfer of Hb results into a patient's electronic record reduces the risk of transcription errors on the ward but clinical staff should be trained to check that they are using the correct method of searching for patients. Having a second check that the correct result has been accessed is good practice. This could be made routinely by the blood transfusion laboratory staff processing a request or by the staff administering the blood as part of the pre-transfusion check.

Anti-D Ig errors

Table 8.3 IT Errors related to administration of prophylactic anti-D Ig

Error	Reports	Unnecessary anti-D Ig administered	Failure to administer anti-D Ig, or excessive delay
Error when manually transcribing data	1	1	
LIMS not updated with reference laboratory result	1	1	
Failure to consult historical record	4	3	1
Failure of logic rules within LIMS software	1	1	
Total	**7**		

There were 7 reports in 2011 where laboratory IT-related errors or problems led to unnecessary administration of anti-D Ig (6 cases) or delay in giving anti-D Ig prophylaxis (1 case). 70% of these cases occurred within normal working hours and involved staff who routinely work in the transfusion laboratory.

There were two additional cases where a laboratory error, rather than an IT-problem, led to inappropriate anti-D Ig administration and the suggested preventative action in response to the incident was to implement a software change. Rule-based algorithms and logic rules are used in LIMS to control critical processes, including the administration of anti-D Ig prophylaxis. Warning flags and/or prevention of the inappropriate issue of anti-D Ig is an essential function of an IT-system, and is supplementary to adequate knowledge of laboratory and clinical policies. Sometimes these logic rules can fail and such a case is outlined below. This demonstrates how important it is to test all possible scenarios when validating an IT system.

In one case, where administration of anti-D Ig was delayed, a woman was incorrectly assigned a RhD positive blood group in the current pregnancy. The D-variant previously identified was fully documented on the LIMS but this record was not linked to the current episode. Although she had been identified as needing anti-D Ig prophylaxis this information was not accessible. In a second case where anti-D Ig was given unnecessarily, the mother and baby records were not linked correctly resulting in the wrong decision being made in the clinical area.

Whilst IT-systems can be used to control the transfusion process, there are always points where manual steps are required. The procedures to control those manual steps are not always kept up to date. There are three cases that exemplify this. Two mothers were given anti-D Ig unnecessarily because information about immune anti-D was held on an electronic 'note pad' and this was not consulted or taken into account. In another case the result from the reference laboratory was not entered into the LIMS in a timely way.

Another manual step that is prone to error is the transcription of data from the LIMS into a paper record, such as a community or patient-held maternity record, which resulted in an error in one case. The use of electronic patient records with data entered via an interface is more secure although the interoperability of IT systems does not always permit this. There were no cases this year where incorrect data from the mother or baby were transcribed onto the LIMS, as in previous years.

Although most of these errors involve the laboratory, lack of knowledge and incorrect prescribing by doctors and midwives contributed in part to the unnecessary administration of anti-D Ig.

Case 10
Important information about allo-anti-D held on LIMS was not used in decision-making when issuing anti-D Ig
Anti-D Ig was administered post-delivery to a RhD negative woman who had been sensitised during the current pregnancy. The patient 'notepad' on the blood bank computer system stated that an allo-antibody was present and prophylactic anti-D Ig was not required. This information was not in the patient's notes. Anti-D Ig was requested by the midwife and was issued from the laboratory without challenge. The information on the blood bank computer had not been used in the decision making process.

Case 11
LIMS system not updated with results from reference laboratory
In her second pregnancy, a woman who had previously grouped as O RhD negative was suspected of having a weak-D antigen. After confirmation by the reference laboratory it was decided that she did not require prophylactic anti-D Ig, although this had been administered in her first pregnancy. The laboratory information system was not updated with this information and anti-D Ig was issued and administered at 28 weeks. Results of a repeat sample identified this omission and the RhD status was corrected on the LIMS.

Case 12
Failure of logic rules to prevent issue of anti-D Ig to a RhD positive mother
Routine antenatal anti-D prophylaxis (RAADP) was issued to a RhD positive mother after a request was received from a community midwife. The request form stated that the patient was O RhD negative following an incorrectly recorded verbal result in the maternity record and the laboratory did not check the LIMS. Logic rules that had been previously developed to prevent anti-D Ig being issued to RhD positive women had failed. These logic rules have now been amended and work correctly. A recent LIMS software upgrade has added an additional level of safety by flashing up a warning that requires a comment to be added whenever anti-D Ig is ordered against a RhD positive patient.

COMMENTARY

The modern transfusion laboratory is critically dependent on IT and automation. This section of the report is no longer confined to laboratory systems but has now been expanded to include electronic blood management systems and other interoperable systems that support safe transfusion practice. For this reason, the number of transfusion errors related to IT systems has increased this year.

The specification and operation of IT systems in hospital transfusion practice has been covered by a series of BCSH guidelines and the 2006 version is being reviewed along with the BCSH pre-transfusion testing guidelines. BCSH validation guidelines[39] were published highlighting the importance of ensuring that all laboratory systems, including IT systems function in the way they are designed and expected to.

Common causes of wrong blood errors in this report are the failure to use warning flags on the LIMS properly; either because they are not heeded or because they are not correctly set up or updated in a timely way. Other important failures occur when the historical computer record, containing important information to guide selection of the right blood components, is not used or cannot be accessed. These two categories account for nearly 70% of the laboratory errors.

In this reporting year there are several examples where IT systems have failed to exclude an unsuitable patient from electronic issue (EI) or where an unsuitable sample has been used for compatibility testing.

The British Committee for Standards in Haematology (BCSH) guidelines[37] advise the patient selection criteria for electronic issue, and the Medicines and Healthcare products Regulatory Agency (MHRA) has issued further guidance[40] emphasising the importance of EI being under the control of the LIMS *without any manual intervention* to compromise the algorithm that compares current and historical blood groups, antibody screening results and validity of the blood sample. Even if the algorithm for EI is under control of the LIMS, there is often a requirement for manual steps in order to apply the EI algorithm.

A particular feature this year has been that problems with printing compatibility labels have led to errors and potential wrong blood incidents. Firstly, label printing is dependent on an interface to the LIMS and labels cannot be printed if the LIMS system is down or the interface is not working. This year a power failure elsewhere in the hospital prevented compatibility labels being printed in the transfusion laboratory because of a problem with the interface. Some laboratories have back-up systems to print labels and others resort to handwritten labels, which is slow and prone to transposition errors. In the event that compatibility labels have to be reprinted, it is important that the system selected to reprint is secure and that staff are familiar with it.

When new IT systems outside the laboratory are implemented, errors have arisen due to lack of familiarity but it is expected that these systems will reduce manual interventions and improve patient safety. The NBTC IT Survey in England and North Wales shows that blood tracking and electronic bedside administration systems have been implemented or are planned in many Hospitals and Boards and in independent hospital networks[38].

Pathology modernisation is likely to result in networked and merged transfusion services, and has created many challenges. ‘Hub and spoke’ models, remote issue of blood and further integration with reference services are dependent on effective IT systems.

Accurate patient identification is key to safe blood transfusion and can be facilitated by IT systems. The IT survey shows the use of electronic ordering for blood transfusion tests is becoming more common but these systems can be confounded by patients with multiple hospital numbers.

Increasing reliance on IT and automated systems creates problems when these systems are unavailable due to computer or power failure. Lack of familiarity with manual back-up systems without the logic rules and algorithms provided by computers can lead to errors as can the need for handwriting multiple compatibility labels.

Access to the LIMS as well as other interoperable systems needs to be in place for all staff at all times. Lack of access has led to errors in this report. This includes the blood transfusion computer system (where separate from the LIMS), LIMS, PAS, and electronic blood management systems.

Recommendations

- Any future specification written for a laboratory information management systems (LIMS) must state that:
  - A direct check is required, within the LIMS, to ensure that the component selected meets the special requirement on record.
  - If warning flags/alerts are overridden, which they may need to be in a clinical emergency, a positive response as to why they are being overridden must be entered. It should not be possible to simply 'escape' past a warning/alert.
  - Warnings/alerts must be clear and appear on all relevant screens within the LIMS.
- Where possible all critical processes in the transfusion laboratory should be identified and, if possible, should be under the control of the Laboratory Information Management System.
- When new information technology (IT) systems are implemented, and existing systems upgraded, they should be validated using a wide range of scenarios to ensure they are working as intended.

  These recommendations will be included in the revised British Committee for Standards in Haematology (BCSH) IT Guidelines for Hospital Transfusion Laboratories
- Where possible all critical processes in the transfusion laboratory should be under the control of the Laboratory Information Management System.

  ACTION: Transfusion Laboratory Managers, Pathology IT managers, LIMS Providers
- When new IT systems are implemented, and existing systems upgraded, they should be validated using a wide range of scenarios to ensure they are working as intended.

  ACTION: Transfusion Laboratory Managers, Pathology IT managers, LIMS Providers

For active recommendations from previous years and an update on their progress, please refer to the SHOT website