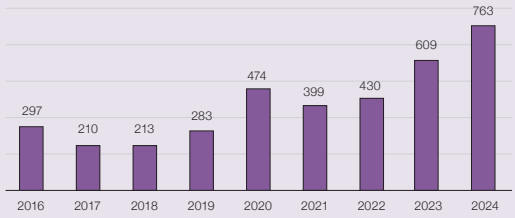
Errors Related to Information Technology (IT) n=763

Authors: Jennifer Davies and Megan Rowley

Headline data 2024

Number of reports n=763
Deaths n=2
Major morbidity n=7

IT-related cases by year



Key findings:

- Reports of IT-related errors to SHOT are rising each year
- This trend reflects both the increased use of IT systems and growing awareness of their role in supporting safe clinical practice
- There is a growing dependence on IT in both clinical and laboratory environments to enhance safety and efficiency

Gaps identified:

- IT systems not configured correctly and/or lack of algorithms in IT to support safe practice
- Ineffective training for staff using new IT systems leads to errors
- Alerts and warnings not heeded
- Manual downtime processes may not be effective in preventing error
- Failure to consider human factors and ergonomics when implementing IT systems

Good practice:

- Near misses (NM) detected by electronic systems used as part of pre-administration checks
- IT identified as an improvement action in incident investigations
- Laboratory information management systems (LIMS) being upgraded and networked to meet changing delivery of healthcare

Next steps:

- There is a need for critical function standards for IT systems, including LIMS, electronic blood management systems (EBMS) and electronic patient records (EPR)/order communications to reflect available national guidelines
- Consideration of human factors and ergonomics principles during all stages of implementation to ensure optimal use of the IT systems

For all abbreviations and references used, please see the **Glossary** and **Reference list** at the end of the full Annual SHOT Report. Please see the supplementary information on the SHOT website (https://www.shotuk.org/shot-reports/annual-shot-report-2024/).

Definition:

This chapter includes transfusion adverse events that relate to laboratory information management systems, other IT systems, and related equipment used in the delivery of hospital transfusion services.

Cases include events where IT systems may have caused or contributed to reported errors, as well as instances where IT systems were used incorrectly. When hospitals recommended IT-based solutions for corrective or preventive actions in response to these errors, those cases have also been included.

Introduction

There is increasing recognition that information technology can support safe practice and provide a barrier to error. IT systems and automation are well established in healthcare and are increasingly being adopted in transfusion practice. SHOT continues to promote vein-to-vein IT systems (clinical and laboratory) for patient safety and the United Kingdom Transfusion Laboratory Collaborative (UKTLC) standards reiterate this (Dowling, et al., 2024). There is evidence that IT supports safe transfusion practice in the clinical setting (Murphy, et al., 2019; Staples, et al., 2019). This facilitates accurate sample labelling, collection of the correct blood component from storage devices, and electronic patient identification (ID) checks at the administration of components. In the UKTLC survey, only 21.6% respondents had IT systems that covered the full vein-to-vein transfusion process, from sample labelling to administration and 31.1% had no clinical EBMS at all (UKTLC and SHOT, 2022).

The cases for this chapter are identified by the reporters in answer to the question – '*Did IT contribute to this error?*' and further reports are included following analysis by the SHOT incident specialists. Gaps in IT provision as well as corrective and preventive action in response to errors have been identified in response to the question – *'Could the error have been prevented by using IT?'*. To avoid duplication, examples related to IT included in other chapters are not covered in this chapter, including reference to the impact of various cyber-attacks experienced during this reporting year.

Overview of cases

The number of IT-related cases in 2024 has increased compared to the 2023 data. The rising proportion of IT errors could potentially reflect improved visibility, reliance on digital systems and increased staff awareness. A total of 763 cases are reviewed for 2024; 623 related to blood components, and a further 140 that involved anti-D immunoglobulin (Ig) (Table 18.1). The main increase in reports related to right blood right patient (RBRP) errors and delayed transfusions. The errors attributed to the laboratory accounted for 329/763 (43.1%) of the total IT errors.

Table 18.1: Primary reporting categories containing errors related to information technology in 2024

Primary reporting category for IT cases	Laboratory errors	Clinical errors	Number of cases 2024	Number of cases 2023
Incorrect blood component transfused-wrong component transfused (IBCT-WCT)	48	17	**65**	78
IBCT- specific requirements not met (IBCT-SRNM)	102	63	**165**	163
Right blood right patient (RBRP)	54	84	**138**	86
Delayed transfusion	32	33	**65**	37
Avoidable transfusion	5	28	**33**	22
Under or overtransfusion	0	3	**3**	4
Prothrombin complex concentrates (PCC)	3	8	**11**	6
Handling and storage errors (HSE)	49	94	**143**	145
Anti-D Ig administration errors	36	104	**140**	68
Total	**329**	**434**	**763**	**609**

Incorrect blood component transfused-wrong component transfused (IBCT-WCT) n=65

Errors mainly resulted in transfusion of a blood component of an incorrect ABO/D group for the patient, 47/65 (72.3%) or transfusion to the wrong patient, 10/65 (15.4%). IT errors were evident in all 4 cases of ABO-incompatible transfusions with LIMS alerts either overridden or a lack of optimal functionality in the IT systems. Errors in transplant patients (haemopoietic stem cell transplant (HSCT) or solid organ transplant (SOT)) accounted for 19/65 (29.2%) cases, D-positive components were inadvertently transfused to D-negative patients in 15/65 (23.1%) cases and in 14/65 (21.5%) cases incorrect, but ABO-compatible components were transfused. The involvement of IT in the error was varied (full details in the supplementary information) but mainly related to warning flags not being heeded, lack of algorithms for safe practice, and reporters noting that IT could have prevented the error had it been available or used.

Incorrect blood component transfused-specific requirements not met (IBCT-SRNM) n=165

IT was noted to be involved in transfusion of blood components that did not match the specific requirements in 165 cases. These mainly related to transfusion of non-irradiated components, 54/165 (32.7%), inappropriate electronic issue of red cells, 36/165 (21.8%), red cells that did not meet antigen-matching criteria, 29/165 (17.6%) and incomplete testing performed, 15/165 (9.1%). The majority of these errors occurred in the laboratory, 102/165 (61.8%). Further details on the involvement of IT can be seen in the supplementary material.

Case 18.1: Antigen-positive red cells transfused to a patient with red cell antibodies

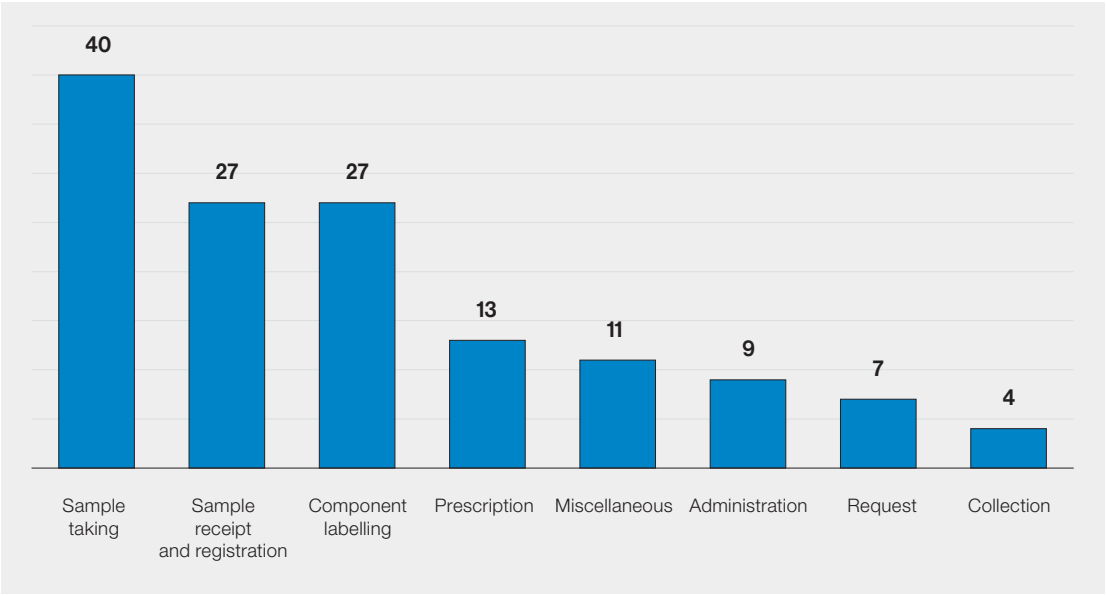
A patient with historic red cell antibodies required a transfusion. Recent antibody screens were negative. The current LIMS contained a 'critical note' that the legacy LIMS should be interrogated for details of the antibody. This note was missed by the biomedical scientist (BMS) and the sample for crossmatch was the first to be tested in the new LIMS. Antigen-positive red cell units were selected, crossmatched and transfused to the patient.

The investigation noted that antibody specificities had not been migrated to the new LIMS from the original legacy LIMS. Correct selection of blood components was reliant on staff reading a note and reviewing the legacy LIMS. Data migration is a critical part of implementation of a new LIMS. Specific transfusion requirements should be migrated to the correct data fields in the new LIMS to drive algorithms for safe practice. Data cleansing may be required prior to migration (Staves, et al., 2024).

Right blood right patient (RBRP) n=138

The majority of RBRP events involving IT occurred in the clinical setting, 84/138 (60.9%). IT-related errors were noted across a range of transfusion process steps (Figure 18.1). In 40/138 (29.0%) cases, sample labelling errors were not noted in the laboratory and blood components were released with incorrect patient details. These may have been prevented by electronic sample labelling. Sample receipt and registration and blood component labelling steps each accounted for 27/138 (19.6%) cases. Of the sample receipt and registration errors, 17/27 (63.0%) could have been prevented had interoperability between the patient administration system (PAS) and LIMS been in place. In 10/27 (37.0%) component labelling errors, the error could have been prevented by an electronic label verification system. Eleven errors occurred at patient registration, incorrect patient details at this stage in the process affect all downstream steps. These are included as 'miscellaneous' in Figure 18.1.

Figure 18.1: RBRP IT-related errors according to the step in the transfusion process in 2024 (n=138)



In many cases, it was noted that IT could have identified or prevented the error prior to administration, 59/138 (42.8%), most notably the potential use of electronic patient identification systems at administration. These would provide an alert to the user when incorrect patient details are present on blood component labels. In 15/138 (10.9%) cases, an electronic patient identification system was used, and provided an alert, but this was ignored. IT downtime accounted for 10/138 (7.2%) cases, including cyber-attack events. Ineffective downtimes processes failed to identify errors. Further details on the contribution of IT can be found in the supplementary information.

Handling and storage errors (HSE) n=143

IT involvement was noted in 143 HSE errors (Table 18.2) resulting from IT systems not being used correctly, 60/143 (42.0%), warning flags not heeded, 21/143 (14.7%) and IT failures, 17/143 (11.9%). In 17/143 (11.9%) cases, it was noted that IT could have prevented the error had it been available and used appropriately.

Table 18.2: HSE errors with IT involvement in 2024 (n=143)

HSE error	Number of cases
Administration error	51
Cold chain error	46
Excessive time to transfuse	25
Reservation period excursion	11
Expired blood component transfused	9
Miscellaneous	1
Total	**143**

Case 18.2: Ineffective alarm escalation leads to transfusion of red cell units subjected to temperature excursion

Laboratory support staff doing daily blood refrigerator checks found that there was water on the floor and the refrigerator door was slightly open. There was a unit of red cells in the refrigerator that was due to be returned to stock. The staff member removed the red cell unit and took it back to the laboratory without checking the cold chain. The support staff informed the BMS about the situation, but lack of clear communication meant that the BMS determined the red cell unit was acceptable and returned it to stock. This blood component was subsequently reissued to another patient and transfused. The temperature-monitoring alarm system had previously alerted the hospital

switchboard and two attempts were made to notify the laboratory staff with no response. The temperature-monitoring system then sent an email informing laboratory staff of the situation, but this had not been actioned. Hence the BMS returning the unit to stock was unaware of a temperature excursion.

Although an IT system was in place for monitoring and escalating temperature excursions, the escalation process was ineffective in ensuring that this information was passed to appropriate staff. Alarm escalations should not culminate in emails to inboxes that may not be monitored or actioned in an appropriate and timely manner. This also highlights the importance of clear and concise communication to support safe decisions in transfusion practice.

Delayed transfusion n=65

IT involvement in delayed transfusions mainly related to the system not being used or configured correctly, 23/65 (35.4%), IT failures, 10/65 (15.4%) and lack of functionality to support safe practice, 6/65 (9.2%). IT could have prevented the error in 11/65 (16.9%) cases.

Case 18.3: Incorrect use of electronic blood 'prescribing' system leading to procedure delay

There was a delay to the availability of blood components for a procedure in a patient with known red cell antibodies. A midwife who was not trained in blood authorisation accessed the EPR prescribing system with an intention to request blood components. Completing the EPR prescription did not order the blood components from the laboratory and therefore they were not available. This resulted in a delay to planned surgery whilst suitable red cells were sourced. The procedure went ahead when all blood components were available. The training on the new EPR had not made it clear how to order blood components and who was eligible to prescribe/authorise blood components.

This case demonstrates the importance of staff training and understanding of the functionality and use of new IT systems. Lack of understanding of new systems was a common theme in transfusion delays, suggestive of ineffective training and inadequate support during the implementation phase.

Near miss events n=181

There were 181 near miss events involving IT (see supplementary information), mainly relating to RBRP, 65/181 (35.9%) and IBCT-WCT, 49/181 (27.1%). It was noted that in 42/181 (23.2%) cases, IT could have prevented the error had it been in place and used appropriately. Label verification systems are available and should be utilised to identify label transposition errors prior to release of blood components and blood products. Errors in data entry accounted for 30/181 (16.6%) cases which were noted later in the process.

Improved interfacing from patient administration systems could reduce risk of error. Computer downtimes accounted for 22/181 (12.2%) cases, many related to cyber-attacks. Organisations should ensure that contingency plans are effective at preventing errors in manual processes. In 21 cases, IT alerted the user and error was prevented, mainly as part of the pre-administration checks. Failure to heed alerts, lack of functionality within systems and failure to use systems correctly continue to be a source of error relating to IT (see supplementary information).

Gaps in staff training to use new systems, using ID bands not attached to patients and EPRs allowing override of scanning patient ID bands contributed to errors. It is encouraging to note that IT is being seen as a preventive measure for wrong blood in tube events. It should however be noted that for new IT systems to be effective, they need to be validated, configured and used correctly, with staff appropriately trained in their use. Failure to consider human factors and ergonomics in the design and implementation can lead to unsafe workarounds.

Case 18.4: Ineffective checks during IT downtime

Two units of fresh frozen plasma (FFP) were issued for a patient. One unit was collected and delivered to the clinical area where it was noted that the unit number on the compatibility label did not match the unit number on the component. The FFP unit was returned to the laboratory where transposition of labels between these two units was noted. A label verification step was available within the EBMS,

but this had been disabled, because of a cyber-attack on the LIMS, to allow other functions to work. During this period, label verification became manual but high workload and interruptions increased the risk of human factors leading to error.

Near miss - wrong blood in tube (NM-WBIT) n=220

In the majority of NM-WBIT, it was noted that IT could have prevented the error had it been in place or used, 142/220 (64.5%). In 34/220 cases IT was not used correctly, predominantly using ID bands not attached to the patient. Themes include challenges with using IT systems in outpatient and antenatal clinics where ID bands cannot be printed, issues with labelling cord blood samples due to the delays in registration in electronic patient record systems, connectivity issues and equipment failures.

Case 18.5: Implementation of a new EPR system introduced unsafe workarounds

A group and screen sample grouped as B D-positive, but the patient was known to be O D-positive. The sample was labelled away from the patient. The organisation implemented an EPR system using workstations on wheels that were too large to be moved to near the patient. There was no other mobile equipment that could be used for sample labelling. Prior to the introduction of the new EPR system, transfusion sample labels were generated using a different system (mobile handset and mobile printer) which allowed easy use at the patient's side. The introduction of the new EPR resulted in an increase in 'workarounds' by staff such as using ID bands not attached to the patient.

Learning point

- IT is an integral part of healthcare provision. It is essential that it is configured, validated, and implemented correctly to reduce risk of error. Training for new and current IT systems must be effective and systems must be designed with consideration of human factors and ergonomics

Conclusion

It is important that IT works for healthcare workers and for patient safety needs and that those needs should not be compromised because the system cannot support them. This requires clear standards for safe functionality. These must be met by the systems and suppliers; collaborative working between healthcare organisations and IT suppliers will improve systems for future users and patients. Sharing learning and good practice via SHOT and SHOT UK Collaborative Reviewing and reforming IT Processes in Transfusion (SCRIPT) enables improvement in transfusion safety.

The Infected Blood Inquiry (IBI) report (2024) recommended IT to support safe transfusion practices. Progress with implementation of the IBI recommendations and the National Health Service Blood and Transplant (NHSBT)/National Blood Transfusion Committee (NBTC) Transfusion Transformation program should increase the availability of IT to support transfusion practice in England. The Blood Services in Scotland and Northern Ireland have paved the way for fully interoperable systems, with bi-directional traceability and monitoring of component usage. Similar work to improve transfusion IT systems are ongoing in Wales.

Across the UK, transfusion laboratories are replacing and upgrading LIMS, requiring formal change control and validation. Organisations should review systems to ensure that interoperability is optimised, and manual entry of data minimised or removed. SHOT near miss cases demonstrate how IT is actively preventing errors, particularly as part of the pre-administration checklist. IT has also been noted as effective in prevention of ABOi (Mirrione-Savin, et al., 2025). SHOT data shows that errors may be introduced because of lack of understanding of the functionality, failures in data migration from legacy systems, interoperability challenges and poor training of staff in use of the new IT systems.

EPR systems, which are being increasingly used across the UK to digitise patient records and replace paper systems, provide more than just a repository of patient data. They can support requesting and timely access to results from transfusion tests, prescription/authorisation of blood components and provide decision-support to promote patient blood management. Interoperability between clinical systems as well as links to laboratory systems is vital if all the benefits are to be realised. Equally, failure

to interface systems, or failure to map data to appropriate fields, leads to error and unsafe practice. Concerns around EPR systems were raised in Australia and New Zealand where they were sometimes perceived as suboptimal, being mostly sourced from the United States with variable adaptation to local healthcare systems (Verral, et al., 2019, cited in Crispin, et al., 2022). Lack of regulation and standards for EPR systems has been noted even within the United States (Crispin, et al., 2022).

The challenge for organisations is in the selection, procurement, validation and implementation of IT systems to support safe transfusion practice. Hospital management should ensure that transfusion subject matter experts are included in the selection process for relevant new systems across laboratory and clinical settings. Consideration of human factors and ergonomics should be applied across the life cycle of the system. Transfusion IT must be designed and implemented using a system-thinking approach to reduce the risk of unsafe practices and workarounds (Kushniruk and Borycki, 2023). Staff training must cover all aspects of the transfusion IT system and be supported by functionality that is intuitive to use, with clear flags and warning where patient safety may be compromised.

The use of artificial intelligence (AI) introduces a range of possibilities in the healthcare setting. International Society of Blood Transfusion (ISBT) surveys are evaluating the global current and potential future use of AI in both clinical transfusion and haemovigilance activities. A lack of national or international standards governing the functionality and use of AI in transfusion could translate into ineffective or unsafe practices. SHOT is uniquely poised to gather signals from new technology and inform recommendations and standards for safe practice.

SHOT data continue to demonstrate our reliance on IT and that contingency plans for planned or unplanned downtimes need to be effective in reducing risk of error. The cyber-attacks in 2024 provided a sobering warning of the vulnerability of IT, impact on the local patient population and on the blood supply chain. Organisations should ensure that systems are protected from cyber-attack.

It is acknowledged that IT requires investment, but this can be offset by savings, including staff efficiencies (Health Technology Wales, 2023). A recent publication reviewing implementation of electronic blood transfusion safety systems in three organisations highlights the importance of involving the end users at an early stage in the process, ensuring training is effective, flexibility in system design and provides an overview of the common challenges and solutions to address them (Horck, et al., 2025). This study also identified a lack of inter-organisational platform for shared learning, at national and international level.

The SCRIPT group have created templates and guidance for using IT, including planned and unplanned downtimes. Organisations are encouraged to access these resources to support their own planned or current use of IT. IT supports safe practice, but only if configured, implemented and used correctly. There is a clear need for agreed standards in the UK for transfusion IT systems.

Recommended resources

SHOT UK Collaborative Reviewing and reforming IT Processes in Transfusion (SCRIPT)
https://www.shotuk.org/script/about-script/

SCRIPT Resources
https://www.shotuk.org/script/script-resources/