# 2022 Annual SHOT Report – Supplementary information

# Chapter 3: Headline Data

Additional tables and analysis – not included in the main 2022 Annual SHOT Report.

**Table 3.3: Distribution of report categories 1996-2022**

| Year/ category | IBCT | ADU | HSE | Anti-D | FAHR | HTR | Allo | TRALI‡ | TACO | TAD | PTP | UCT | TA-GvHD | TTI† | CS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2022 | 296 | 365 | 272 | 345 | 294 | 49 | 0 | 5 | 160 | 47 | 1 | 13 | 0 | 2 | 20 |
| 2021 | 266 | 347 | 244 | 341 | 318 | 44 | 0 | 2 | 131 | 28 | 0 | 31 | 0 | 0 | 38 |
| 2020 | 323 | 285 | 278 | 400 | 321 | 46 | 0 | 2 | 149 | 37 | 0 | 12 | 0 | 1 | 23 |
| 2019 | 329 | 279 | 306 | 413 | 288 | 49 | 0 | 3 | 139 | 21 | 0 | 15 | 0 | 2 | 23 |
| 2018 | 272 | 236 | 264 | 466 | 238 | 35 | 0 | 1 | 110 | 8 | 1 | 8 | 0 | 3 | 17 |
| 2017 | 307 | 225 | 243 | 426 | 284 | 42 | 0 | 3 | 92 | 20 | 0 | 11 | 0 | 1 | 17 |
| 2016 | 331 | 246 | 192 | 409 | 253 | 35 | 0 | 0 | 86 | 10 | 0 | 9 | 0 | 1 | 9 |
| 2015 | 280 | 241 | 254 | 350 | 296 | 59 | 236 | 3 | 89 | 3 | 2 | 14 | 0 | 6 | 20 |
| 2014 | 278 | 185 | 188 | 359 | 343 | 46 | 151 | 4 | 91 | 7 | 1 | 5 | 0 | 3 | 16 |
| 2013 | 247 | 161 | 193 | 354 | 320 | 49 | 114 | 5 | 96 | 6 | 3 | 6 | 0 | 0 | 12 |
| 2012 | 252 | 145 | 316 | 313 | 372 | 42 | 69 | 7 | 82 | 19 | 1 | 8 | 1 | 3 | 11 |
| 2011 | 247 | 149 | 325 | 249 | 587 | 40 | 54 | 1 | 71 | 35 | 2 | 2 | 0 | 4 | 42 |
| 2010 | 200 | 110 | 239 | 241 | 510 | 33 | 25 | 4 | 40 | 35 | 1 | 0 | 0 | 0 | 15 |
| 2009 | 282 | 92 | 196 | 186 | 400 | 47 | 0 | 9 | 34 | 4 | 0 | 0 | 0 | 3 | 14 |
| 2008 | 262 | 76 | 139 | 137 | 300 | 55 | 0 | 5 | 18 | 1 | 1 | 0 | 0 | 6 | 28 |
| 2007 | 164 | 50 | 118 | 63 | 114 | 23 | 0 | 11 | 0 | 0 | 2 | 0 | 0 | 3 | 0 |
| 2006 | 198 | 51 | 74 | 77 | 85 | 34 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 2005 | 252 | 67 | 79 | 87 | 68 | 28 | 0 | 7 | 0 | 0 | 2 | 0 | 0 | 4 | 0 |
| 2004 | 262 | 56 | 54 | 67 | 34 | 43 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 2003 | 252 | 29 | 43 | 24 | 39 | 25 | 0 | 24 | 0 | 0 | 1 | 0 | 0 | 5 | 0 |
| 2001/2002* | 303 | 0 | 0 | 43 | 48 | 47 | 0 | 33 | 0 | 0 | 2 | 0 | 0 | 3 | 0 |
| 2000/2001 | 173 | 0 | 0 | 17 | 31 | 39 | 0 | 13 | 0 | 0 | 3 | 0 | 1 | 5 | 0 |
| 1999/2000 | 188 | 0 | 0 | 12 | 33 | 24 | 0 | 18 | 0 | 0 | 5 | 0 | 2 | 9 | 0 |
| 1998/1999** | 131 | 0 | 0 | 5 | 34 | 30 | 0 | 16 | 0 | 0 | 10 | 0 | 3 | 8 | 0 |
| 1997/1998 | 107 | 0 | 0 | 3 | 24 | 25 | 0 | 14 | 0 | 0 | 9 | 0 | 3 | 5 | 0 |
| 1996/1997 | 63 | 0 | 0 | 0 | 24 | 23 | 0 | 9 | 0 | 0 | 11 | 0 | 4 | 18 | 0 |
| **Total** | **5969** | **3030** | **3745** | **5042** | **5364** | **963** | **649** | **211** | **1228** | **234** | **57** | **121** | **14** | **96** | **285** |

**2001/2002 figures covered a 15-month period. **Total excludes 7 cases that were not classified*
*‡ The number of TRALI reports have been amended (back to 2003) to reflect the revised acceptance criteria adopted in 2016*
*† The number of TTI have been updated to reflect the same number of reports as those investigated and confirmed by the PHE Epidemiology Unit*

## Table 3.4: Cumulative mortality/morbidity data 1996-2022

| | Total | IBCT | ADU | HSE | Anti-D | FAHR | HTR | Allo | TRALI | TACO | TAD | PTP | UCT | TA-GvHD | TTI | CS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Death in which the transfusion reaction was causal or contributory | 408 | 26 | 95 | 0 | 1 | 25 | 24 | 0 | 44 | 116 | 26 | 3 | 20 | 14 | 14 | 0 |
| Major morbidity attributed to the transfusion reaction | 2101 | 168 | 73 | 0 | 27 | 1012 | 162 | 0 | 145 | 367 | 47 | 15 | 16 | 0 | 63 | 6 |
| Minor or no morbidity as a result of the transfusion reaction (including unknown outcomes) | 26368 | 6071 | 3227 | 4017 | 5359 | 4621 | 826 | 649 | 27 | 905 | 208 | 40 | 98 | 0 | 21 | 299 |
| **TOTAL**** | **28877** | **6265**** | **3395** | **4017** | **5387** | **5658** | **1012** | **649** | **216** | **1388** | **281** | **58** | **134** | **14** | **98** | **305** |

***Total excludes 7 cases from 1998-1999 that were not classified*

*The totals for IBCT may also include some ADU, HSE and ANTI-D up until 2008 where these cannot be identified and split out*

*TACO, TAD and autologous are new since 2008, and HSE and ADU were separated from IBCT in 2008.*

*Alloimmunisation is included since 2010 (separated from HTR) and is no longer collected since 2015*

*Cases with potential for major morbidity are included in minor or no morbidity*

*CS=cell salvage autologous transfusion*

## Table 3.5: Mortality and morbidity data 2022

| | Total | IBCT | ADU | HSE | Anti-D | FAHR | HTR | TRALI | TACO | TAD | PTP | UCT | TA-GvHD | TTI | CS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Death in which the transfusion reaction was causal or contributory | 35 | 2 | 15 | 0 | 0 | 1 | 1 | 1 | 8 | 6 | 0 | 1 | 0 | 0 | 0 |
| Major morbidity attributed to the transfusion reaction | 144 | 5 | 10 | 0 | 0 | 77 | 11 | 2 | 25 | 10 | 1 | 1 | 0 | 2 | 0 |
| Minor or no morbidity as a result of the transfusion reaction (including unknown outcomes) | 1690 | 289 | 340 | 272 | 345 | 216 | 37 | 2 | 127 | 31 | 0 | 11 | 0 | 0 | 20 |
| **TOTAL** | **1869** | **296** | **365** | **272** | **345** | **294** | **49** | **5** | **160** | **47** | **1** | **13** | **0** | **2** | **20** |

*Cases with potential for major morbidity are included in minor or no morbidity*

# Review of transfusion-related deaths

In 2022 there was a total of 35 reports where patient death was related to a transfusion reaction (18/35) or error (17/35). Figure 3.4 in the headlines chapter in the 2022 Annual SHOT Report provides an overview of all the transfusion-related deaths reported to SHOT in 2022.

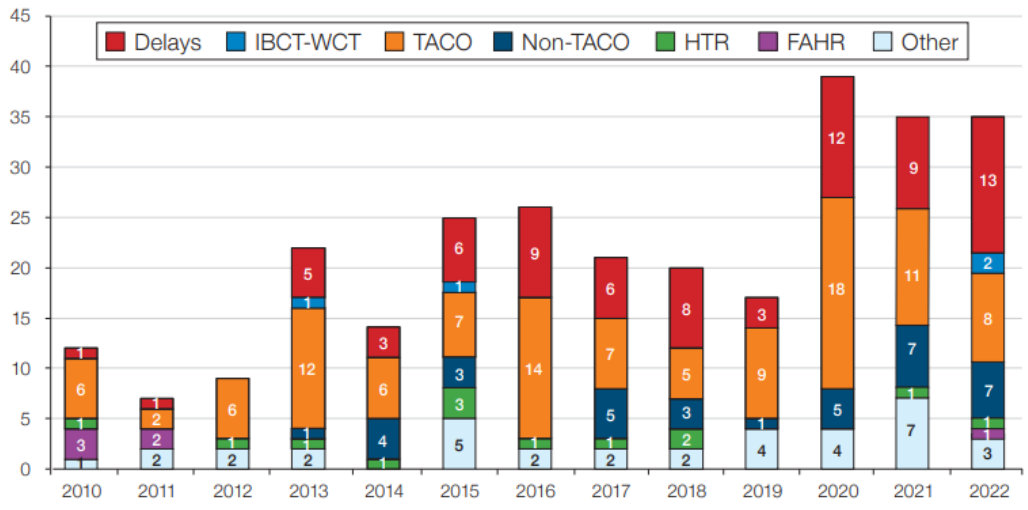
In most of these cases (26/35) the evidence was indeterminate for attributing death to the reaction or adverse event (imputability 1), in 6/35 it was considered likely, or probable (imputability 2), that the reaction/error was causal and in 3/35 cases there was conclusive evidence (imputability 3). Transfusion-associated circulatory overload (TACO) was implicated in 8/18 deaths, with one case noted as imputability 3. Regardless of whether the transfusion was directly related to the patient death, or not, there is important learning and improvements that can be shared from cases where errors occurred. Transfusion-associated dyspnoea (TAD) was implicated in 6 cases (4 TAD-IC and 2 TAD-C). Other respiratory complications accounted for 2 cases, 1 allergic case and 1 hyperhaemolysis case.. Where errors were implicated in patient deaths, 13/17 related to delays in transfusion, 2/17 resulted from ABO-incompatible red cell transfusion and 2/17 resulted from errors in administering prothrombin complex concentrate (PCC). In 24/35 cases errors or reactions related to red cells, in 4/35 cases platelet components were implicated and 2 cases related to PCC. In the remaining 5 cases multiple components were involved. The transfusion priority was stated as emergency in 13/35 cases, urgent in 7/35 cases and routine in 13/35 cases, in one case the priority was not stated.

# Trend in deaths reported to SHOT

Figure 1 (see below) shows all the transfusion-related deaths reported to SHOT between 2010-2022.

**Transfusion-related deaths 2010-2022 (n=282)**

TACO and delays are the most prevalent causes of transfusion-related deaths year on year.




*IBCT-WCT=incorrect blood component transfused-wrong component transfused; TACO=transfusion-associated circulatory overload; HTR=haemolytic transfusion reaction; FAHR=febrile, allergic and hypotensive reactions*

*Delays include 1 delay due to PCC in 2019; 'Other' includes 1 each for post-transfusion purpura, transfusion-associated graft-versus-host disease (2012) and anti-D Ig related; there were 8 in the avoidable, over or undertransfusion category, 3 transfusion-transmitted infections, 2 PCC administration errors and 20 deaths related to other unclassified reactions*

TACO and transfusion delays continue to be the leading causes or contributory factors in transfusion related deaths. SHOT recommended a TACO risk assessment as part of the pre-transfusion checks to identify patients as risk of circulatory overload in the 2015 Annual SHOT Report. There were 4/8 cases that did not include a TACO pre-transfusion risk assessment undertaken despite 3/8 patients having evidence of fluid overload prior to the transfusion. In 5/8 cases a formal investigation was performed following a patient death, but in only 1 case the SHOT structured templated was used.

## Illustrative cases with key learning points

### TACO

**Case 1: TACO in a patient with decompensated liver disease**

*A patient with a known history of decompensated alcoholic liver disease attended ED acutely unwell with haematemesis and melaena. They received fluid resuscitation with crystalloids followed by one-unit of red cells given at a rate of 300mL/hour. The patient developed TACO and later died. The investigation noted that the decision to transfuse one unit of red cells was appropriate, but that a full TACO risk assessment prior to transfusion may have identified fluid overload earlier in the patient pathway.*

Checking patient's Hb prior to further transfusion support may prevent unnecessary transfusion and reduce risk of TACO. This case illustrates that TACO may occur in vulnerable patients with risk factors even when haemodynamically unstable with active bleeding following even single unit transfusion, so careful monitoring is needed when patients with risk factors for TACO are identified so that appropriate measures can be initiated promptly.

Failure to incorporate a TACO risk assessment into the transfusion process, at either the time of making the decision to transfuse and/or at administration of blood components and blood products, is a recurrent theme in SHOT reports. A TACO risk assessment was only applied in 3/7 cases where this information was recorded in the SHOT dataset questions provided by reporters. Formal investigation of TACO cases is vital to identify learning and improvements in practice, however, this was only performed for only 5/8 cases. SHOT provided a structured template to facilitate investigation, this was utilised in a single case. In 3/8 cases local practice was changed as a result of learning, in all three cases the improvement action was to incorporate a TACO risk assessment into the transfusion process.

SHOT provide a simple TACO pre-transfusion risk assessment that can be used to support medical and nursing decision making, allowing appropriate transfusion whilst minimising the risk of TACO (See recommended resources at the end of this chapter).

### Reactions

Other reaction types relating to patient deaths included TAD (n=6), TRALI (n=1), allergic (n=1), hyperhaemolysis (n=1), and other reaction (n=1). These reactions are generally unavoidable and unpredictable but can have devastating consequences. Post transfusion pulmonary complications occurring contribute significantly to death and major morbidity. Patients with respiratory complications are often elderly with multiple co-morbidities which have the potential to contribute to the development of post transfusion reactions.

## Transfusion delays

Transfusion delays were noted as preventable and addressed with the CAS alert in 2022. However, in 2022 transfusion delays were associated with more patient deaths than TACO. In the 13 reported cases, delays were considered to be attributable to the clinical decisions/actions. In 12/13 the events occurred outside core hours. Delays were related to failures in the recognition of bleeding, activation of the major haemorrhage protocol, communication issues, challenges with provision of red cells for patients with multiple red cell antibodies and problems with sample taking or labelling. These errors are preventable, as increasing number of hospitals implement the improvement actions identified in the CAS alert it is hoped that SHOT reports relating to delays in transfusion will reduce.

**Case 2: Delay in provision of red cells for patient with autoimmune haemolytic anaemia**

*A patient with autoimmune haemolytic anaemia (AIHA) required urgent transfusion. Transfusion samples were taken and sent to the laboratory; the samples were referred to the Blood Service as they could not be tested locally due to the autoantibody. Laboratory staff explained to the clinicians that a deviation would need to be approved by a consultant haematologist if units required prior to testing being complete. Communication issues and failure to request red cells via concessionary release resulted in a delay of 5 hours and the patient arrested with Hb <30g/L.*

Patients with haemolysis are at risk of death due to cardiac failure, particularly where the Hb is <60g/L. Provision of red cells are complicated by the presence of autoantibodies that can mask presence of alloantibodies. Organisations should have agreed protocols for the rapid release of red cells (concessionary release) in these situations using 'best matched' units such as ABO/D compatible Rh and K matched. Severe anaemia is a risk factor for TACO, and where rapid transfusion is needed for patients with AIHA consideration should be given to reducing the risk of fluid overload. Red cell antibodies, and other scenarios where transfusion specific requirements cannot be met, can also complicate the provision of red cell in major haemorrhage events. Concessionary release should include decision support for provision of best matched blood components where transfusion is required urgently.

## ABO-incompatible red cell transfusion

ABO-incompatible transfusion can result from errors in sample collection and labelling, laboratory processes, component collection/delivery and administration to the patient. In 2022, there were 2 deaths related to ABOi red cell transfusion. In both cases, errors occurred at collection/delivery steps and were compounded by suboptimal patient pre-transfusion identification checks.

**Case 3: Collection error and incomplete pre-administration checks lead to a haemolytic transfusion reaction**

*A group O patient was given a unit of group A red cells. The patient subsequently had a serious haemolytic transfusion reaction. The collector transported blood from the hospital transfusion laboratory for two patients in two different clinical areas and accidentally mixed the two blood boxes up therefore the wrong blood went to the wrong location. The pre-transfusion checking procedure for patient A was significantly disrupted, the patient would not permit the two nurses to look at their identification band and was displaying challenging behaviour. The patient was also known by a chosen name that did not bear any resemblance to their formal name, refusing for anyone to use their formal name. The unit was authorised to be given over 1 hour. The unit (313mL) was transfused via gravity drip through a pressure device and was transfused within approximately 45 minutes. The patient was not allowing the staff to undertake all the necessary observations during the transfusion. The error was detected when clinical area looking after patient B phoned the transfusion laboratory to ask where the unit was for their patient and said they had a box for another clinical area. This was*

*45 mins after blood had been dropped off to each location. The laboratory phoned the clinical area treating patient A and explained the error, asking for the blood to be returned immediately. The remainder of the transfusion (10-15mL) was stopped immediately, senior medical staff were informed and responded straight away with commencement of emergency treatment of the patient. Haematology medical staff were alerted immediately upon identification of the event and worked in collaboration with the patient's clinical team.*

Patient identification is critical at all stages in the transfusion process. The final pre-administration check is the most vital as this is the last opportunity to identify errors in the collection and delivery process. In the case described above, accurate and complete patient identification was complicated by the patient's challenging behaviour. A process for checking that the correct components had been received in the clinical area could have prevented this incorrect transfusion. Electronic blood management systems can reduce the risk of error at all stages of the transfusion process and should be standard for all organisations.

It is encouraging to note that all cases where errors were involved (ADU and IBCT, n=17) were formally investigated. For 14/17 cases the investigation had been completed and in 3/17 cases the investigation was on-going. In only 3 cases information was provided relating to improvement actions identified in the investigation. These actions were mainly people focussed, including checklists, guidelines, policies and training. While these are useful actions and may be appropriate, stronger system-focussed interventions will also need to be considered for long term sustained changes.

SHOT encourages reporters to share the learning and improvement actions from investigations so that this can be more widely shared across the transfusion community. Tools used to support investigations included the SHOT HFIT (6/14), in-house RCA (5/14), SHEEP (2/14) and combination of SHOT HFIT and in-house RCA (1/14). SHOT recommends that, whichever tools are used to formally investigate errors, these should incorporate human factors principles. There is rarely a single root cause found within an investigation and this was supported by the multiple contributory factors noted in 11 investigations. Contributory factors included staff shortages, high workload, communication issues between staff groups and with patients, gaps in knowledge and education, lack of documentation, sample mislabelling and rejection by laboratories, and deficiencies in training for using IT systems. Where contributory factors are identified in investigations these should all be addressed within the improvement action plan, including sustainable long-term actions.

## Conclusion

TACO and delays in transfusion continue to be implicated in most cases involving patient deaths. Recommendations for reducing the risk of TACO and delays in transfusion, supported by SHOT resources, have been available for many years but the level of reporting suggests that these may not have been implemented effectively in all organisations. The increasing use of electronic patient record and blood management systems provides an opportunity to implement effective clinical decision support for patients with severe anaemia and major haemorrhage, incorporation of TACO risk assessment, patient identification checks at administration, communication pathways and access to emergency red cell units. However, these systems need to be configured and used correctly to ensure that they do not contribute to errors. Configuration, design and implementation of electronic systems must include human factors principles, consideration of potential shortcuts, assumptions, effective training and procedures for downtime. SHOT has created a document that can be used to identify areas of transfusion practice where IT can be used to improve safety. A driver diagram is also available on the SHOT website that can be used to identify improvement interventions. Where IT is not available checklists should be incorporated into transfusion care plans and need to be effective to ensure that they do not become a 'tick box' exercise. Information in checklists should be appropriate, relevant and not overly prescriptive. Laboratories should have processes in place for concessionary release of red cells in emergency situations where samples

are mislabelled and/or patients have red cell antibodies. Patients must not die due to delays in transfusion in these situations.

Training and education for clinical staff must include recognition of haemorrhage, particularly where this is not obvious or where patients are haemolysing. Training and education for clinical and laboratory staff must include procedures for major haemorrhage situations, ideally supported by simulation exercises. Laboratory staff training and competency assessment must include understanding of concessionary release, supported by information relating to appropriate selection of components and relevant risks on documentation used in this process.

## Recommended resources

**SCRIPT – Using Information Technology for Safe Transfusion**
https://www.shotuk.org/resources/current-resources/script/

**Safe Transfusion Checklist**
**TACO checklist**
**TACO Investigation Guidance Tool**
**SHOT Driver Diagram**
https://www.shotuk.org/resources/current-resources/

**Safety alerts are available on the SHOT website**
https://www.shotuk.org/resources/current-resources/safety-notices/

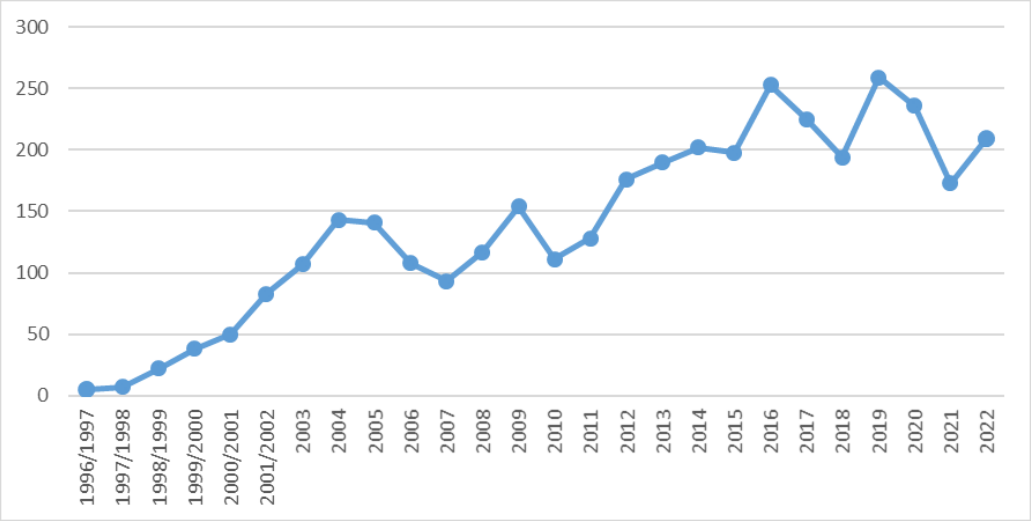
**CAS alert 2022: Preventing transfusion delays in bleeding and critically anaemic patients**
https://www.cas.mhra.gov.uk/ViewandAcknowledgment/ViewAlert.aspx?AlertID=103190

**CAS alert 2017: Safe Transfusion Practice: Use a bedside checklist**
https://www.cas.mhra.gov.uk/ViewandAcknowledgment/ViewAlert.aspx?AlertID=102663

## Transfusion errors where specific transfusion requirements were not met

Trends in IBCT-SRNM reports received by SHOT since reporting began in 1996 are shown in Figure 3.15.

**Figure 3.15: IBCT-SRNM errors by year of Annual SHOT Report 1996-2022**




Between 2016-2022, IBCT-SRNM errors accounted for 1549/19311 (8.0%) of errors analysed and included in the Annual SHOT Reports. Of these, 159/1549 (10.3%) cases involved paediatric patients. No deaths occurred due to IBCT-SRNM during this period, but 19 cases of major morbidity resulted due to these errors. Errors have been reported from both clinical and transfusion laboratory settings. Most clinical errors are failure to request irradiated or CMV-screened components, and most laboratory errors are failure to complete testing prior to issue, inappropriate use of electronic issue or providing the incorrect phenotype. These are detailed further in Chapter 9, Incorrect Blood Component Transfused (IBCT).

Staff involved in blood transfusions must have basic knowledge of blood components, indications for use, rationale for specific transfusion requirements and an understanding of the availability of alternative options. Staff authorising, prescribing, and ordering blood should be aware of the risks and benefits of transfusions including risks of not meeting specific transfusion requirements for patients and must be able to identify and manage any possible reactions and their management. Interventions to address these errors and improve safety are covered in the Safety Notice that was released in June 2022 (https://www.shotuk.org/resources/current-resources/safety-notices/).