National Haemovigilance Office

NHO ANNUAL REPORT 2023

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National Haemovigilance Office
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National Haemovigilance Office

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List of Abbreviations

EBTS	Electronic Blood Track System
FNHTR	Febrile, Allergic, and hypotensive reactions
HPRA	Health Products Regulatory Authority
HSE	Health Service Executive
HBB	Hospital Blood Bank
IUT	Intra Uterine Transfusion
LIS	Laboratory information systems
MNCMS	Maternal and New-born Clinical Management System
NHO	National Haemovigilance Office
PPI	Positive patient identification
SAE	Serious Adverse Events
SAR	Serious Adverse Reactions
TACO	Transfusion Associated Circulatory Overload
TAD	Transfusion Associated Dyspnoea
TRALI	Transfusion related Acute Lung Injury
WBIT	Wrong Blood in Tube

Introduction

It has been 25 years since the National Haemovigilance Office (NHO) was established, created in response to the recommendations of the Finlay Tribunal, which investigated the infection of numerous patients in the 1970s and 1980s with contaminated blood. This year, the UK released the Infected Blood Inquiry report (2024) examining infections of patients with contaminated blood during a similar period. Both events serve as a reminder of the critical role of haemovigilance in ensuring patient safety and the severe consequences that can arise when adverse outcomes and procedural errors are not adequately addressed.

Since its inception in 1999, the Irish Haemovigilance system has played a crucial role in identifying trends related to adverse events and reactions, offering recommendations that have enhanced patient safety in blood transfusions. Key improvements have included better patient identification, a reduction in ABO mismatches, and the use of wrong blood in tube data to support the transition to electronic sample collection and administration, among other advancements. Nevertheless, additional efforts are necessary to tackle factors affecting patient safety during transfusion.

The Health Products Regulatory Authority (HPRA) is the competent authority for implementation of legislation relating to blood and blood components in Ireland and in this regard works closely with the NHO. The NHO provides assistance to the HPRA through the continued collection, collation and evaluation of Serious Adverse Reactions (SARs) and Serious Adverse Events (SAEs), as provided for in Statutory Instruments 360 of 2005 and 547 of 2006 and associated EU legislation. SAR and SAE reports within scope of the legislation are then notified to the HPRA by the NHO.

The NHO department has also experienced several changes in 2024. We bid farewell to Professor Tor Hervig, the former medical and scientific director of the IBTS, and welcome Dr Andrew Godfrey as the new Medical and Scientific Director for the IBTS. Additionally, we have welcomed another haemovigilance officer, Niall Flavin. Efforts are currently underway to finalise the review of the Haemovigilance handbook and develop a new online Haemovigilance database. Furthermore, we in the process of creating new eLearning modules with the UK-IBTN, which will be accessible via HSeLanD.

This report will highlight the significant adverse event and reaction trends noted by the NHO in 2023, particularly the increase in Wrong Blood in Tube Most (WBIT) reports linked to errors occurring on maternity/labour wards. The report will also provide recommendations for staff involved in the transfusion process and document trends in Near Miss, SAE and SAR reports.

Participation in Haemovigilance

In 2023, the NHO received a total of 369 reports. Consistent with previous years, SAEs and SARs comprise the majority, accounting for 68% of reports received (refer to Table 1). This year experienced a decrease in both Near Miss and SAE reports submitted to the NHO. However, there was an increase in the number of WBIT reports and SARs reported in 2023.

Table 1: Number and classification of reports received by the NHO between 2019 and 2023.

Report classification	2019 (n=332)	2020 (n= 313)	2021 (n=322)	2022 (n=372)	2023 (n=369)
SAE	100	83	102	133	103
SAR	135	118	133	134	147
WBIT	54	77	56	57	78
Near Miss	43	35	31	48	41

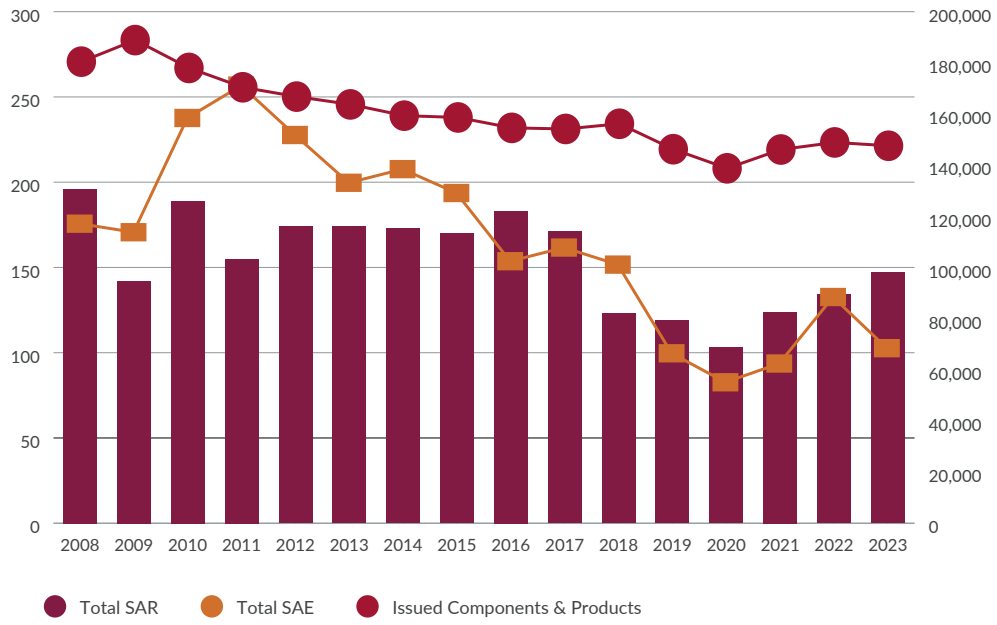
Red cell and platelet component issues saw a slight decline in 2023 compared to 2022. However, the quantity of components classified as 'other' (which includes granulocytes and cryoprecipitate) experienced a slight increase in 2023 (see Table 2).

Table 2. Number of components issued by the IBTS (2019-2023).

No. of components issued (2019-2023)*			
Total Number of components issued	RCC	Platelets	Other
2019	123,646	22,461	163
2020	116,591	22,120	92
2021	122,526	23,521	108
2022	125,135	23,689	101
2023	124,848	22,665	112

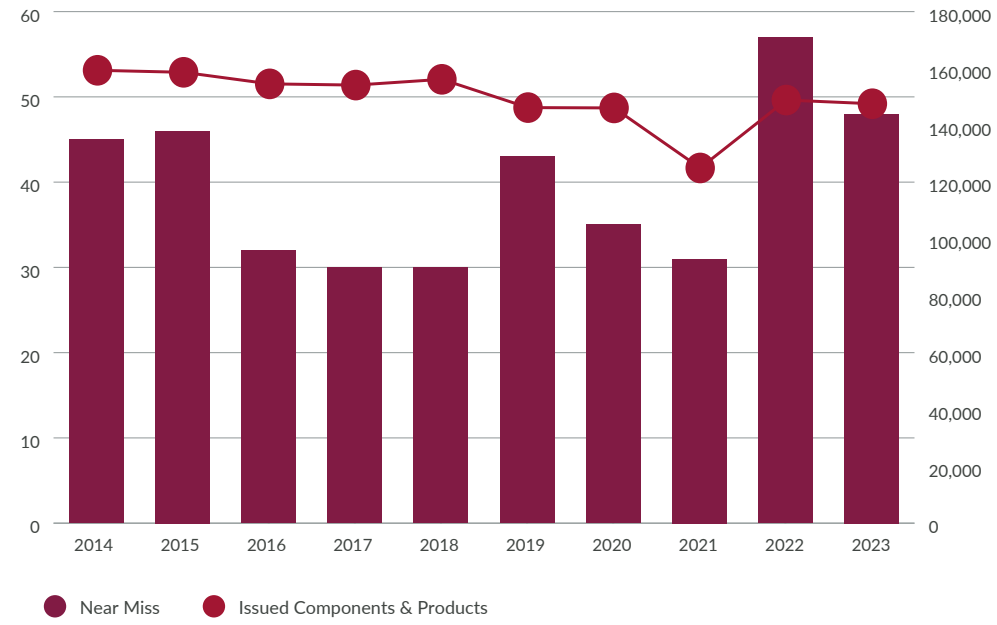
The number of SAE and SAR reports received, and the number of components issued per year from 2008 to 2023 are presented in Figure 1. As noted, there is a decrease in the number of SAEs received in 2023 and the reasons are unclear.

Figure 1: SAE and SAR reporting trends from 2008 to 2023.



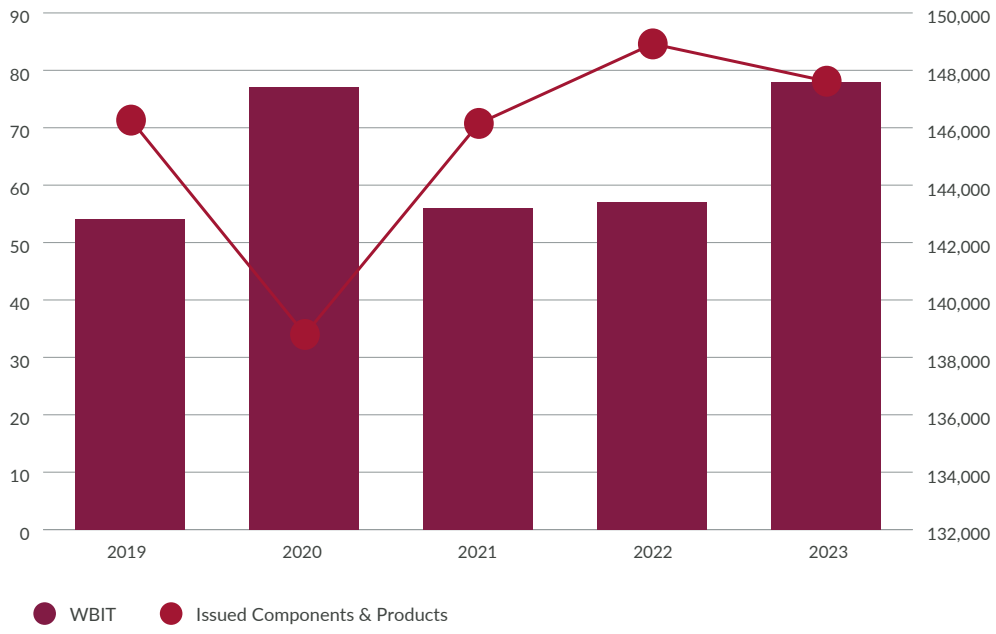
The number of Near Miss reports received in 2023 and the number of components issued is presented in Figure 2.

Figure 2: Near Miss reporting trends from 2014 to 2023.



The number of WBIT reports received in 2023 and the number of components issued is presented in Figure 3. The number of WBIT reports received in 2023 relative to the number of components issued indicates an increase in WBIT events reported for 2023. It is difficult to ascertain whether there was an increase in WBIT events in 2023 or whether reporting of WBITs has improved.

Figure 3: WBIT reporting trends from 2019 to 2023.



There are 85 reporting establishments listed on the NHO database as capable of providing a blood transfusion in the Republic of Ireland. 45% of all sites listed have not submitted an SAE or an SAR in 2023. Sites that did not submit either an SAE or an SAR in 2023 were Category A hospitals, hospices, or clinics where a low number of transfusions occur (<1000 units). Information regarding issues to each of these sites was unavailable.

Of the SAE and SAR reports received fifty-one per cent of came from Hospitals which were in the blood usage category D (>6000 Units). As expected, the number of reports from Category A and B hospitals was less than that of category D hospitals. Only ten per cent of all SAE and SAR reports came from hospitals categorised as blood usage category C (3000-6000 units).

The number and category of SAE and SAR reports, including those that did not progress (DNP), received from hospitals in 2023 by blood usage category is presented in Table 3.

*Taken from ANSARE Figures

Table 3: Number and category of SAE and SAR reports received by hospitals categorised by blood usage (2023).

Hospital Blood Usage Category	Total Number of reports received	Total DNP	Total SAE	Total SAE reportable to the HPRA	Total SAR	Total SAR reportable to the HPRA
Category A (<1000 units)	32	3	17	5	12	4
Category B (1000 – 3000 units)	64	5	27	5	32	12
Category C (3000 – 6000 units)	26	1	11	1	14	4
Category D (>6000 units)	128	7	44	15	77	47
Total no. of reports	250	16	99	26	135	67

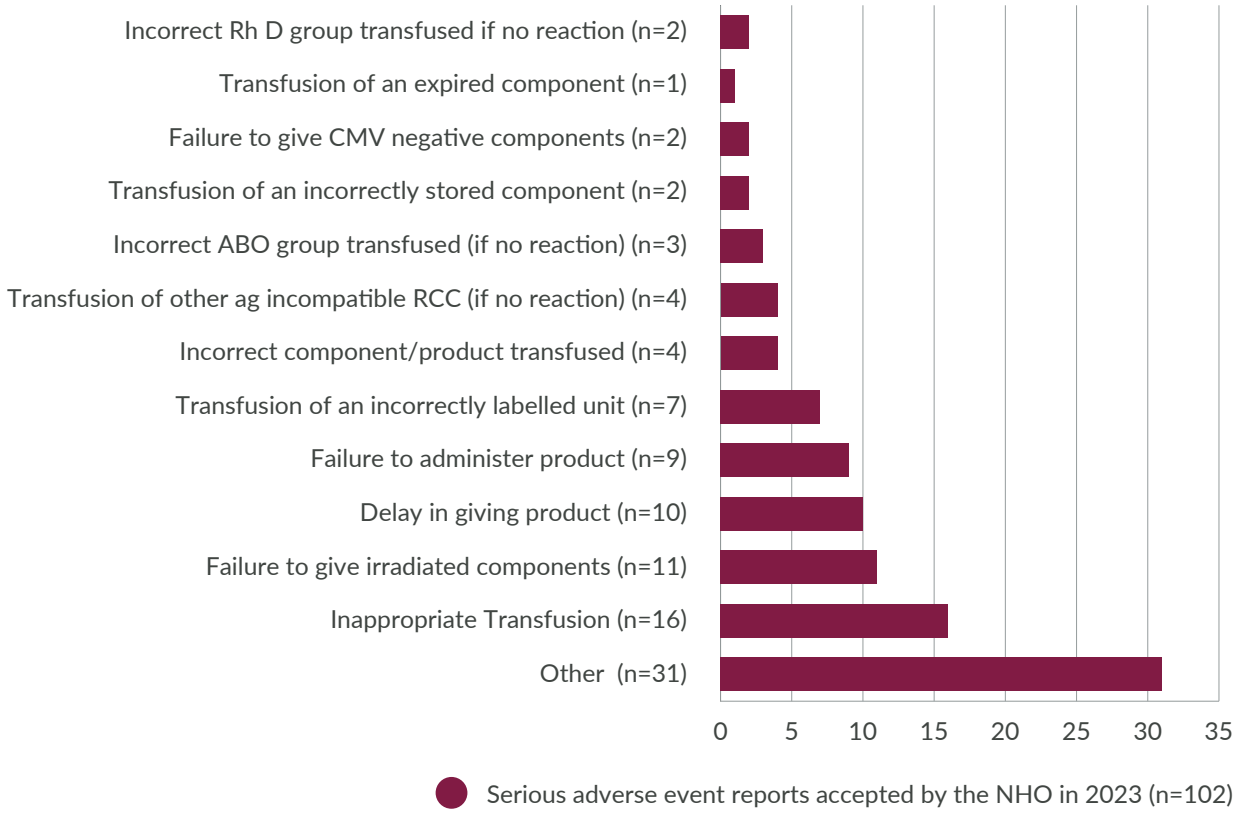
Serious Adverse Events (SAEs)

In 2023, the NHO received 103 SAE reports, a decline from the 133 reports received in the previous year. 102 reports were accepted, and one report did not progress.

The NHO observed a decrease in reports of errors such as 'other' types, transfusion of other antigen incompatible red cell component if no reaction, incorrect ABO group transfused if no reaction and inappropriate transfusions when compared to the figures from 2022.

There was a notable increase in the number of reports concerning delay in giving product specifically delays in Anti D administration and transfusion of an incorrectly labelled sample compared to 2022.

Figure 4: Serious Adverse Event reports accepted by the NHO in 2023.



Other (n=31)

The number of reports categorized categorised as “other” decreased from 41 in 2022 to 31 in 2023. Out of these, 30 reports were accepted, and 9 were determined to be within scope of the EU legislation and reported to the HPRA.

Errors occurred at various stages of the transfusion process. The NHO accepted 14 reports where the error first occurred during the administration stage, 5 reports during lab processing, 5 at the prescription request stage, 5 during sampling, and 1 report where the stage of the error was described as “other.”

The types of errors varied. Most reports (12) were classified as administration errors, including incorrect giving sets used (6) and incorrect transfusion times (6). Other errors included 5 prescription request errors, 5 processing errors, 5 sampling errors, and 3 miscellaneous errors.

Human failure was cited as the causative factor in 29 reports and system failure cited on 5 reports. The human failure errors were identified as below:

- Failure to adhere to policy and procedure - 17 reports.
- Carrying out task incorrectly – 10 reports.
- Knowledge – 9 reports.
- Other- 5 reports.
- Monitoring – 3 reports.
- Failure in communication and co-ordination – 2 reports.
- Verification – 2 reports.
- Slip – 1 report.
- Trip – 1 report.
- Patient related – 1 report.

System failures included failures in policies and procedures (n=2) and system failures described as other (n=4).

Case 1:

Female patient >80 years received 1 unit of Red Cell Components for anaemia (Hb 7.6). A group and screen was received by the medical scientist on call. Antibody identification performed on 2 panels was inconclusive. The medical scientist requested a further sample for investigation. A crossmatched unit was requested and a serological crossmatch was performed. The unit was found to be compatible and was issued and transfused. A second medical scientist who was taking over from the on-call staff noticed the antibody panel was inconclusive and the presence of an underlying antibody had not been excluded prior to issue of crossmatch compatible units. This report was determined to be a result of human error specifically a failure to follow policy and procedures. Corrective action involved the sample being sent to referral centre. The referral centre's report indicated the presence of cold antibody with no significant alloantibody detected. The staff member involved was re-trainaed.

Inappropriate Transfusions (n=16)

Inappropriate transfusions remain the second most common SAE report received by the NHO. However, the number of these reports decreased slightly from 20 in 2022 to 16 in 2023. Of the reports received, 15 were accepted, and none were reportable to the HPRA.

Ten of the reported events occurred at the prescription request stage of the transfusion process, while five occurred at other stages.

Most inappropriate transfusion reports were due to clinical decisions not conforming to guidelines (7 reports). Four reports identified the error as "Other," and three were based on incorrect or absent Hb results. One case was due to incorrect documentation or paperwork. The staff involved in these errors included doctors (15), nurses (3), and lab staff (1). Inappropriate transfusion events were most frequently reported from wards (7), A&E (3), day wards (2), ICU (1), and other locations (2), including critical care and medical assessment unit.

Case 2:

A male patient >60 years received 1 unit of red cell component for anaemia. The patient's Hb was 8.7 post transfusion of the first red cell. The patient was asymptomatic with no evidence of bleeding. A second unit was administered by nursing staff as they thought the unit would be wasted if not used. A medical scientist had contacted the ward to tell ward staff that units could be returned to referring hospital if not used, however not at weekend as no one was available. The patient's Hb was 10.7 post second transfusion. Transfusion was carried out overnight. The error was determined to be due to human error specifically failure in co-ordination and communication and failure to follow policy and procedure. Corrective and preventative actions included single unit transfusions stressed at education sessions; nurses were informed that units can be returned to hospital of origin. A single unit laminated poster was included with blood documentation in clinical areas.

Failure to give an irradiated component (n=11)

The NHO received 11 reports of failure to give an irradiated component. Ten reports were accepted, and two of the ten reports were within scope of the EU legislation and reported to the HPRA.

Most of these errors occurred at the prescription request stage of the process (n= 6). Errors also occurred at initial clerking (n=1) and sampling (n=2) and in one case the error occurred at a stage in the transfusion process identified as other (n=1).

Prescription request errors were identified on 9 reports. Prescription request errors identified include failure to prescribe special requests (n=5) and failure to request special requirements (n=4). One report (n=1) identified processing errors as the causative factor. In this case the historical records were not checked and so the correct unit was not ordered or prescribed.

Human failure was cited as a causative factor in 10 reports. The human failure errors were identified as below:

- Failure to adhere to policy and procedure- 10 reports.
- Knowledge - 6 reports.
- Failure in communication and co-ordination - 4 reports.

Staff members involved in these incidents include doctors (n=10), nurses (n=3) and lab staff (n=1). The locations where the events occurred include wards (n=6), ICU (n=1), theatre (n=2), lab (n=1) and Accident and Emergency (n=1).

Delay in giving product (n=10)

The NHO received 10 reports of delay in transfusion (specifically delay in Anti D administration). All reports were accepted and not within scope of the EU legislation with no requirement to report to the HPRA.

All ten reports cited human failure as the primary cause of error. Human failures identified failures in following policies and procedures (n=5), knowledge gaps (n=2), slips (n=2), coordination and communication failures (n=1), carrying out task incorrectly (n=1) and patient related errors (n=3).

Three reports cited failures of patients to relate information regarding bleeds in the appropriate timeframe. Ensuring that patients have all information regarding their care may reduce these events occurring.

Failure to administer product (n=9)

The NHO received nine reports of failure to administer product. All reports were accepted and not within scope of the EU legislation with no requirement to report to the HPRA.

Most reports cited human error as the primary cause of error. Co-ordination and communication errors (n=3), knowledge gaps (n=2), failure to adhere to policies and procedures (n=4), verification errors (n=1) and carrying out task incorrectly (n=1) were identified on the reports received. Two cases identified system errors as the cause of the failure to administer products specifically policy and procedure errors and a system error defined as other.

Transfusion of an incorrectly labelled unit (n=7)

The NHO received 7 reports of transfusion of an incorrectly labelled unit. All reports were accepted with six events within scope of the EU legislation and as such reportable to the HPRA.

The stage in the transfusion process where the error initially occurred varied. Errors were reported to have initially occurred at initial clerking in the hospital (n=3); lab processing in the blood transfusion lab (n=2); Lab processing at a stage designated other and one error initially occurred at the supply centre.

Incorrect patient identifiers were reported in four cases with incorrect details recorded during initial administration (n=3) and incorrect details on ID band (n=1).

Incorrect component/product transfused (n=4)

The NHO received 4 reports of incorrect component/product transfused. Two of these reports were within scope of the EU legislation and as such reportable to the HPRA.

The errors that led to incorrect components/products being transfused occurred at the lab processing (n=2) and prescription request (n=2) stage of the transfusion process.

Staff involved included doctors (n=2) and lab staff (n=2). The errors reported originated in labs (n=2), Accident and Emergency (n=1) and on a ward (n=1).

Human failure was identified as the causative factor in all reports with specific errors such as gaps in knowledge (n=1), failure to follow policies and procedures (n=1) and carrying out task incorrectly (n=2) identified.

Incorrect ABO group transfused (n=3)

The NHO received 3 reports of incorrect ABO group transfused. All three reports were accepted, and two reports were within scope of the EU legislation and as such reportable to the HPRA.

Errors occurred at lab processing in the blood transfusion lab. All errors involved lab staff.

Human failure was identified in all cases with knowledge (n=1), failure to follow policies and procedures (n=1) and carrying out task incorrectly (n=2) identified as causative factors in the reports submitted.

Case 3:

Male patient aged 30+ years was administered with SD plasma for an intra operative bleed. Group B plasma issued to patient with no previous blood group on record (sample was handwritten). Hospital sample policy is to have first sample labelled electronically or second sample if first sample handwritten to confirm blood group otherwise O RCC should be issued. Medical scientist forgot the policy. The case was identified as human error specifically gaps in knowledge, and failure to follow policy and procedure. A repeat sample was requested which confirmed patient's blood group was BRhD. An amended report was issued stating sample was processed in error. The event was discussed at staff meeting to remind all staff of 2nd sample rule. QC department discussed with medical scientist involved.

Transfusion of an incorrectly stored component (n=2)

The NHO received two reports of transfusion of an incorrectly stored component in 2023. Both reports were accepted, and one report was within scope of the EU legislation and as such reported to the HPRA.

One of the events reported occurred at the collection stage of the transfusion process and the other event occurred at a stage in the transfusion process identified as Other. Both errors were identified as errors in the collection/storage or handling of products with one specified as a transportation error and the other error identified as excessive time out of storage.

One of the events occurred in the laboratory and involved lab staff. The other event occurred on the ward and involved a nurse and a porter. Both events were attributed to human failure specifically failure to follow policies and procedures.

Transfusion of an expired component (n=1)

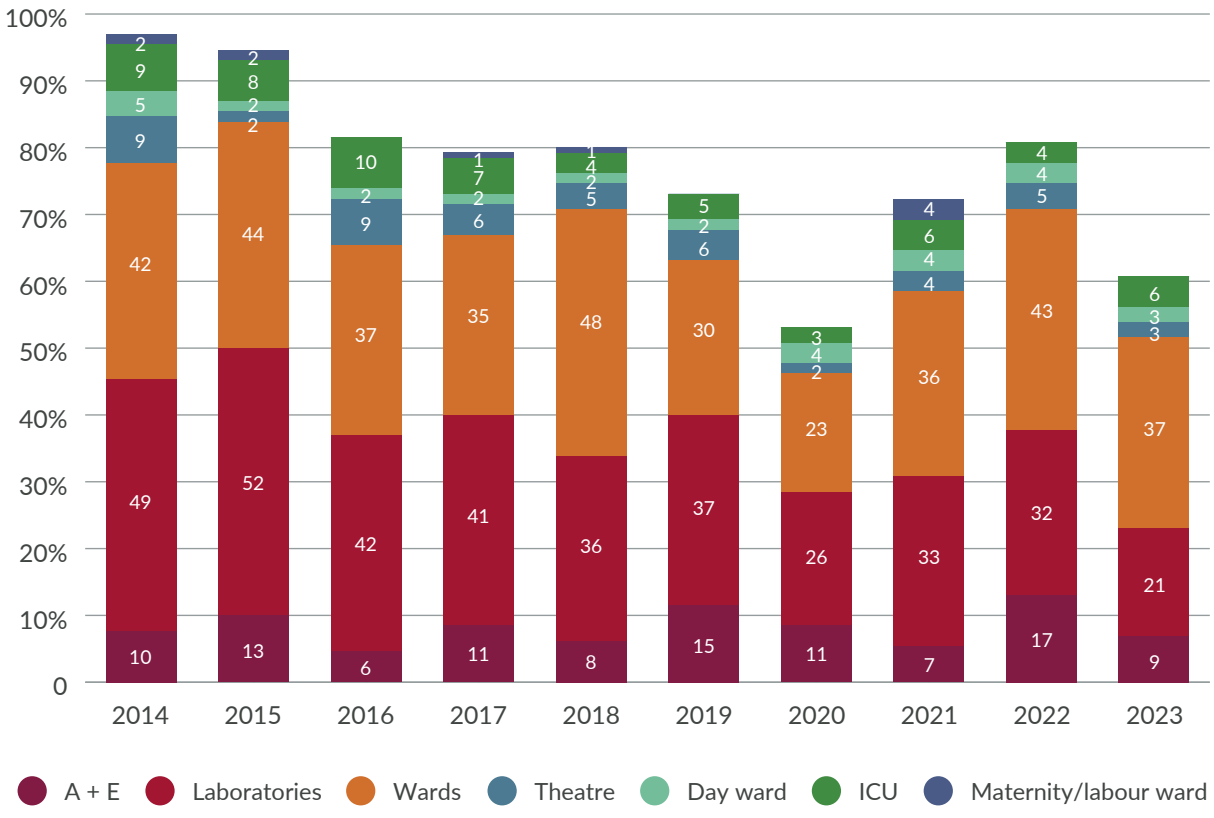
The NHO received one report of a transfusion of an expired component in 2023, which was not within scope of the EU legislation and as such was not reportable to the HPRA. The error occurred at the collection stage of the transfusion process, on a ward, and involved a nurse.

Human factors specifically knowledge gaps and failure to adhere to policy and procedure were identified as contributory factors to the event that occurred. A system design failure was also identified by the HVO who reported this case.

Locations where SAEs error occurred.

There was an overall decrease in reports received from all locations except for ICU which saw a small rise in the number of reports from 4 in 2022 to 6 in 2023. Although the number of WBIT reports from maternity and labour wards has risen, no SAEs were reported for incidents that took place in these locations in 2023. Wards continue to be the primary source of SAE reports, followed by laboratories.

Figure 5: Location where the first error occurred in the reports received by the NHO in 2023.

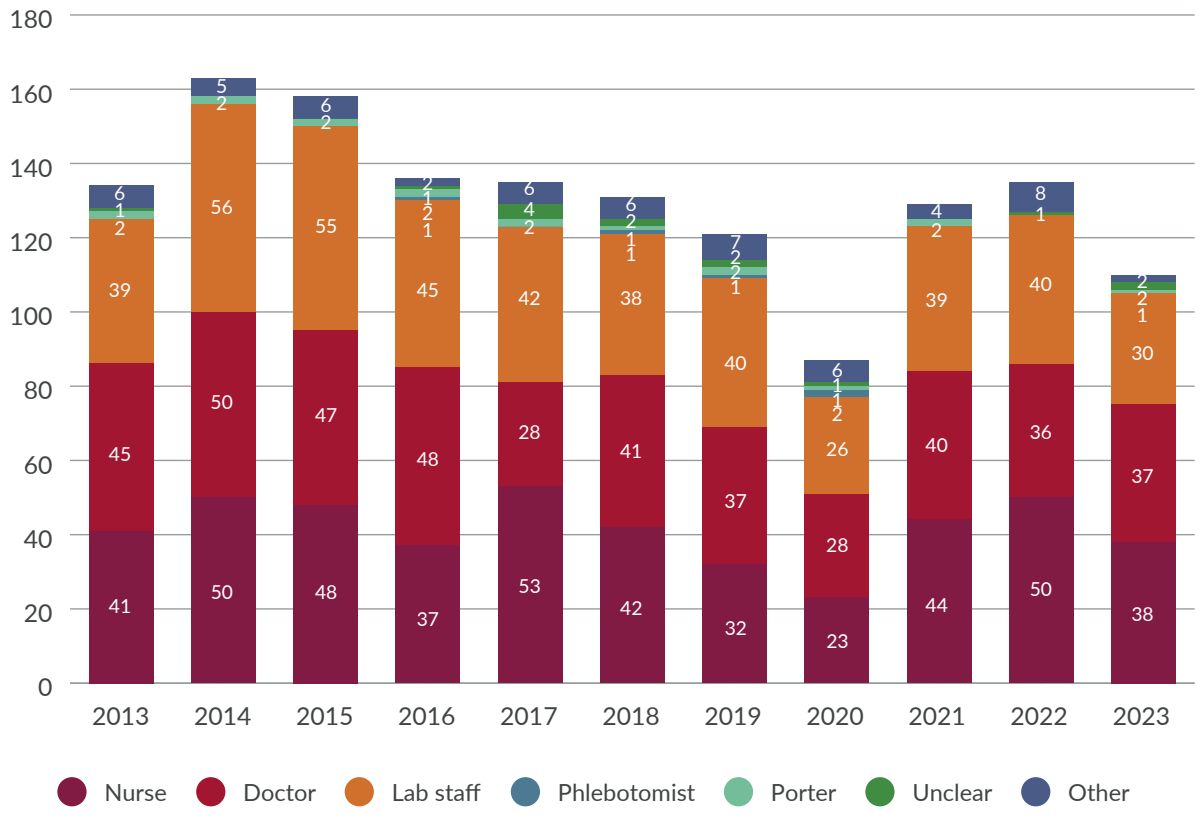


Staff involvement in SAEs

Nurses, lab staff and doctors remain the staff most likely to be involved in an SAE. It should be noted that phlebotomists have not been involved in any SAE events reported to the NHO in 2023.

While there was an overall reduction in the number of SAE reports received in 2023 the number of events that reported doctor involvement was comparable with 2023 (n=37). The number of reports received that involved nurses and lab staff decreased from 2022.

Figure 6: Staff involved in first error in SAE reports sent to NHO in 2023.



Human versus System errors in SAE reports

Failure to adhere to policy and procedure remains the most common human error identified on SAE reports submitted to the NHO, refer to Table 4. Currently the NHO do not capture the reasons why staff failed to adhere to established policies and procedures. Qualitative analysis on reports over the years suggest busy work environments, changeovers and resourcing issues contribute to staff failing to follow policies and procedures.

Gaps in knowledge continue to be identified in many reports as contributing to the event that occurred. Staff involved in the transfusion process should receive training including regular refresher training and should be competency assessed before being allowed to perform any task in the transfusion process.

Interestingly, the NHO noted a decline in coordination and communication errors reported in 2023. This may suggest broad system improvements have been made in coordination and communication.

Table 4: Types of human error identified by HVOs as contributing to the event that occurred in SAE reports, in 2023.

Types of Human Error	No. of reports (n=87) 2019	No. of reports (n=67) 2020	No. of reports (n=90) 2021	No. of reports (n=107) 2022	No. of reports (n=79) 2023
Failure to adhere to policies and procedures	60	33	48	64	47
Knowledge	19	19	24	30	27
Co-ordination and communication	14	14	13	17	4
Carrying out task incorrectly	18	12	13	22	16
Other	7	9	9	13	10
Verification	25	7	3	4	6
Slip	9	3	5	1	1
Monitoring	4	1	1	3	3
Patient related	2	1	1	2	1
Trip					1

Recommendations

Prescription errors made up 19% of all serious adverse events reported in 2023. Clinical decisions made not in conformity with current guidelines were the most common cause of prescription error. Staff prescribing blood components must have appropriate training and competencies and must adhere to current transfusion guidelines. Historical records must be checked to ensure patient's special requirements are met.

Single unit policy should be adhered to for all stable normovolaemic patients who do not have evidence of clinically significant bleeding. Non-adherence to the single unit transfusion policy is the most common prescription error identified on reports reported to the NHO. Single unit transfusion policy reduces patient exposure to blood products reducing risk of TACO and other risks associated with transfusion such as transfusion transmitted infections. The single unit policy also reduces blood usage and pressure on blood supply.

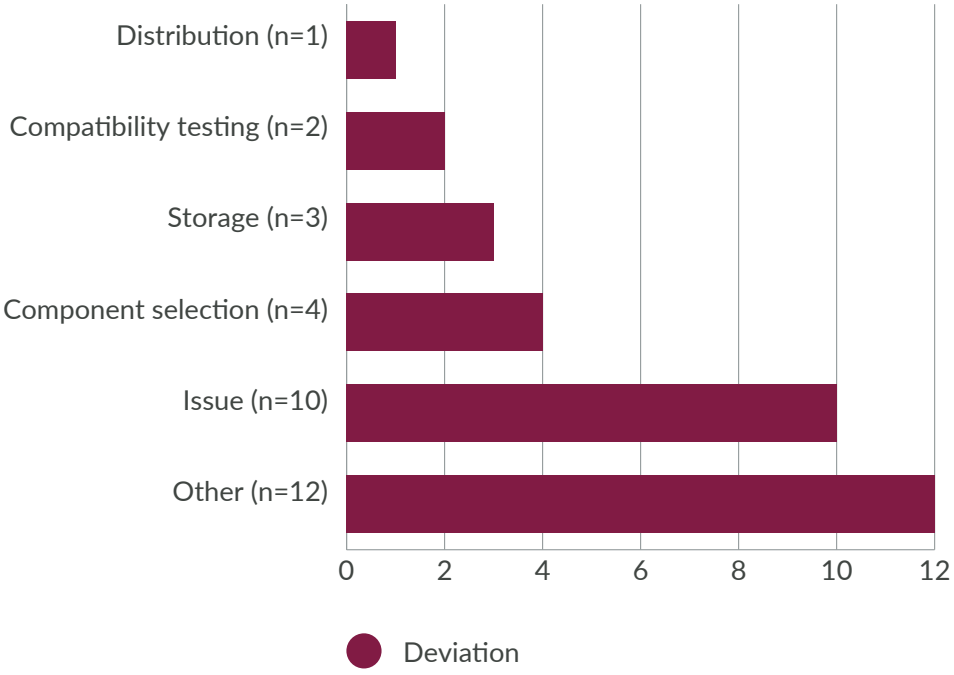
Delays in administration of Anti D can be avoided by ensuring all staff is aware of Anti D administration guidelines. Incorrect clinical decisions resulted in the omission of Anti D and were predominantly associated with pregnancy sensitising errors. Some delays in administration were related to D negative mothers not attending appointments. D negative mothers should be provided with clear information regarding associated risks of being D negative and the risks associated with not attending appointments.

Near Miss Reports

In 2023, the NHO received 41 near-miss reports from 15 different sites, with 32 reports accepted. Nine reports were rejected: four were clinical near misses, one involved Octaplex, one was related to SD plasma, and three did not meet the criteria for a near-miss report. This marks an increase in the number of reports compared to the previous year.

Most near miss cases reported to the NHO occurred at a stage in the process designated as other (many of which occurred at specimen registration) or at the issue stage of the process.

Figure 7: Stage in the transfusion process where the first error occurred



Human error versus System error in Near Miss Events

Human error was the most cited causative factor on Near Miss reports received in 2023, (n = 31) reports. Carrying out tasks incorrectly, failure to adhere to policies and procedures and insufficient attention to detail are the most common human errors identified on Near Miss reports. Slips and verification errors were identified in one report each.

System error was cited as the primary causative factor in 1 report. Respondents may overlook system errors when completing reports. When examining why an event occurred it is important to ask if anything could have been changed to prevent the error from occurring. Issues with staffing, resourcing, materials etc. could impact events that occur and should be noted on reports submitted to the NHO.

Human factors in Near Miss reports

The NHO identified several common human factors in both Near Miss event reports and Serious Adverse Events, using the twelve most common human error factors outlined by Gordon Dupont in 1997 for Human Performance in Maintenance training for Transport Canada. The NHO conducted database word searches and qualitative analyses to identify these common human factors.

Distractions, communication errors, fatigue, lack of resources, and pressure were identified in some of the Near Miss Reports received. It should be noted that HVOs are not required to report human factors on reports at present. It is possible that human factors may contribute to more of the events that occur annually than is currently reported.

Key Recommendations

Greater care must be taken when entering patient details on to LIS. Lab staff need to pay particular attention when entering patients with historical records. Current and historical records need to be compared, and further information requested if records differ. Care must also be taken when merging records.

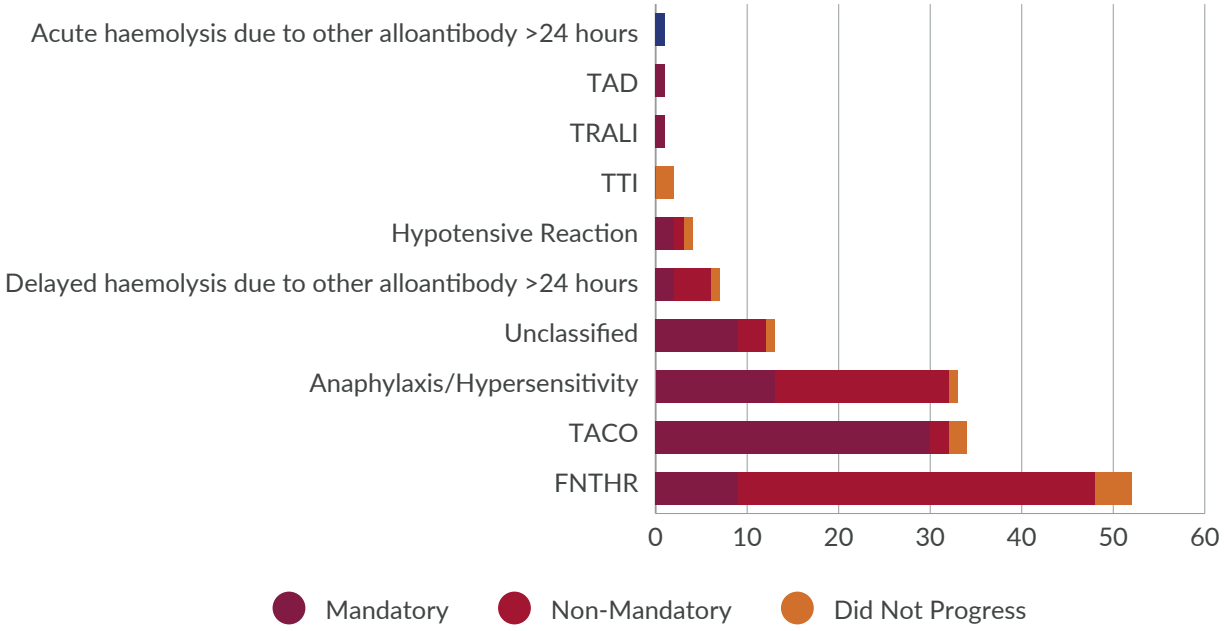
Transposition of labels occurs when more than one unit is being processed at one time. Units should ideally be processed one at a time to prevent transposition of labels. A second signed check by a competency assessed staff member could reduce the risk of units being issued with the incorrect label.

Regular checks of all fridges should be carried out to reduce the risk of transfusion of an expired component. Staff should be reminded of the risks associated with the transfusion of an expired component and their responsibility in ensuring all expired units are removed from fridges and any units removed must have the expiration date checked.

Serious Adverse Reactions

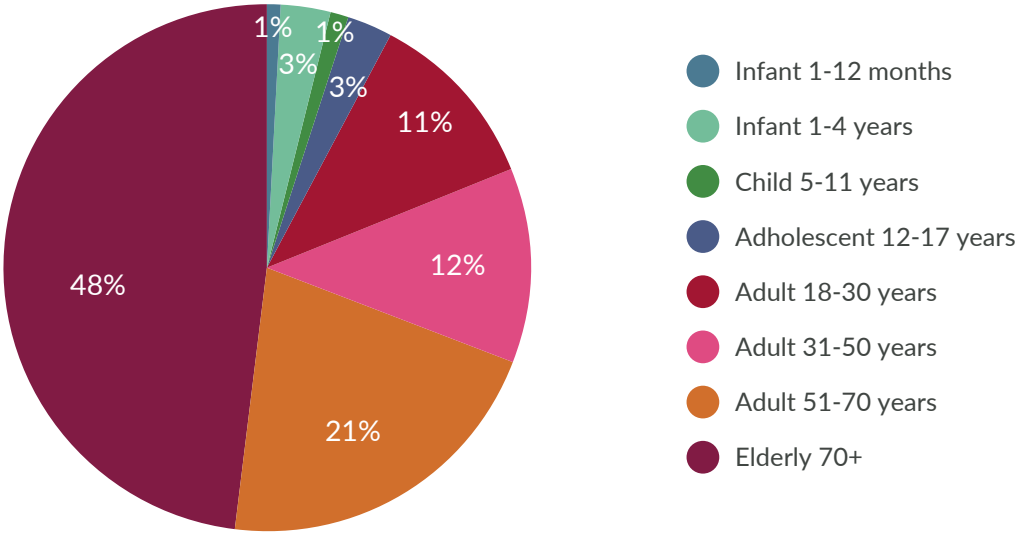
Collectively the NHO received 147 SAR reports in 2023. 13 of these did not meet the criteria for reporting and therefore did not progress. 135 SAR reports were accepted by the NHO. 67 of these were within scope of the EU legislation and as such reportable to the HPRA and 67 were not reportable. The breakdown of reports can be seen in Figure 8.

Figure 8: SAR types, categorisation and number of reports received by the NHO in 2023.



Of the accepted reactions 70 (52%) were associated with females and 64 (48%) males. The 70+ age group were most frequently associated with transfusion reactions and accounted for 48% of SARs accepted by the NHO. In 2023, the NHO received fewer reports from younger age groups, and none from neonates. Please see figure 9 for percentage of SARs received for each age category.

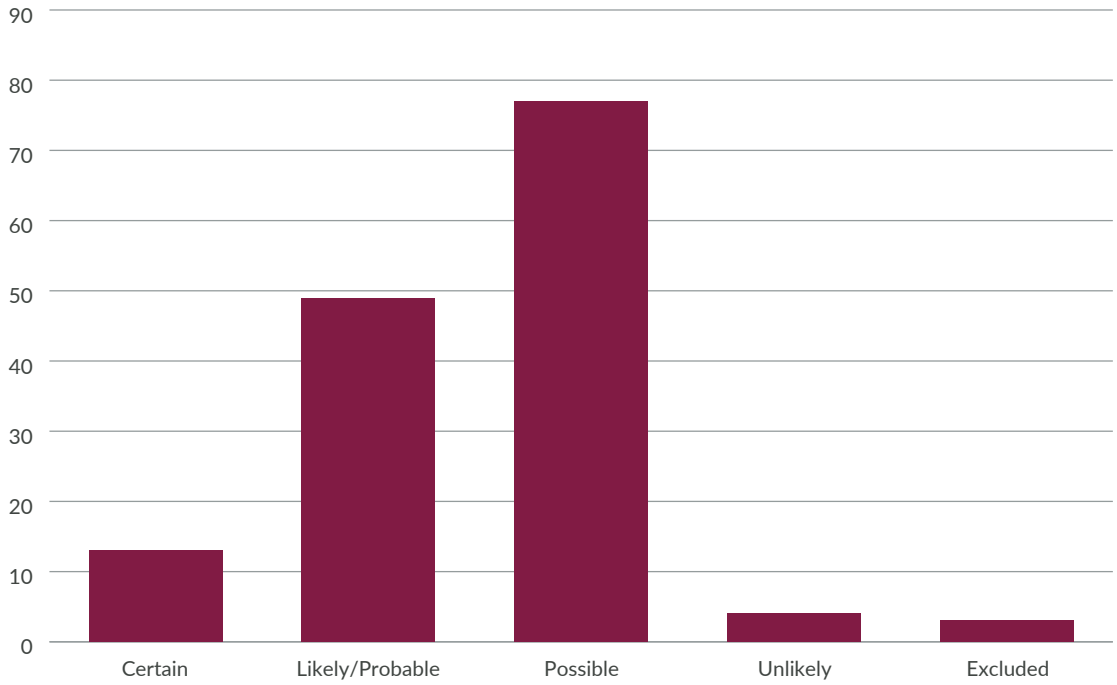
Figure 9: Percentage of SARs received for each age category reported to NHO in 2023.



Each transfusion reaction is assigned an imputability level (the likelihood the transfusion caused the reaction). The imputability levels are as follows; certain, likely/probable, possible, not assessable, unlikely, and excluded. The NHO only accepts cases with an imputability of certain, likely/probable, or possible assigned.

Assigning imputability to a SAR case can be difficult due to patients' underlying conditions and patient treatments. Furthermore, if a transfusion reaction is delayed or atypical, linking the symptoms to the transfusion may be challenging for clinicians.

Figure 10: The imputability assigned to each SAR case reported to the NHO in 2023.



Febrile, Allergic and Hypotensive Reactions

The NHO received 89 reports of febrile, allergic, and hypotensive type reactions. Of these, 6 did not meet the criteria to progress, 24 were within scope of the EU legislation and as such reported to the HPRA and 59 were deemed non-mandatory. Fortunately, most cases made a complete recovery (n=78), 4 had minor sequelae and 1 patient died (unrelated to transfusion).

Febrile, allergic, and hypotensive reactions can be categorised as mild, moderate, or severe. Please see table below for different classifications.

	1=MILD	2=MODERATE	3=SEVERE
FNHTR	A temperature ≥38°C and a rise of between 1 and 2°C from pre-transfusion values, But no other signs or symptoms	A rise in temperature of 2°C or more, or fever 39°C or over and/or chills/rigors, other inflammatory symptoms/ signs such as myalgia or nausea which precipitate stopping the transfusion	A rise in temperature of 2°C or more, or fever 39°C or over and/or chills/rigors, other inflammatory symptoms/ signs such as myalgia or nausea which precipitate stopping the transfusion, prompt medical review AND/ OR directly results in, or prolongs hospital stay.
ANAPHYLAXIS/ HYPERSENSITIVITY	Transient flushing, urticaria or rash.	Wheeze or angioedema with or without flushing/ urticaria/rash but without respiratory compromise or hypotension.	Bronchospasm, stridor, angioedema or circulatory problems which require urgent medical intervention AND/OR directly result in or prolong hospital stay, or anaphylaxis (severe, life-threatening generalised or systemic hypersensitivity reaction with rapidly developing airway and/ or breathing and/or circulation problems, usually associated with skin and mucosal changes).
HYPOTENSIVE		Isolated fall in systolic blood pressure of 30mmHg or more occurring during or within one hour of completing transfusion and systolic blood pressure 80 mmHg or less in the absence of allergic or anaphylactic symptoms. No/minor intervention required.	Hypotension, as previously defined, leading to shock (e.g. acidaemia, impairment of vital organ function) without allergic or inflammatory symptoms. Urgent medical intervention required.

Anaphylaxis/ Hypersensitivity Reactions

The NHO received 33 cases of anaphylaxis/hypersensitivity type reactions. There was 1 case that did not progress as symptoms were attributed to a newly commenced medication. From the cases accepted, 13 were within scope of the EU legislation and as such reportable to the HPRA and 19 were deemed not reportable to the HPRA. Males were associated with more allergic type reactions when compared to females (males=19, females= 13).

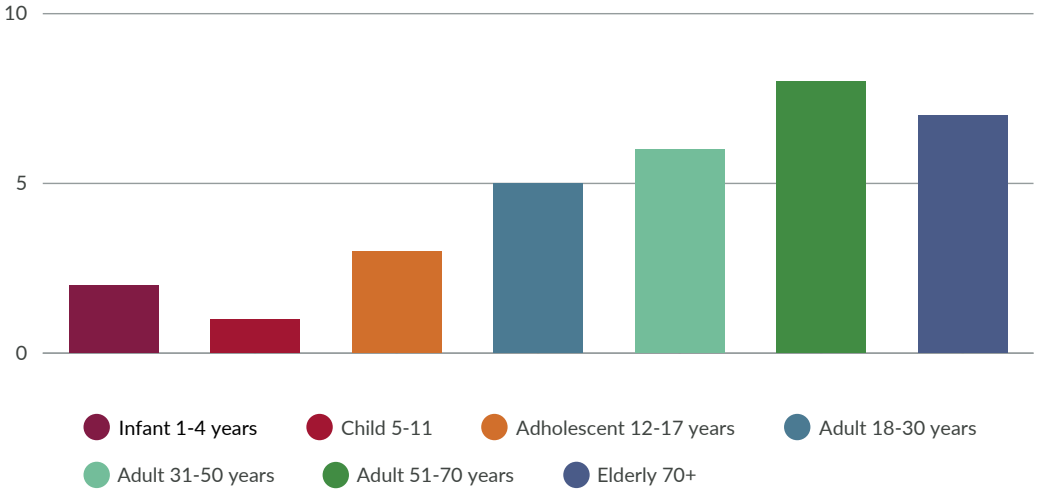
Platelets apheresis was most associated with anaphylactic/hypersensitivity reactions. Review table 2 for breakdown of cases for each component.

Table 5: Components associated with anaphylactic/hypersensitivity.

Component	No of cases n=32
RBC	12
Solvent Detergent Plasma	1
Platelets Apheresis	15
Platelets Pooled	4

When compared to the younger population adults were more frequently associated with allergic type reactions with the 51–70-year-old cohort having most cases. See figure 11 for breakdown.

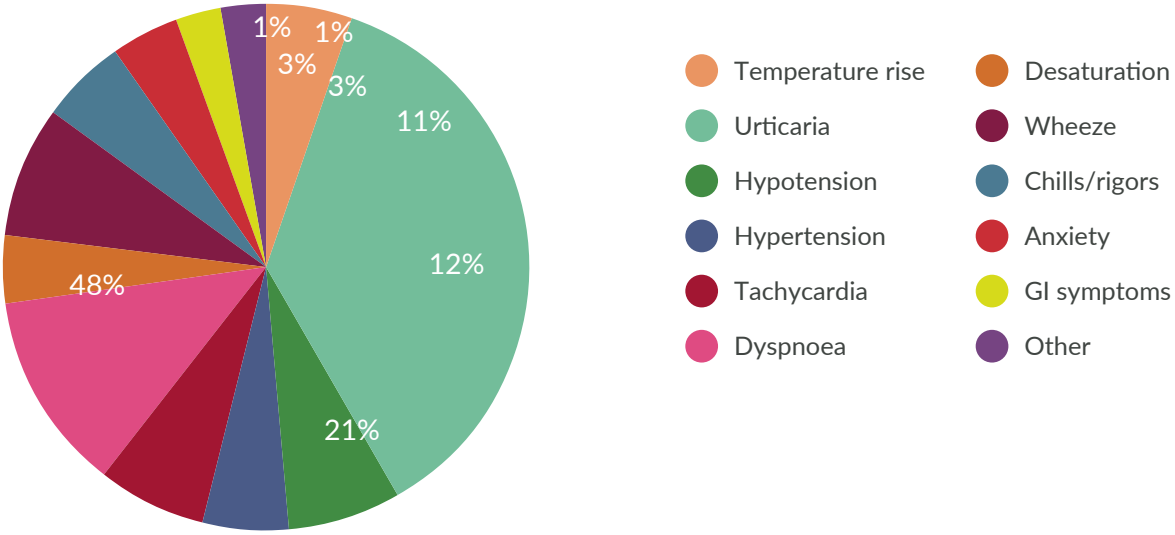
Figure 11: Number and age range of patients with anaphylactic/hypersensitivity reactions.



Urticaria was the most common symptom reported, for full list of symptoms see figure 12. Treatment options were diverse, with antihistamines (n=30) and steroids (n=22) most frequently utilised. All patients that received steroids were also treated with antihistamines. Other treatments included oxygen therapy (n=7), antipyretics (n=7), intravenous fluids (n=7) and adrenaline (n=4). A complete recovery was made by 31 patients and 1 had minor sequalae due to extended hospitalisation.

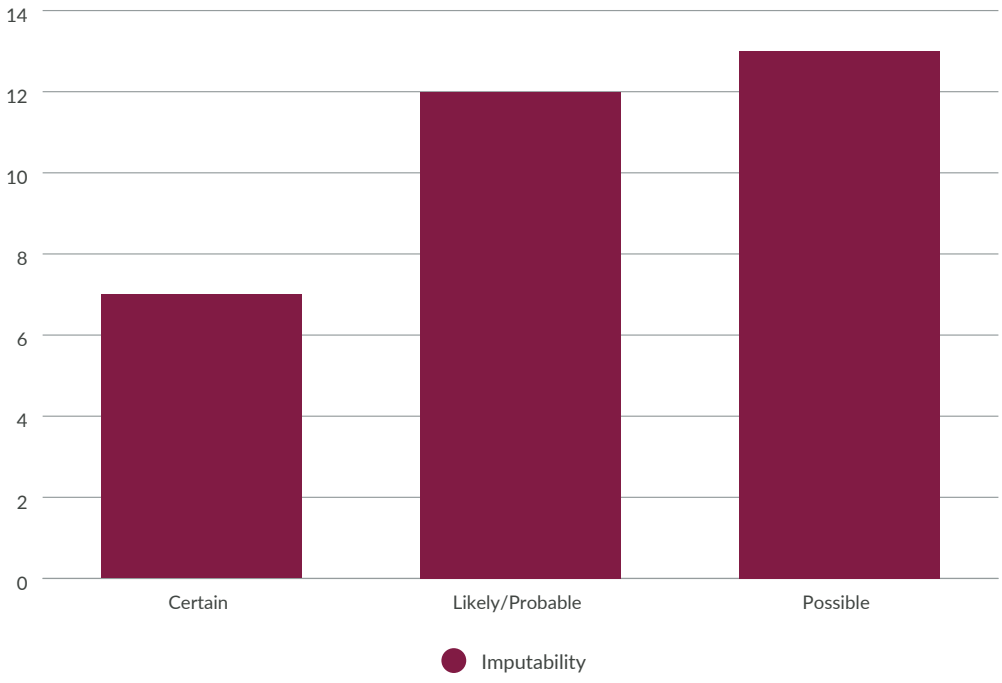
All patients who received adrenaline were male, 2 patients received platelets apheresis, 1 patient received pooled platelets, and 1 received RBCs. The NHO recommends the administration of adrenaline if anaphylaxis is suspected.

Figure 12: Symptoms identified in patients who experienced anaphylaxis/hypersensitivity reactions reported to the NHO in 2023.



Please see figure 13 for imputability of received cases.

Figure 13: Imputability assigned to cases of anaphylaxis/hypersensitivity reactions reported to the NHO in 2023.



Case 4:

Male aged 18-30 years with a history of B-cell acute lymphoblastic anaemia received 2 units of pooled platelets. Platelet count pre transfusion was 25. Patient had extensive transfusion history and received 1 unit of pooled platelets prior to this reaction with no issues. The patient developed urticaria on trunk, dyspnoea, and wheeze with feeling of throat tightening and angioedema to face, trunk, arms, and lips. Although the transfusion was completed the symptoms developed within 28 minutes from unit commencement. The patient received oxygen, IV hydrocortisone, piriton and adrenaline nebulisers. A complete recovery was made within 30 minutes and the patient is to receive antihistamine pre-med prior to platelet transfusions.

Febrile non-Haemolytic Transfusion Reactions

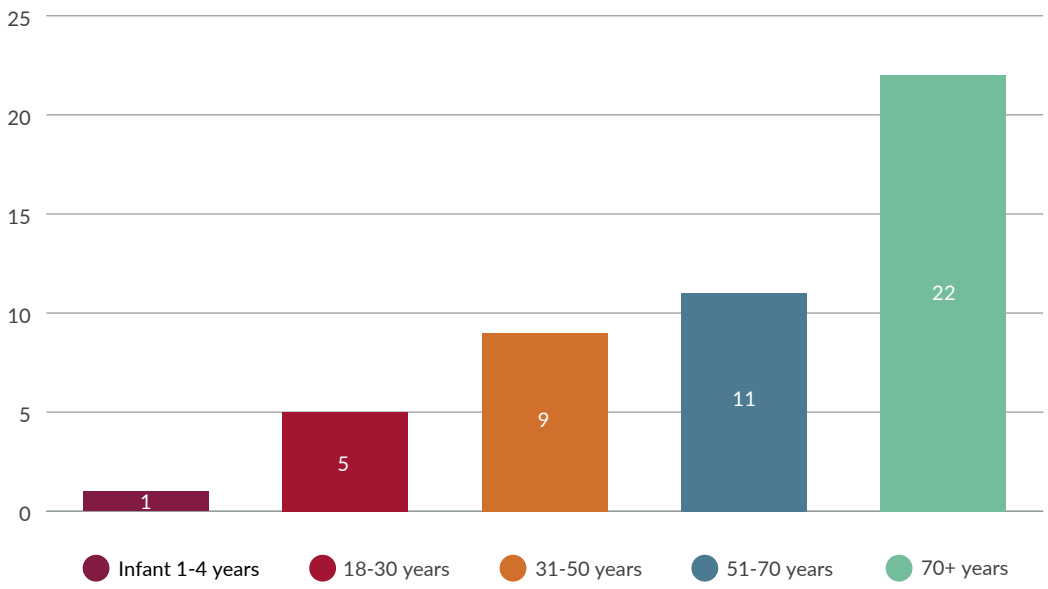
The NHO received 52 reports of FNTHR reactions. Of these, 4 did not progress (3 had an imputability of unlikely and one patient's symptoms were attributed to their underlying condition). Red cell transfusions were most associated with FNTHR.

Table 6: Components associated with FNTHR in 2023

Component	No of cases no=48
RCC	44
Apheresis Platelets	2
Pooled Platelets	2

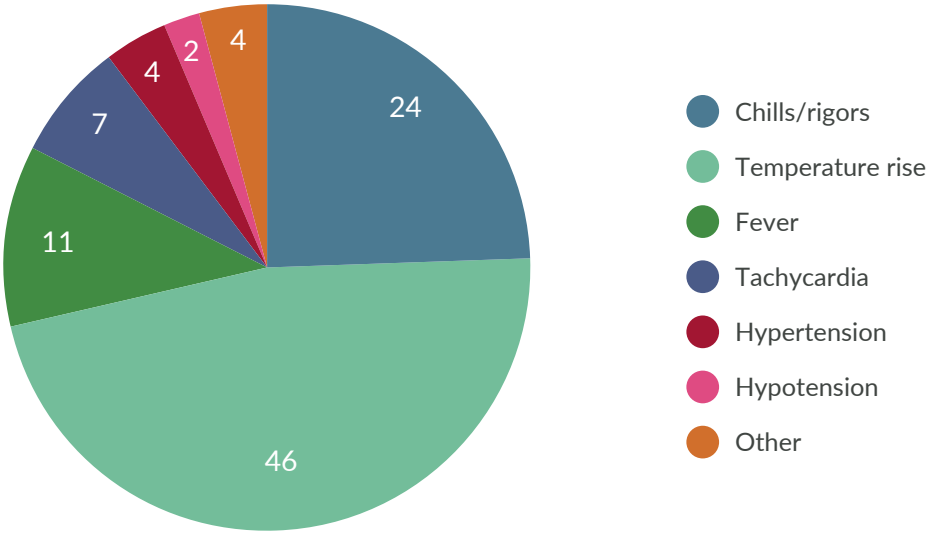
33 cases involved females and 15 involved males. Those aged 70 or greater were most frequently reported to have FNTHR post transfusion. For full breakdown of age ranges see figure 14.

Figure 14: FNTHR divided by age range and number of patients.



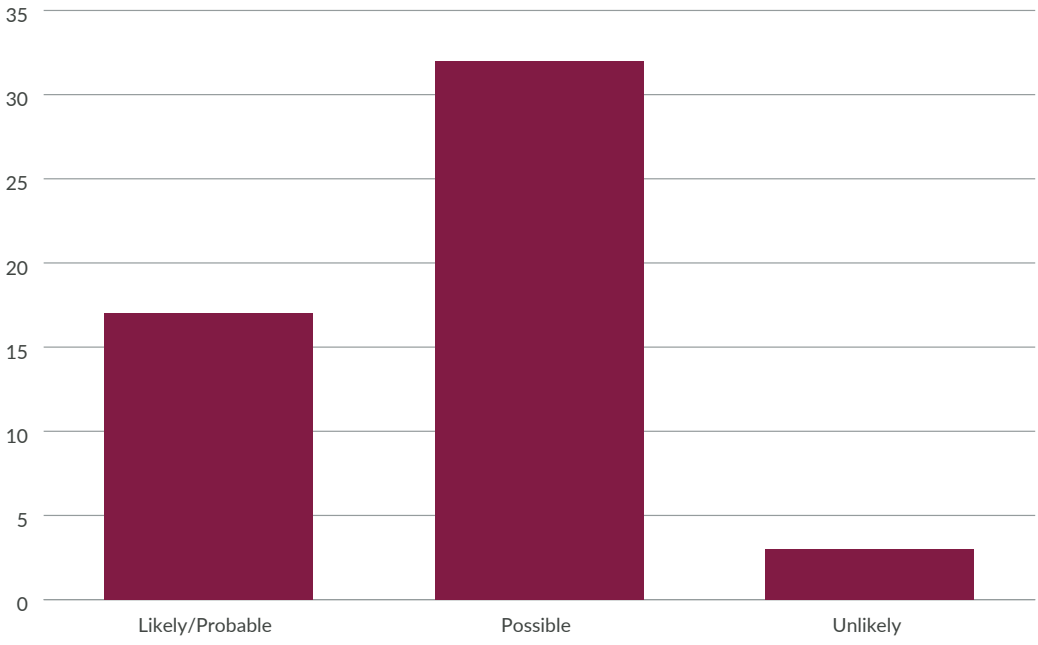
The most common symptom with FNTHR was temperature rise. See Figure 15 for full range of symptoms.

Figure 15: Symptoms associated with FNTHR by case.



Anti-pyretics were the most used treatment (n=33), followed by antibiotics (n=10), fluids (n=7), steroids (n=4), antihistamines (n=3), oxygen therapy (n=3) and diuretics (n=1). 5 patients required no treatment. Fortunately, 44 patients made a complete recovery, 3 had minor sequalae and 1 patient died unrelated to transfusion.
See figure 16 for imputability assigned to FNTHR.

Figure 16: Imputability assigned to FNHTR cases reported to the NHO in 2023.



Case 5:

A female patient aged between 31-50 years developed anaemia post nephrolithotomy and JJ stent insertion for renal and staghorn calculi. The patient's PERC was draining haematuria post procedure and haemoglobin level was 7.7g/dl. She received 2 units of red blood cells; first unit was uneventful. Patient developed fever with a 3-degree temperature rise going from 36.9 at baseline to 39.9 and chills and rigors after second unit. Symptoms developed 2 hours and 30 minutes into the transfusion. Transfusion was stopped and discontinued completely. Bacterial screening of both patient and product was undertaken and results indicated that there was no bacterial growth. There was also no clinical evidence of haemolysis. Patient received 1g of paracetamol and temperature decreased within 10 hours. The patient did not require further transfusions.

Hypotensive Transfusion Reactions

The NHO received 4 reports of hypotensive transfusion reactions in 2023. 1 case was not accepted by the NHO, 2 were within scope of the EU legislation and as such reportable to the HPRA and 1 was not reportable to the HPRA.

All hypotensive reactions reported to the NHO in 2023 occurred in patients 70 years or older, with 2 males and 1 female being affected. All had an imputability of possible and all involved the transfusion of RBCs.

The first report involved a male admitted with atrial fibrillation secondary to anaemia. He received 1 unit of RBCs. At 20 minutes into transfusion, his blood pressure dropped to 96/56. The transfusion was discontinued, and patient received intravenous fluids and blood pressure stabilised 9 hours following the suspected reaction.
The second report involved a man with prostate cancer and anaemia. The patient received 1 unit of RBC. At 80 minutes, blood pressure dropped to 78/49 and no other symptoms were noted. Transfusion was stopped and discontinued. The patient was administered fluids and hydrocortisone. Full recovery was achieved in 30 to 60 minutes.

The final report was involved a female with haematuria. She received one unit of RBCs and had a hypotensive episode 2 hours into transfusion. Transfusion was stopped and discontinued, and she received intravenous fluids. A complete recovery was made in 90 minutes.

Conclusion

Febrile and allergic type reactions continue to be two of the most frequently reported SAR. They are unavoidable and can occur with any transfusion. Comparable to the SHOT annual report (2022), antihistamines and steroids continue to be inappropriately prescribed as a treatment for FNTHR. Clinicians have a responsibility in ensuring that patients receive appropriate treatment (SHOT 2023). More emphasis on symptom recognition and SAR management is required to ensure that patients receive appropriate treatment. Our data highlights that linking the adverse symptoms of FNHTR and hypotensive reactions is more difficult than with allergic type reactions, as allergic type reactions had more cases whereby imputability of certain and likely/probable were assigned compared to FNTHR and hypotensive reactions.

Pulmonary Complications

Pulmonary complications of blood transfusion include transfusion associated pulmonary overload (TACO), transfusion related acute lung injury and transfusion associated dyspnoea (TAD). It is believed that TACO results from hydrostatic pulmonary oedema because of increased pulmonary capillary pressure (Bulle et al 2022). In contrast TRALI is often caused by inflammatory triggers such as the patients' underlying issues, followed by mediators present in the transfusion which activate the endothelium and pulmonary neutrophils. This results in increased pulmonary permeability leading to exudative pulmonary oedema. This can be antibody or non-antibody mediated (Vlaar and Juffermans, 2013; Van Wonderen et al 2023). Sometimes pulmonary complications do not fit the definitions of TACO, TRALI or allergic type reactions; in these cases, they are classified as TAD.

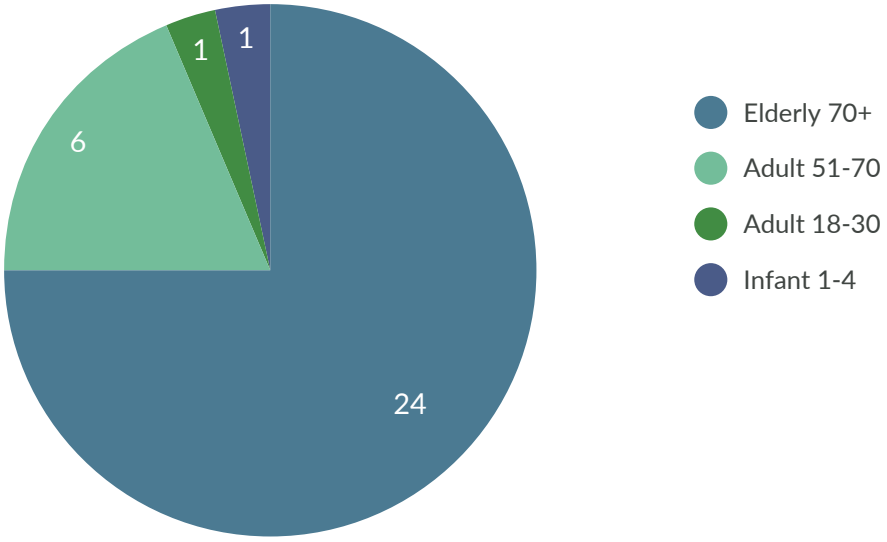
The NHO received 36 reports of pulmonary type reactions in 2023. This is slightly less than what was reported in 2022 whereby 42 reports were received. TACOs were the most reported pulmonary complication and accounted for 94% of the cases received.
The NHO accepts cases of both mandatory and non-mandatory TACOs and adheres to the ISBT mandatory TACO surveillance definition when classifying cases (Wiersum-Osselton et al 2019).

Transfusion Associated Circulatory Overload

In 2023, 34 cases of TACO were reported to the NHO. 30 cases were within scope of the EU legislation and as such reportable to the HPRA, 2 were considered not reportable to the HPRA and 2 did not progress. Of the cases that did not proceed 1 patient's symptoms were attributed to the patients underlying condition and the second had an imputability of excluded assigned. An imputability of certain was attributed to 4 cases, likely/probable to 13 and possible to 15. All cases were associated with RBC, with n=8 cases reporting that the patient also received RBC before the unit that caused the reaction, and one patient had multiple components transfused.

The elderly were disproportionally affected and accounted for 75% of reported TACOs. See chart below for division of age groups affected by TACO.

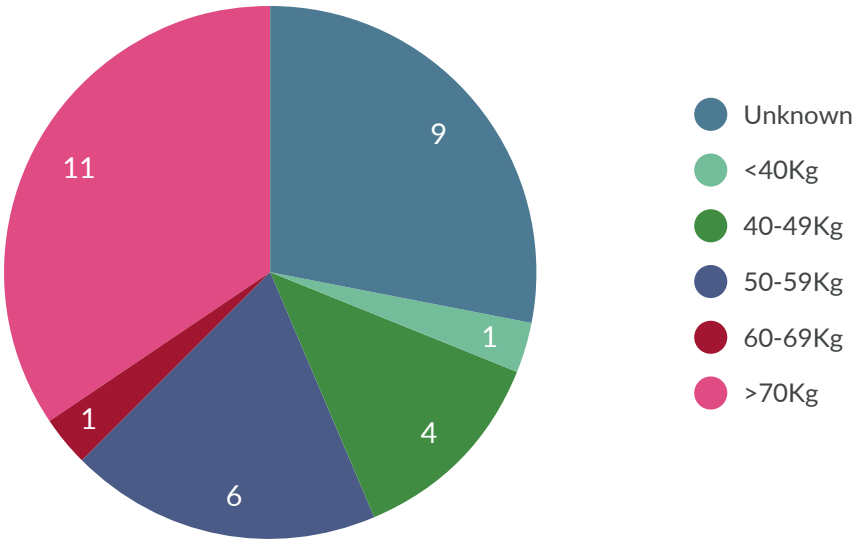
Figure 17: Age range of patients who developed TACO in 2023.



With the exemption of 1 patient all patients had co-morbidities that increased their risk of TACO (renal n= 6, respiratory n=12, Cardiac n=26). A total of 10 patients had 2 high risk contributing co-morbidities (renal/Cardiac n= 2, Respiratory/cardiac n= 8) and 1 patient had all three risk factors.

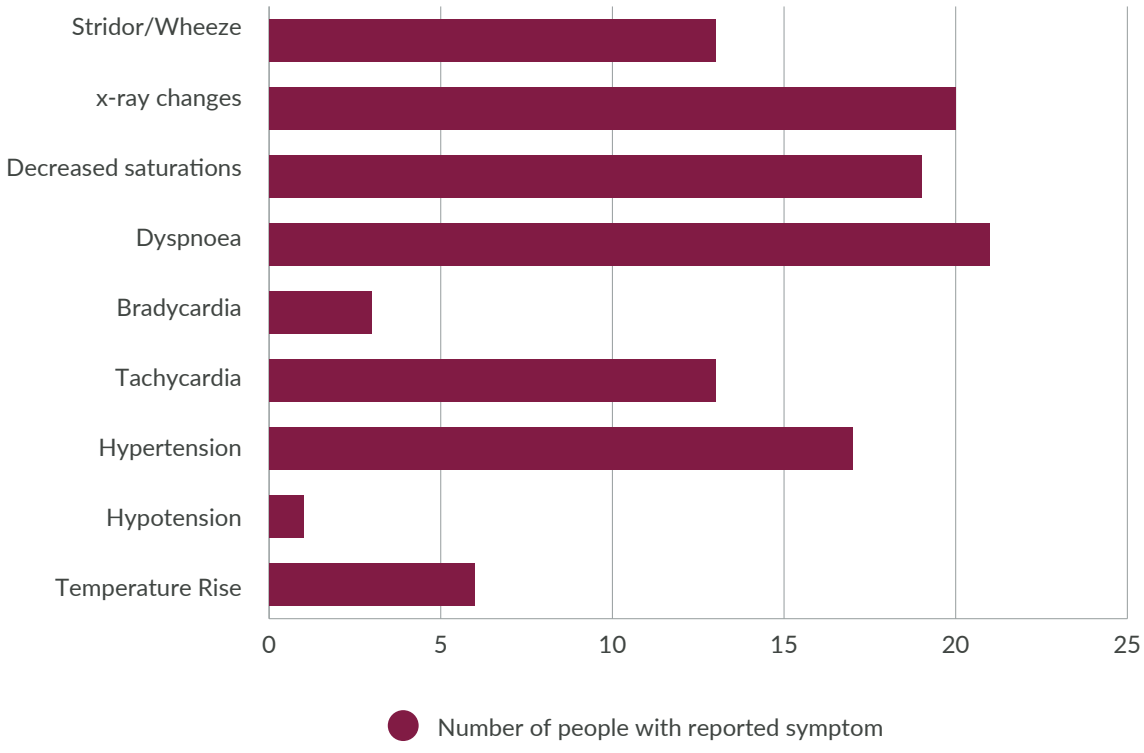
It was difficult to determine if patients had a positive fluid balance prior to transfusion due to failure in initiating or accurately recording fluid balance (n=25). Of cases whereby fluid balance was reported 4 cases reported a positive balance and 3 reported negative balances. Similarly, pre transfusion weight was not always available see figure 18 for breakdown of patient's weight range.

Figure 18: Weight range of patients who developed TACO in 2023.



Respiratory issues were the most reported symptom.

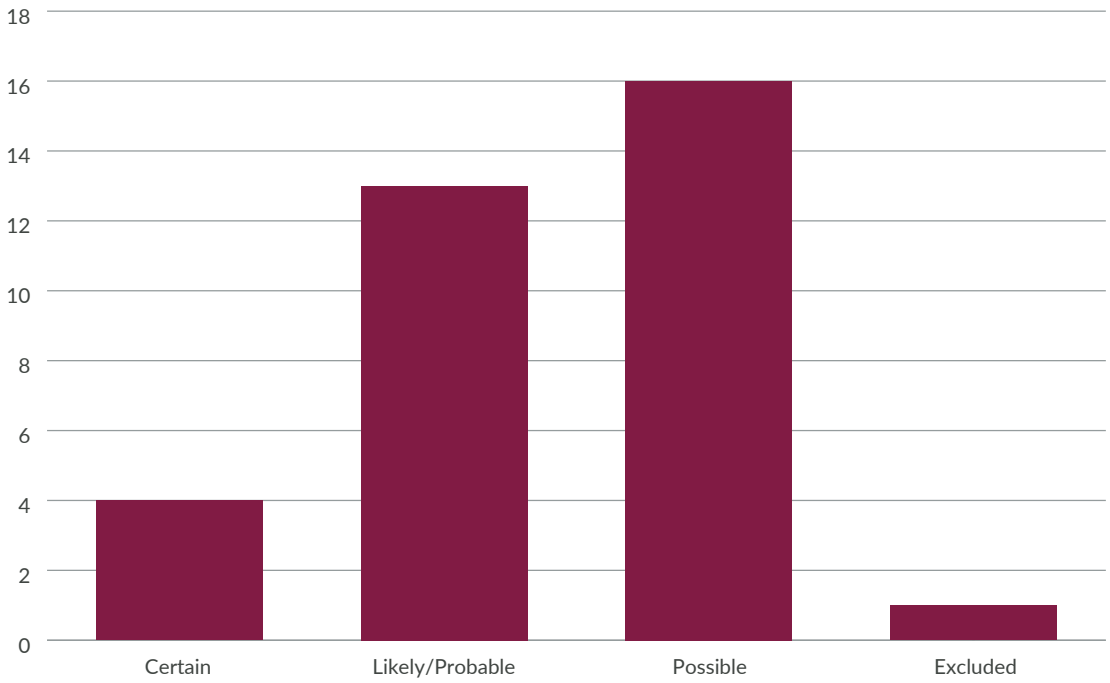
Figure 19: Reported symptoms of TACO patients reported to the NHO in 2023.



Administration of diuretics was the most common treatment (n=28), 3 patients were on a regular diuretic and 2 patients received a diuretic pre and post transfusion. Oxygen therapy was the second most common treatment of choice (n=22). Other treatments included nebulizers inhalers (n=12), steroids (n=4), anti-pyrectics (n=4).
Most patients made a complete recovery (n=22), 7 suffered minor sequalae and 3 died (unrelated to transfusion).

See figure 21 for imputability assigned to TACO cases.

Figure 20: Imputability assigned to TACO cases reported to the NHO in 2023.



Case 6:

Female patient aged over 70 years admitted with anaemia secondary to persistent PR bleed. Haemoglobin was 7.6gd/l and she was prescribed 1 unit of red blood cells. Patient had a history of severe aortic stenosis and COPD. Transfusion was temporarily stopped at 45 minutes as the patient became agitated and developed tachycardia. Transfusion was discontinued completely after a further 40 minutes due to respiratory distress (desaturation and dyspnoea). A bilateral wheeze was identified on auscultation of the chest and chest x-ray was consistent with TACO showing pleural effusions. Furthermore, BNP levels were elevated however pre transfusion BNP levels were not available. The patient received Oxygen and a diuretic post transfusion and suffered minor sequalae.

Transfusion Related Acute Lung Injury

The NHO received 1 case of TRALI in 2023, which was within scope of the EU legislation and as such and reported to HPRA. This case involved a child aged less than 1 year. The patient was receiving RBC and developed hypotension (52/30mm/hg), desaturated (O2 sats <40%) and new bilateral pulmonary infiltrates. Patient was difficult to ventilate with pink frothy endotracheal secretions. Patient was critically ill at time of transfusion and required increased ventilation and inotropic medications. The onset of symptoms developed within 40 minutes of starting transfusion. Donor was recalled and IgM anti HNA 1a detected in donor and recipient. Fortunately, patient made a complete recovery. An imputability of likely/Probable was assigned to the case.

Transfusion Associated Dyspnoea

The NHO received 1 report of TAD in 2023; this report was within scope of the EU legislation and as such and reported to the HPRA. This case involved a female (aged 70+) who received RBC for anaemia. The patient developed dyspnoea, desaturated from 90% to 78% and tachycardia (77 to 130 bpm) 30 minutes into donation. Treatment included oxygen therapy, steroids, and nebulisers/inhalers. Complete recovery was made after 2 days. An imputability of possible was assigned to the case.

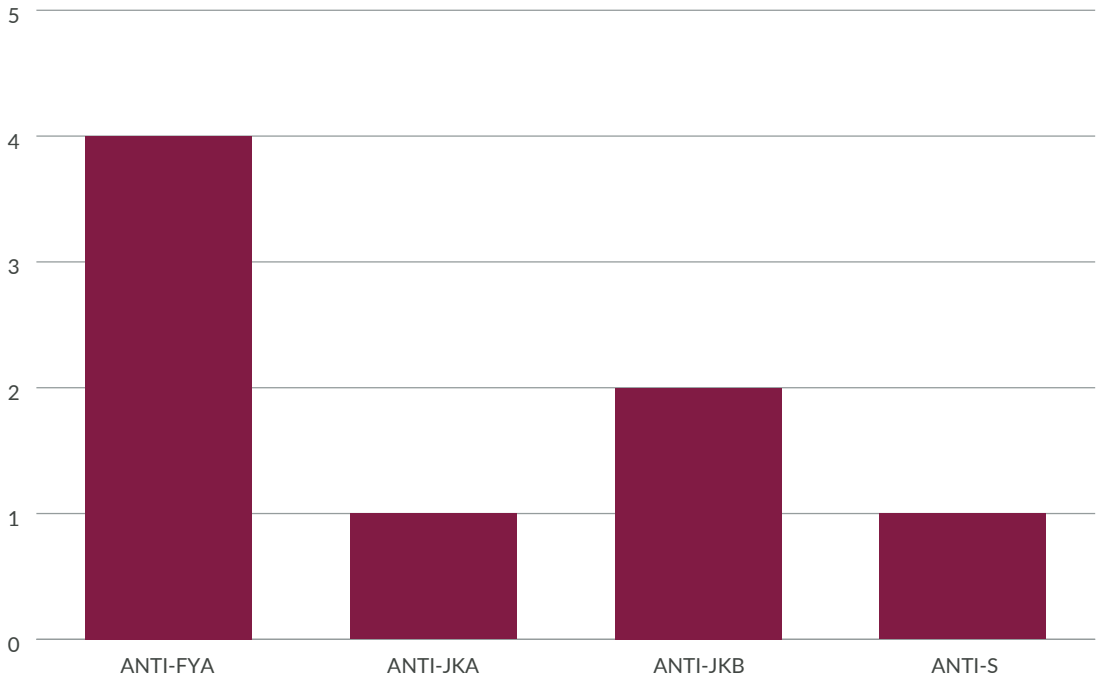
Conclusion

Fortunately, the incidence of TRALI and TAD remain low. TACOs were the most common pulmonary complication reported, and the second most common SAR reported. Given that this reaction is preventable, a continued effort in identifying patients at risk is vital. The NHO recommends that a checklist is utilised to identify those at risk. This checklist should capture patients with TACO risk factors such as a history of cardiac, renal, or pulmonary co-morbidities, those with a low body weight, positive fluid balance and advanced age. If a patient is identified as a high risk of TACO and requires transfusion the NHO recommends careful observation of the patient, decreased transfusion rate if possible and the administration of pre and/or post diuretic therapy if clinically indicated. The SHOT annual report (2023) emphasises that the TACO checklist is not a tick box exercise and should be considered a safety pause to ensure patient safety. As TACO is a preventable SAR the NHO have constructed a TACO algorithm to identify those at risk and promote patient safety (see appendix 1).

Haemolytic Transfusion Reactions

The NHO received 8 reports of haemolysis in 2023, 2 of which were within scope of the EU legislation and as such reported to the HPRA. Two cases did not meet the reportable criteria and did not progress. All reported cases were of immunological haemolysis caused by alloantibody excluding ABO. All accepted cases were of delayed haemolysis with symptoms occurring greater than 24 hours post transfusion. Imputability assigned was as follows certain (n=1), likely/Probable (n=3) and possible (n=2).

Figure 21: Alloantibody detected post transfusion.



All cases involved females who were transfused with RBCs. Most cases involved the elderly (n=4), but people aged 51 to 70 years (n=1) and 18 to 30 years (n=1) were also involved.

Laboratory symptoms reported included falling haemoglobin (n=4), increased lactate dehydrogenase (n=5), presence of spherocytes on blood film (n=3), decreased haptoglobin (n=1) and increased bilirubin (n=2).

Case 7:

Female aged over seventy was admitted with anaemia secondary to diverticular disease. Pre transfusion haemoglobin was 5.7g/dl and the patient received two units of red blood cells. The patient had no clinical symptom of haemolysis, however laboratory results indicated that haemolysis was present. Reaction was identified 14 days post transfusion. Laboratory symptoms included falling haemoglobin and haptoglobin and an increase in both creatinine and LDH. Antibody screening discovered the presence of anti- JKb. The patient did not require any treatment, but it was recommended that JKb negative blood be issued for future transfusions.

Conclusion

Patients who develop laboratory evidence of haemolysis need to be clinically assessed (SHOT annual report 2022). The NHO recommends that patients receive education post transfusion on the clinical signs and symptoms of delayed haemolysis and who they should contact if these symptoms manifest on discharge from hospital.

Transfusion Transmitted Infections.

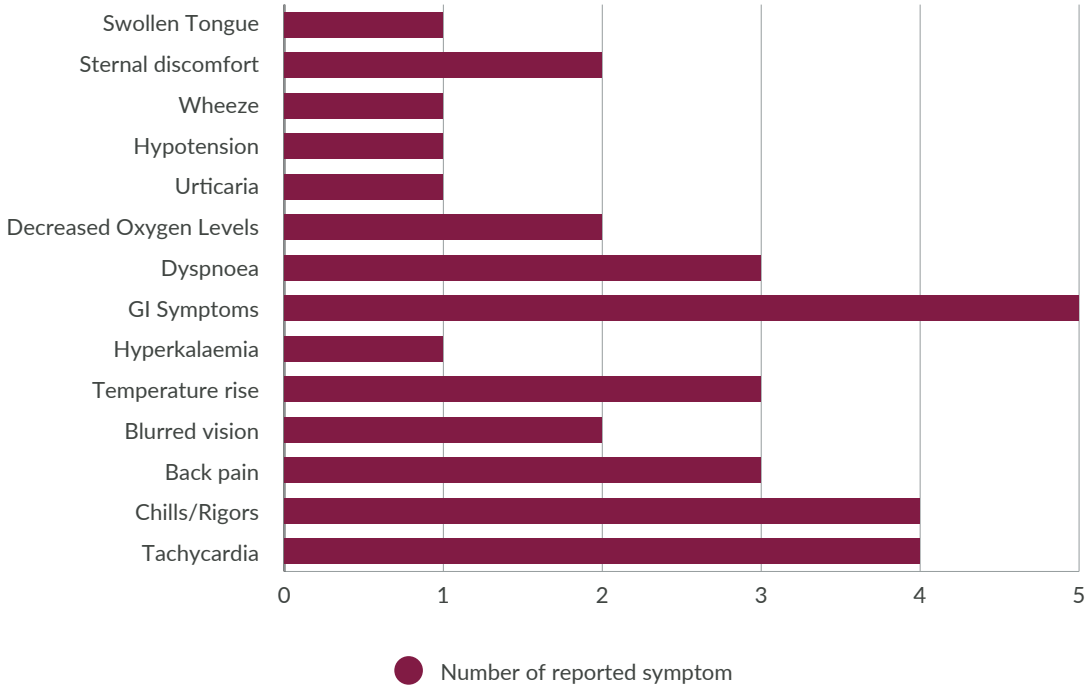
The NHO received 2 reports of transfusion transmitted infection both had an imputability of excluded and therefore did not progress.

Unclassified Transfusion Reactions

The NHO received 12 reports of unclassified transfusion reactions. Of these 11 cases were accepted by the NHO and a further 9 were reported to the HPRA. Most reactions were associated with RBC transfusions (n=9), however platelet apheresis (n=1) and platelets pooled (n=1) were also associated with unclassified reactions.

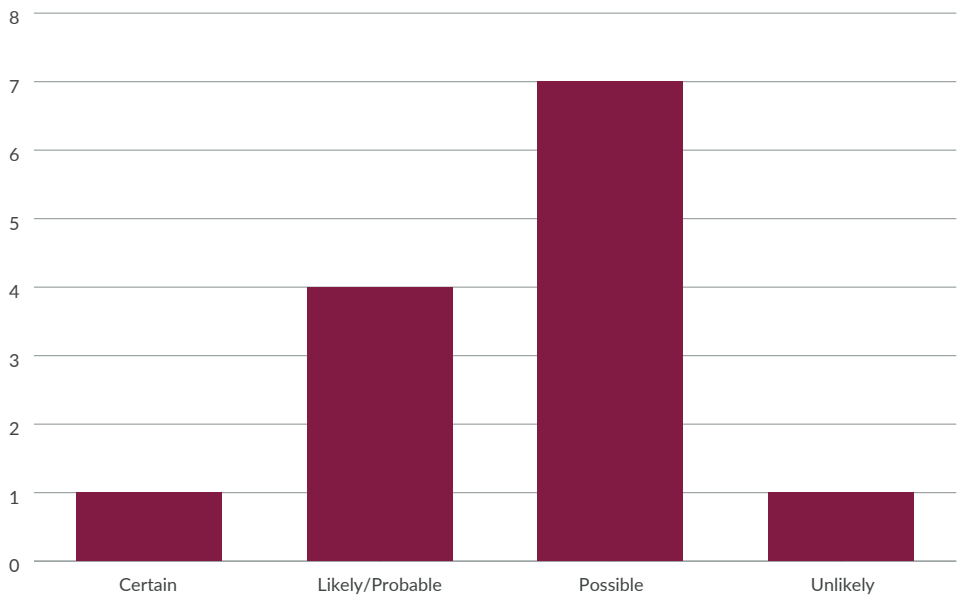
Symptoms were multifaceted and all cases had multiple symptoms reported.

Figure 22: Symptoms reported for patients who developed an unclassified reaction in 2023.



A complete recovery was made by 8 patients, however 3 suffered minor sequalae. Of those cases where clinical outcome was classified as minor sequalae, 1 patient developed septicaemia requiring antibiotics, a second required overnight admission for antibiotic administration and 1 developed respiratory difficulty that persisted for 4 days.
Please see figure 23 for imputability of unclassified reactions.

Figure 23: Imputability assigned to reported cases of unclassified reactions.



Case 8:

Male patient aged 18-30 years with acute myeloid leukaemia was transfused one unit of red blood cells for anaemia. Haemoglobin pre transfusion was 6.5g/dl. Transfusion was stopped and discontinued after twenty-seven minutes as the patient developed abdominal pain, backpain and chest tightness. Other symptoms included hypotension, light headedness, blurred vision, and the patient was clammy but had no associated fever. Clinical screening out-ruled haemolytic transfusion reaction and bacterial contamination. CT abdomen/pelvis was undertaken, and results indicated no evidence of intra-abdominal bleeding. Patient received oxygen, antihistamine, steroids, opioids, and intravenous fluids and made a complete recovery within 3 hours. The patient has received transfusions after this reaction, and all have been uneventful.

Conclusion

Classification of SARs can be difficult when symptoms do not correlate with the definitions in the European Commission, Common Approach document. It is important to collate information on non-specific reactions to improve knowledge and practice (SHOT 2022)

Wrong Blood in Tube

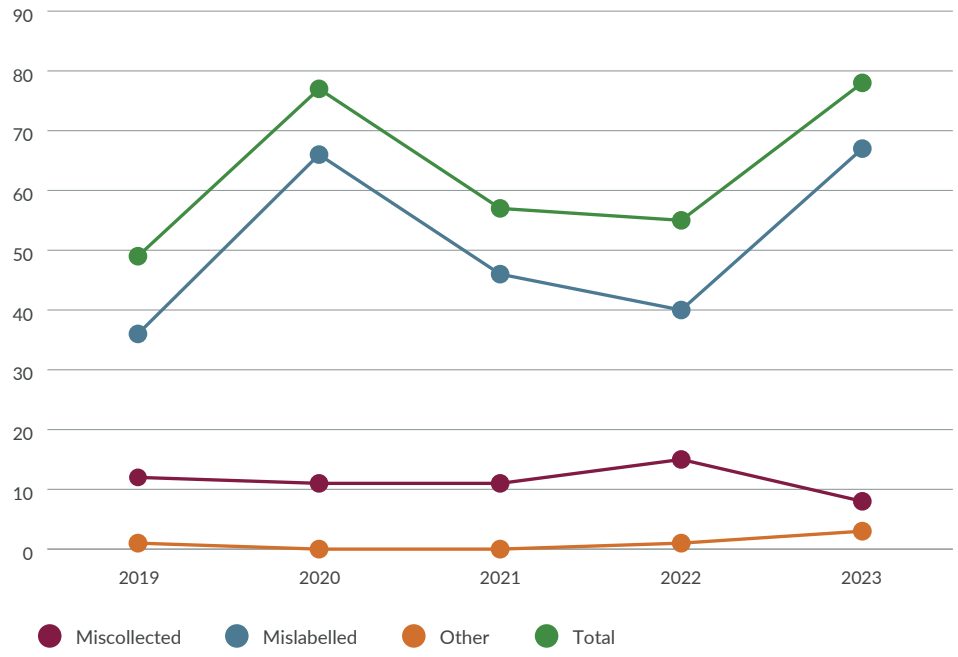
Definition: A wrong blood in tube (WBIT) occurs when blood is taken from the wrong patient and is labelled with the intended patient's details OR blood is taken from the intended patient, but labelled with another patient's details (SHOT, 2022).

Types of WBIT error that occurred in 2023.

The NHO received seventy-eight reports of wrong blood in tube in 2023. All reports met the reporting criteria and were accepted. There were sixty-seven reports of the sample being taken from the intended patient but labelled incorrectly (mislabelled), and 8 samples taken from wrong patient and correct labels applied (mis-collected) a further 3 samples fell into the category of other. Of the three samples that were categorised as 'other' reporting institutions were unable to determine if the sample was mislabelled or mis-collected in 2 of the cases, the remaining WBIT was caused by a sample being taken from the same limb whereby emergency O negative blood was being infused.

WBITs continue to be a concern with a noticeable increase in reports received in 2023.

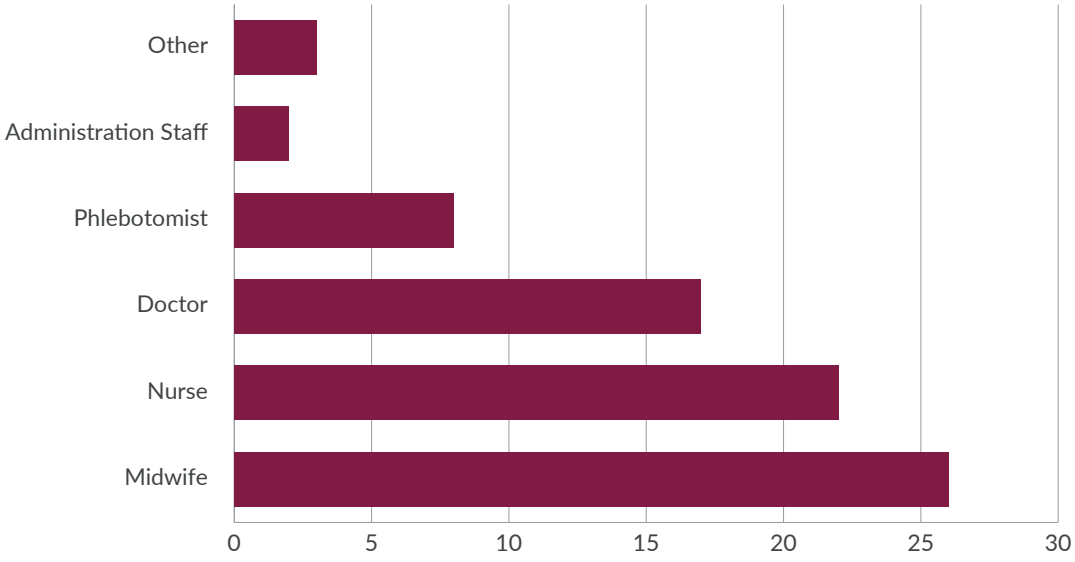
Figure 24: Graph illustrating the trend in the types of errors from 2019 until 2023.



Who was involved in the error?

Doctors, nurses, and midwives continue to be the leading contributors to WBIT. Midwives were the highest group associated with WBITs. Our data suggests that continuing education focusing on these groups is required.

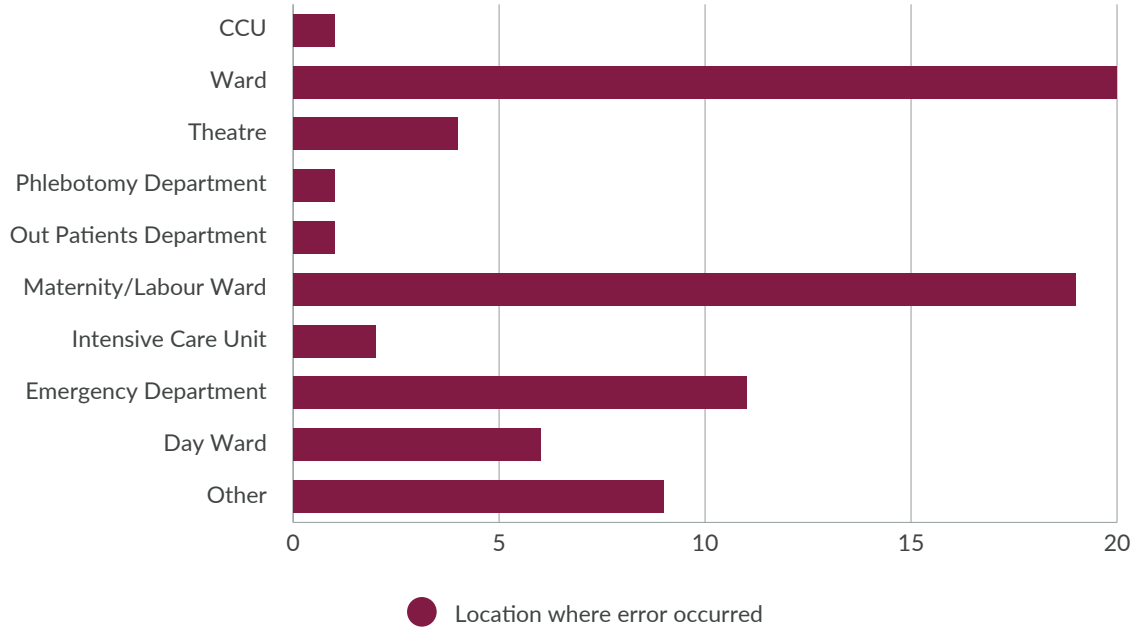
Figure 25: Number and category of health workers involved in WBIT events in 2023.



Where did the error occur?

Errors most frequently occurred on the ward, maternity/labour ward and in the emergency department.

Figure 26: Location where the 1st error occurred in WBIT events reported to the NHO in 2023.



Types of error human error vs. system error

Human error continues to be the leading cause of WBIT with errors related to human failure being cited in 142 of the cases. Multiple human failures were reported in 40 of the reported cases. System failures were identified in 13 of the reported WBITs. Please see figure 27 and figure 28 for a breakdown of the reported human and system failures.

Figure 27: Human failures cited by HVOs on reports received by the NHO in 2023.

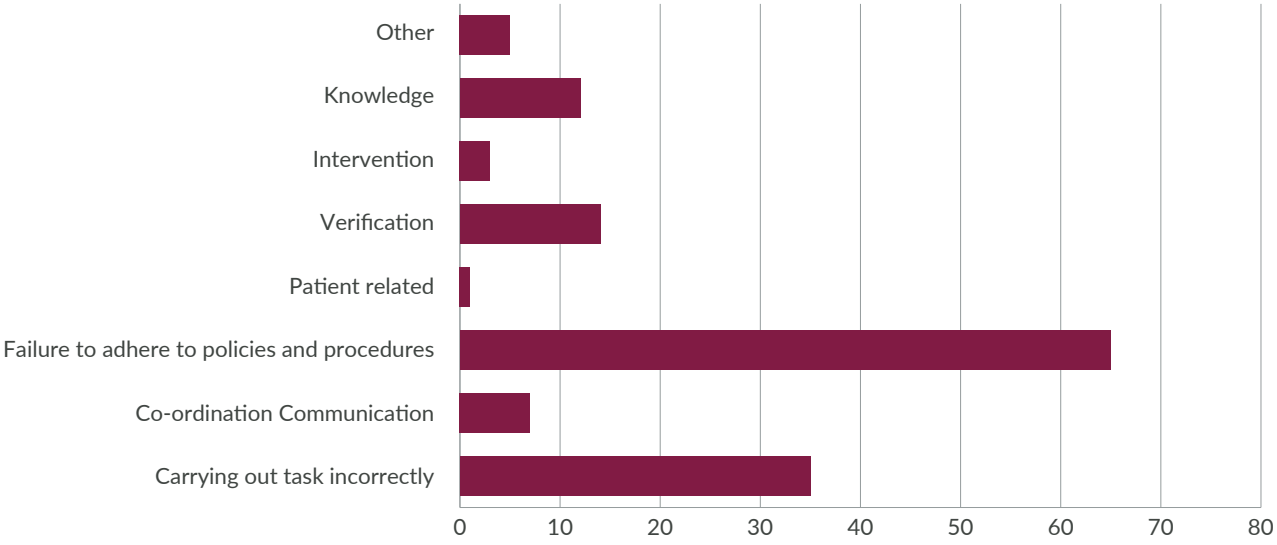
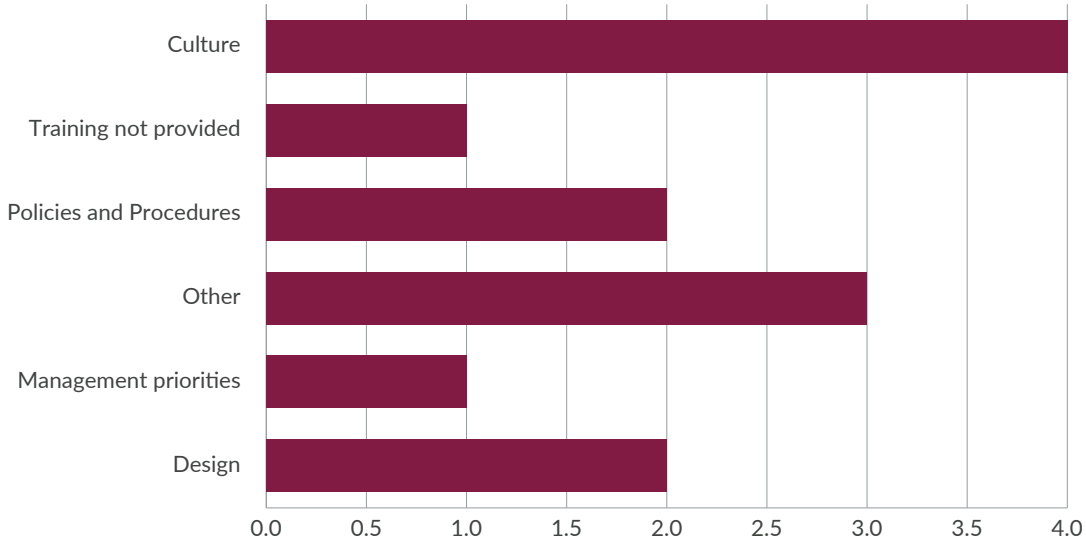


Figure 28: System failures cited by HVOs on reports received by the NHO in 2023.



WBITS What Happened?

Multiple errors and omissions generally lead to a WBIT. Labelling and sampling were identified as the most frequent part of the process where WBITs first occurred. Single errors or omissions did not usually occur in isolation with multiple factors and omissions leading to each WBIT.

Not identifying the patient correctly at phlebotomy was the leading contributor of WBIT. This highlights the importance in performing positive patient identification at sample collection. Positive patient Identification involves asking the patient their name and date of birth and ensuring that the information obtained matches both the patient's wristband and labels. Labelling samples remotely was also a recurring problem; samples should be labelled at the bedside and not pre-labelled or labelled remotely post sampling. Please review figure 29 for stage in sampling process whereby error first occurred.

Figure 29: Stage in the sampling process where the error first occurred

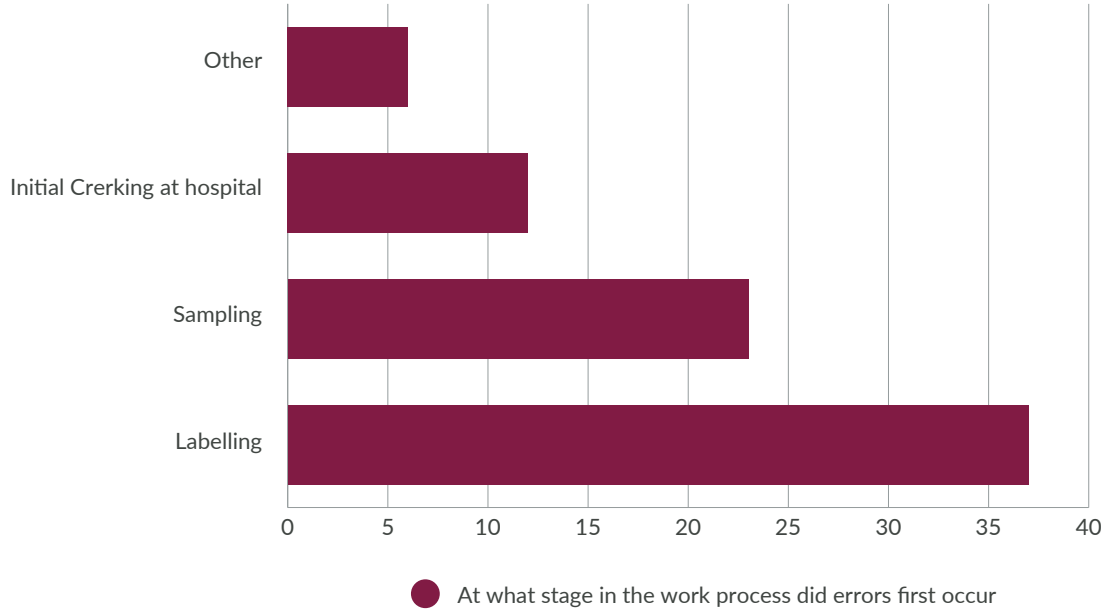
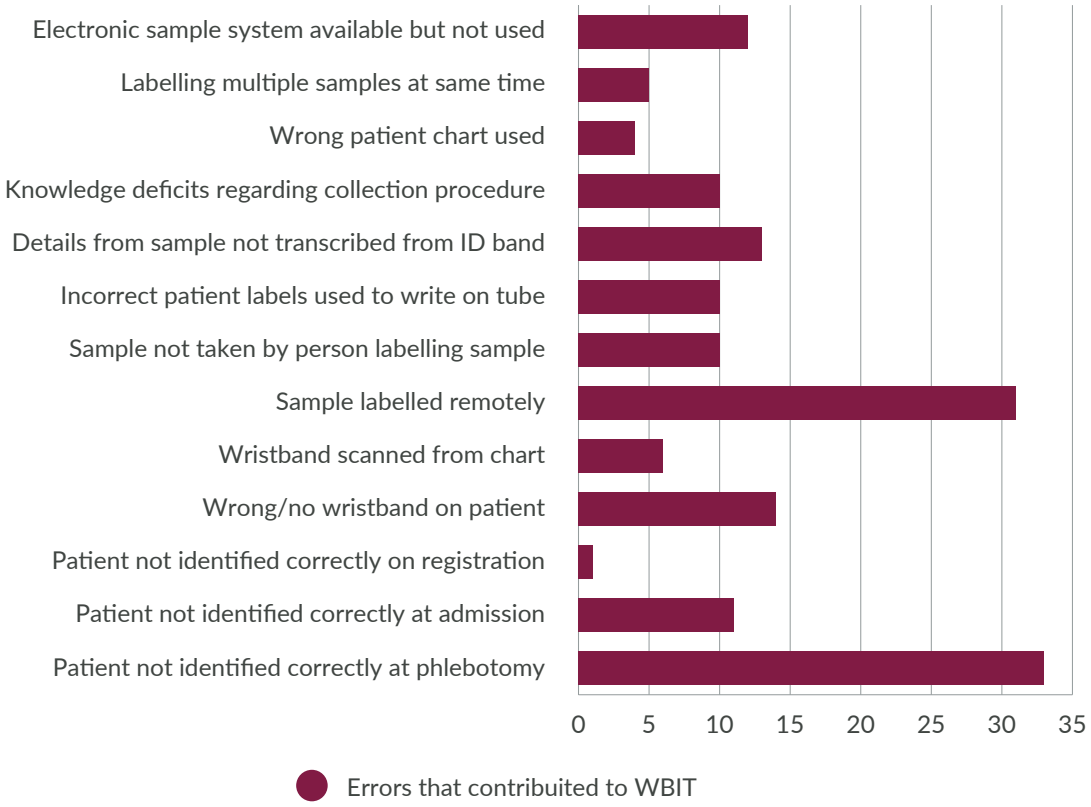


Figure 30: Errors identified by HVOs and cited on WBIT reports submitted to the NHO in 2023.

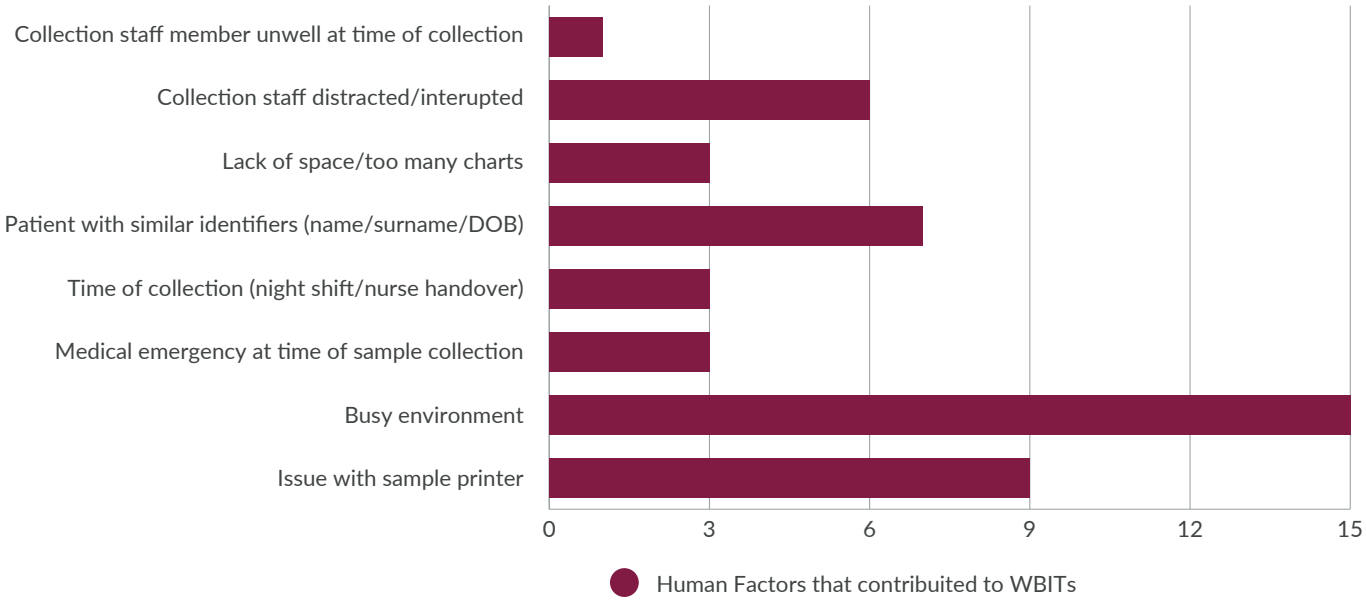


Human Factors that contributed to the error

It is difficult to establish the impact human factors had on the reported WBITs as we currently do not have a question on the WBIT report document that examines this in detail. Qualitative analysis was utilised, and human factors were extracted and coded to identify any trends in the free text.

A busy environment was most frequently reported this was followed by problems with the electronic systems whereby there was troubleshooting problems or previous patient labels printed. This again highlights the importance of checking patient identifiers.
The NHO recommends that if a sampler is interrupted during the collection of blood that positive patient identification process should be repeated. More emphasis on reporting human factors that contributed to the WBIT is required to get a more thorough understanding of the nature of WBITs. Please review figure 31 for a list of human factors that contributed to the WBIT.

Figure 31: Human factors identified as contributing to WBIT event reported to NHO in 2023.



Electronic Identification Systems and WBIT events

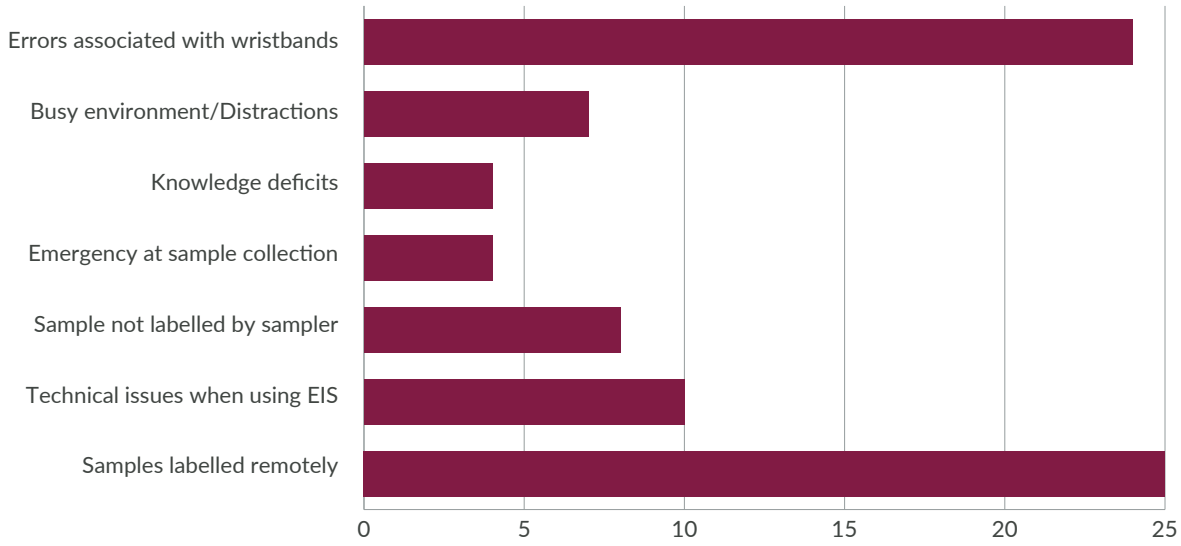
- Electronic Identification Systems (EIS) were available in 64 WBITs (82%)
- Despite being available the EIS was not used in 12 WBITs.

Reasons for not using EIS despite device being available were multifaceted:

- There was one report that the EIS and printer were not working and therefore samples were handwritten.
- Four of the cases reported that sampler had not received training or did not have the relevant knowledge in the use of the EIS.
- One healthcare member did not have and access account to use the EIS.
- There was no barcode on one patient wristband and therefore the EIS could not be used.
- It was unclear why EIS was not used in a further 5 cases.

Reasons given for WBIT event occurring despite use of EIS was varied. Errors associated with wristbands and remote labelling of samples were the leading contributors to WBITs. WBIT errors involving wristbands include; incorrect or no wristband on the patient, wristbands being scanned from notes and wristbands being illegible.

Figure 32: Factors that contributed to WBIT event when using EIS.



Blood groups that could have been transfused in WBIT events.

If the WBIT resulted in a transfusion, 21 of the cases would have resulted in a major mismatch. The blood group that could have been transfused was unknown in 12 samples most of these samples were rejected by the lab prior to sampling.

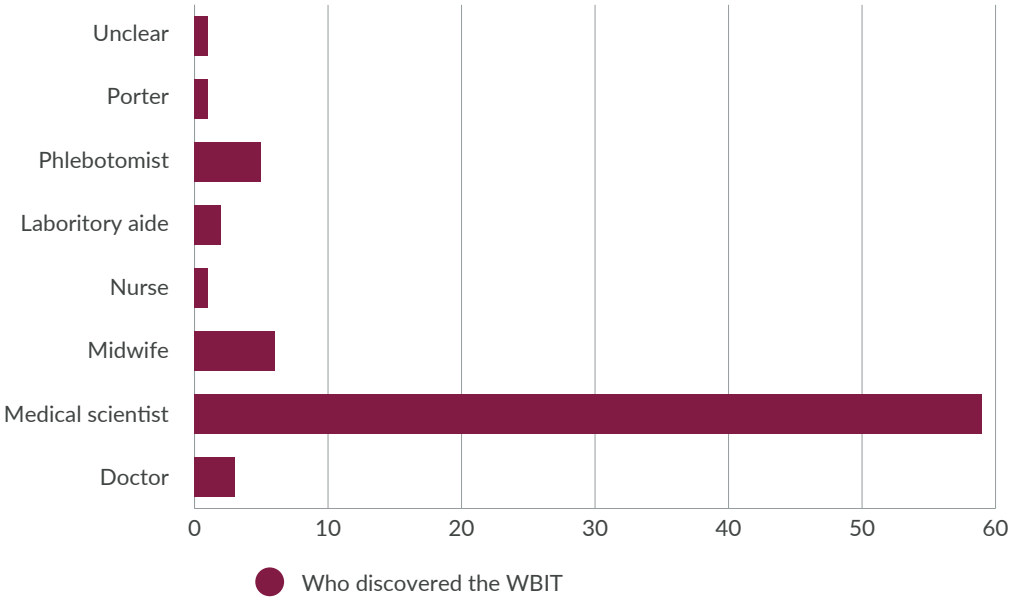
Figure 33: Blood group incompatibilities identified in WBIT reports submitted to the NHO in 2023.

		Blood Groups that could have been transfused						
		A	B	O	AB	Unknown	Compatible	Incompatible
Patients' Blood group	A	9	1	8	1	2	17	2
	B	2	0	4	0	0	4	2
	O	13	5	18	1	3	18	19
	AB	1	0	3	0	1	4	0
	blank					6		
	Totals	25	6	33	2	12	39	21

WBIT discovery information

WBITs were most frequently identified by medical scientists. Other healthcare staff also identified WBITs for example a porter was able to identify the error when they asked a patient to confirm their name and DOB and realised it did not correspond with the patient ID band, thus highlighting the importance of positive patient identification.

Figure 34: Staff members who discovered the error.



A two-sample rule is implemented in most Irish hospitals to prevent incompatible transfusions from WBITs. This requires two samples to be taken from the patient at separate times and ideally by two different venepuncturists prior to issuing group-specific blood. A two-sample rule was reported in sixty-nine of the cases. The two-sample rule led to the identification of the WBIT in eighteen cases.

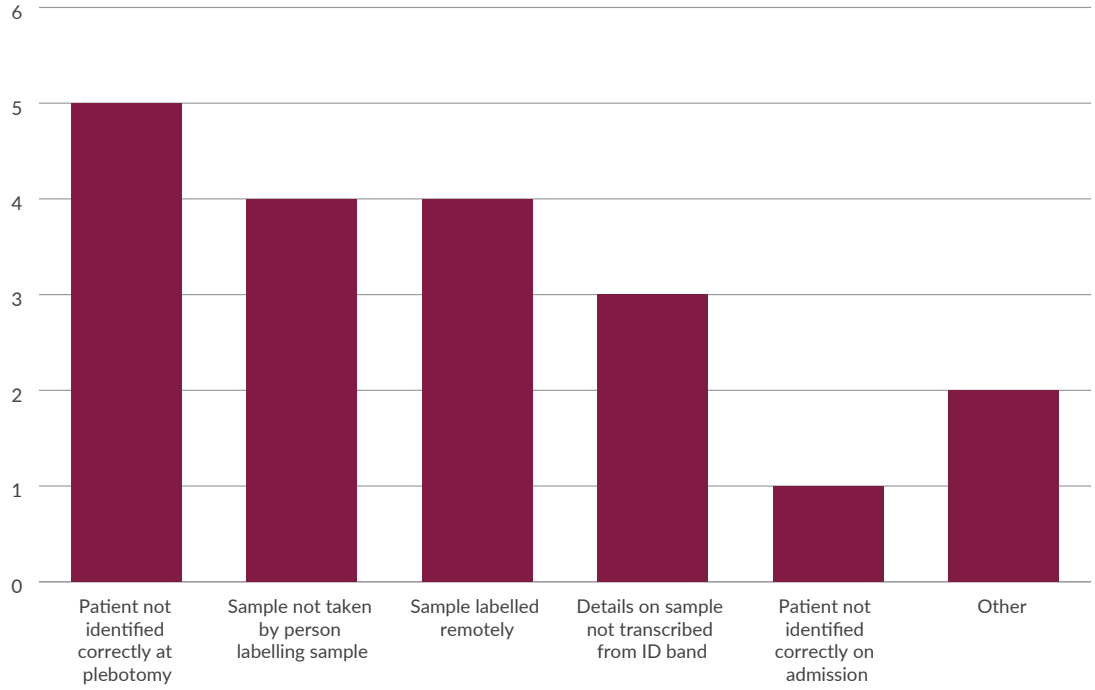
On discovery of the WBIT retraining of staff was the most common corrective and preventative measure (n=47), other HVOs adopted informal feedback reviews (n=21) or reflective reviews (n=2). Repeat samples were sent to the lab in twenty-seven cases.

WBIT Events Maternity Hospitals

The NHO saw an increase in WBIT reports from maternity/labour wards (n=19, 24%). Most of these errors involved midwives (n=17), however doctors were also involved (n=4). Please see figure x for number of reports received each year from maternity labour wards from 2019 – 2023. Most errors that occurred were labelling errors (n=12). Other errors included sampling errors (n=5) and initial clerking errors on arrival to hospital (n=2). An electronic system was available and used in 17 cases. There was no one factor that led to the increase in reports from maternity/labour wards and like other WBITs several non-conformances usually led to the near miss event. There were some instances whereby mother and baby (n=2) and Cord and mothers (n=4) samples were transposed.

Figure 35: The number of WBIT reports received in 2023 where the first error occurred on the maternity/labour ward.

Figure 36: The type of error identified in WBIT events reported in 2023.



The SHOT annual report (2023) also found that maternity departments were high risk for errors. In relation to the labelling of cord blood sample SHOT 2023 recommend that labelling of samples be performed before the placenta is removed from the mother's side.

Case 9:

Doctor in emergency department took a sample from the correct patient. Although PDA was utilised the doctor labelled samples and scanned patient wristband remotely. It is unclear whether the wristband was scanned from the wrong chart, or the wrong wristband was in the correct chart. The error was detected in the blood transfusion lab when sample and request did not match. This sample was a confirmatory sample, and the error would have been detected as the hospital has the 'two sample rule' in place. The sample was discarded, and a new sample was taken from the patient. The doctor was retrained in the correct procedure for sample taking.

Conclusion

Completing positive patient identification is paramount for patient safety. Regardless of whether identification is taken manually or electronically it is imperative that it is performed correctly. Involving the patient in process (when applicable) will reduce the risk of error. Collection and labelling should be a continuous uninterrupted process, if interrupted the process should restart.

It is evident from our report that more care is needed to ensure that patients are wearing correct wristbands and samples are not labelled remotely. The NHO recommend that wristbands are removed from patient charts to avoid remote scanning.

More information is needed to establish the barriers that prevent staff from following correct sampling procedures. An increase in WBITs in maternity/labour wards was evident; our data could not determine the root cause of this increase. There were incidences whereby mother and baby or baby and cord sample labels were transposed, however the reasons for the increase in errors in maternity hospitals was generic covering a wide range of non-conformances.

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Appendix 1

Consider the following TACO risk factors

Patient history:

- Pre existing Co-morbidies i.e. Cardiac Failure, Hypertension, Severe aortic stenosis or moderate to severe ventricular dysfunction
- Is the patient on regular diuretics?
- Does the patient have severe anaemia?
- Is the patient known to have Pulmonary Oedema?

Patients current condition:

- Positive fluid balance
- Acute Kidney injury
- Elevated Blood Pressure
- Elevated proBNP
- Is the patient receiving other IV fluids?
- Is there peripheral oedeme present?