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Transfusion-related errors and associated adverse reactions and blood product wastage as reported to the National Healthcare Safety Network Hemovigilance Module, 2014–2022

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Abstract

Background: Transfusion-related errors are largely preventable but may lead to blood product wastage and adverse reactions, resulting in patient harm. In the United States, the incidence of transfusion-related errors is poorly understood nationally. We used data from the National Healthcare Safety Network (NHSN) Hemovigilance Module to describe and quantify transfusion-related errors, as well as associated transfusion-related adverse reactions and blood product wastage.

Methods: During 2014–2022, data from the NHSN Hemovigilance Module were used to analyze errors, including near misses (errors with no transfusion), incidents (errors with transfusion), and associated serious adverse reactions (severe, life-threatening, or death).

Results: During 2014–2022, 80 acute care facilities (75 adult; 5 pediatric) reported 63,900 errors. Most errors occurred during patient blood sample collection (21,761, 34.1%) and blood sample handling (16,277, 25.5%). Less than one-fifth of reported errors (9822, 15.4%) had a completed incident form. Of those, 8780 (89.3%) were near misses and 1042 (10.7%) incidents. More than a third of near misses (3363, 38.3%) were associated with a discarded blood product, resulting in 4862 discarded components. Overall, 87 adverse reactions were associated with errors; six (7%) were serious.

Conclusions: Over half of the transfusion-related errors reported to the Hemovigilance Module occurred during blood sample collection or sample handling. Some serious adverse reactions

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CONFLICT OF INTEREST STATEMENT

The authors have disclosed no conflicts of interest.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

identified were associated with errors, suggesting that additional safety interventions may be beneficial. Increased participation in the Hemovigilance Module could enhance generalizability and further inform policy development regarding error prevention.

Keywords

biovigilance; blood wastage; hemovigilance; transfusion incidents; transfusion-related errors

1 | INTRODUCTION

Despite advancements in transfusion safety, errors remain a source of patient harm. Errors have been observed to occur across a wide spectrum of transfusion activities, including patient blood sample collection, product administration, testing, and storage. If gone undetected, they can result in serious transfusion-related adverse reactions.[1-3] Some of the most serious, but preventable adverse reactions associated with errors include the transfusion of ABO-incompatible blood products, resulting in acute hemolytic transfusion reactions, which can be fatal.[4,5] The 2023 United Kingdom annual report on serious hazards of transfusion indicated that nearly half of all reported transfusion-related fatalities from adverse reactions were preventable.[6] Furthermore, transfusion-related errors can have a substantial economic impact due to the associated wastage of blood products, which includes not only the price of the blood product but also the labor and time associated with blood preparation and storage.[7]

Globally, hemovigilance systems have been developed to monitor and report transfusion-related events and help guide implementation of safety interventions.[8,9] In the United States, the frequency of transfusion-related errors is poorly understood, at both the national and local levels. The National Healthcare Safety Network (NHSN) Hemovigilance Module, a US national hemovigilance system, was introduced in 2010 and, subsequently, facilities that enroll can report transfusion-related errors and adverse reactions.[10] The NHSN Hemovigilance Module is operated by the Centers for Disease Control and Prevention (CDC) and receives standardized reports of transfusion-related adverse reactions and errors, including near miss events (errors that were detected prior to blood transfusion) and incidents (errors detected during or after transfusion). It also collects information on the number of blood components transfused or discarded.[11,12] In this study, we used the 2014–2022 NHSN Hemovigilance Module data to describe and quantify transfusion-related errors, transfusion-related adverse reactions, and blood product wastage.

2 | METHODS

2.1 | Data

During January 1, 2014–December 31, 2022, data on transfusion-related errors and transfusion-related adverse reactions that resulted from errors reported to the NHSN Hemovigilance Module were included in this study. Facilities were included if they submitted at least one annual facility survey and reported at least one transfusion-related error during the study period. A facility had two options for reporting errors: (1) submit a monthly error summary with a total number of errors by category and (2) submit a detailed

report for each error that includes the following: whether a product was transfused, whether a patient developed a reaction due to an error, and whether the blood product was discarded as a result of the error. The Hemovigilance Module recommends a detailed report on all errors that are associated with an adverse reaction.

Healthcare facility characteristics were assigned based on the most recently submitted facility annual survey. Characteristics included the following facility information: number of beds (<249, 250–499, 500–749, ≥750), community setting (urban, rural, suburban), whether the facility employed a full-time staff member to investigate transfusion-related incidents, entity providing transfusion services (the healthcare facility, a separate healthcare facility, or a blood center), and type of facility (pediatric or adult). All facilities that were not reported as being a pediatric-specific hospital were classified as an adult facility.

Although enrollment in the NHSN Hemovigilance Module is voluntary, prior to 2014, facilities were recommended to report all errors as part of module participation. Beginning in 2014, participating facilities were recommended to only report errors that were associated with adverse reactions. Additionally, one state (Massachusetts) mandated all licensed blood banks and transfusion services to report data on transfusion-related adverse reactions and serious reportable events (e.g., blood or blood products, wrong blood type to the wrong patient, or blood or blood products that have been improperly stored or handled) to the NHSN Hemovigilance Module starting in June 2014.[13]

All errors are grouped by categories, representing a specific activity across the spectrum of transfusion. Error categories include satellite storage, inventory management, product/test order entry, product check-in, product/test request, request for pick-up, sample collection, sample handling, sample receipt, sample testing, product issue, product manipulation/processing/testing, product storage, product administration, and other. For each error category, there are also numeric codes that further specify the error in the transfusion process. Error codes in the NHSN Hemovigilance Module are based on the classification systems set forth by the Transfusion Error Surveillance System and the Medical Event Reporting System for Transfusion Medicine incident classification schemes.[12] The result of an error was reported by facilities as: (1) product transfused, resulted in adverse reaction, (2) product transfused, resulted in no adverse reaction, (3) no product transfused, error discovered by serendipity, or (4) product transfused, error discovered through a standardized process.[12]

Adverse reactions were assigned case definition, imputability, and severity designations. Case definition designations (definite, probable, or possible) were based on signs, symptoms, and laboratory results. Imputability designations (definite, probable, possible, doubtful, ruled out, or not determined) reflect the likelihood that the reaction was related to a transfusion. Severity designations (non-severe, severe, life-threatening, fatal, or not determined) were based on the degree of medical intervention required to treat the complications following the reaction. Adverse reactions associated with errors that met case definition criteria (definite or probable) and imputability criteria (definite, probable, or possible) were defined as serious if the severity designation was “severe,” “life-threatening,”

or resulted in death. Multiple errors could be reported as associated with the same transfusion-related adverse reaction.

2.2 | Analysis

2.2.1 | Number of errors—Numbers of errors, overall and by each error category, were calculated by summing the number of errors from the monthly error summary reports.[14] The number of individual error reports that did not have a corresponding organization identifier and time of discovery under a monthly error summary were also added to the total.[15] The number of errors in each category was expressed relative to the total number of errors each year. The 10 most frequently reported error categories were described.

2.2.2 | Incidents and near miss events—If an error was discovered during or after transfusion, and, therefore, resulted in the transfusion of a blood product, it was considered an "incident." If an error was discovered prior to transfusion, it was considered a "near miss." The proportions of errors were then calculated for each of the following four error categories: (1) product transfused, reaction occurred [incident]; (2) product transfused, no reaction occurred [incident]; (3) no product transfused, error discovered by accident [near miss]; (4) no product transfused, discovered through standardized process [near miss]. The number of errors that resulted in wastage and number of discarded products by error categories were also described.

2.2.3 | Adverse reactions—Adverse reactions were quantified by number of unique events and categorized by reaction type (acute hemolytic, allergic, delayed hemolytic, delayed serologic, febrile non-hemolytic, transfusion-associated graft vs. host disease, hypotensive, post-transfusion purpura, transfusion-associated circulatory overload, transfusion-associated dyspnea, transfusion-related acute lung injury, and transfusion-transmitted infection), whether they met case definition and imputability criteria, and whether they were considered serious as described above.

All descriptive analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA).

This activity was reviewed by CDC and was conducted consistently with applicable federal law and CDC policy.[1]

3 | RESULTS

During 2014–2022, 470 facilities were enrolled in the NHSN Hemovigilance Module (Figure 1), of which 114 (24.3%) facilities did not submit an annual survey. Of the 356 facilities that did submit a survey, 80 (80/356, 22.5%) facilities that submitted at least one monthly error summary or an individual error report were included. These included facilities reporting a total of 63,900 errors. Of those, 9822 (15.4%) had individual error reports and were categorized as near misses (8780 errors, 89.3%) and incidents (1042 errors, 10.7%). Over one-third of near misses (3363, 38.3%) resulted in the wastage of at least one blood

[1]See e.g., 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

product, totaling 4862 discarded units. As multiple incidents can be associated with the same adverse reaction, 99 (99/1042, 9.5%) incidents were associated with 87 unique reactions. Based on facility location, slightly less than half of all states were represented in this study (23/50, 46.0%). More than one-third of all participating facilities were in Massachusetts (28/80, 35.0%).

Of the 80 facilities included in the study, 75% had <500 beds (Table 1). While the 11 large facilities (≥750 beds) accounted for the largest percent of errors (41.2%, 26,297/63,900 errors), and accounted for the lowest percent of incidents, that is, errors that resulted in a transfusion (12.2%, 127/1042 incidents). Over one-third of facilities (28 facilities, 35.0%) employed a full-time staff member to investigate incidents. Facilities with a full-time investigator reported the most errors (34,985, 54.8%) and incidents (760, 72.9%). Of the large facilities, nine (9/11, 81.8%) employed a full-time investigator. Half of the participating facilities were in urban community settings (51.2%) and reported the majority of errors (51,446, 80.5%). Suburban and rural facilities reported 16.7% and 2.8% of errors, respectively. More than two-thirds of all facilities provided their own transfusion services reported, which accounted over half of all errors (83.1%) and incidents (57.9%). Most facilities were adult hospitals (75/80, 93.8%), which reported 95.1% (60,745/63,900) of all errors and 92.3% (962/1042) of incidents. Pediatric hospitals accounted for 6.2% (3155/63,900) of all included facilities, reporting 3155 (5%) errors and 8% (80/1042) of all incidents.

During 2014–2020, there was a concomitant decline in the number of facilities reporting to the NHSN Hemovigilance Module and the number of errors (49 enrolled facilities in 2014 reported 12,157 errors vs. 17 facilities in 2022 reported 2398 errors; Table 2). Across 15 error categories, the most common errors occurred during sample collection (21,761, 34.1%), sample handling (16,277, 25.5%), and product administration (8, 671, 13.6%). Of note, over half (31,209, 48.8%) of all errors were discovered between 2014 and 2016.

Figure 2 shows the most frequently reported error code for each error category. The two most frequently reported errors were sample collection error, “label is incomplete/illegible/incorrect” (14.6%) and sample handling error, “data entry incorrect/incomplete/not performed” (11.6%). The frequencies of the top 10 reported errors are presented in Table 3. Of the more than 100 error codes, the top 10 most frequently reported accounted for nearly two-thirds of all reports (40,435/63,900, 63.3%); of which, seven (70%) are errors that occur during sample collection or sample handling. The 5 most reported error codes accounted for nearly half of all errors (30,389/63,900, 47.6%) and the 10 most frequently reported represented nearly two-thirds of all errors (40,435/63,900, 63.3%).

Of 9822 detailed individual error reports submitted, 1042 (10.6%) were incidents. Approximately, 1% (87/1042) of all incidents resulted in an adverse reaction (Table 4). Near misses were most common (89.4%); one in three was associated with at least one discarded blood product (3363/8780, 38.3%) resulting in 4862 discarded blood products. Most near misses (80.4%) were discovered through a standardized process designed to capture errors. Over two-fifths of near misses captured via a standardized process (3268/7898, 41.4%)

resulted in a discarded blood product. Most discards came from near misses that were discovered via a standardized process (4706/4862, 96.8%).

Between 2014 and 2022, 99 incidents were associated with 87 unique adverse reactions (Table 5). Of these 87 adverse reactions, 32 (36.7%) were febrile non-hemolytic transfusion reactions. However, 10 (11.5%) of these 87 reactions had no information regarding the reaction other than the details of the associated incident. Over two-thirds (53/87, 60.9%) of the adverse reactions met case definition criteria and imputability criteria; of these, febrile non-hemolytic reactions were most common (17/53, 32.1%). Of the 53 reactions that met case definition criteria and imputability criteria, six (6/53, 11.3%) were considered serious (severe, life-threatening, or death) and included transfusion-associated circulatory overload reactions (3), acute hemolytic transfusion reaction (1), delayed hemolytic transfusion reaction (1), and transfusion-associated acute lung injury (1). The error code associated with transfusion-associated circulatory overload reactions indicates that the transfusion reaction protocol was not followed. The code for the two hemolytic transfusion reactions indicates that the blood sample test results were misinterpreted. The transfusion-associated acute lung injury incident was listed as “Other.”

4 | DISCUSSION

Although blood transfusions in the United States are common and considered to be safe, with over 10 million transfusions performed in 2021, the risk of errors or adverse reactions is still present.[16] An important part of understanding the safety of the current transfusion process, causes of adverse reactions, and blood wastage is the monitoring for transfusion-related errors through hemovigilance. The findings from this report of the NHSN Hemovigilance Module suggest that transfusion-related errors can occur at any point in the transfusion process. Errors were identified in both pediatric and adult facilities across a wide spectrum of transfusion activities. Of these, nearly three-fourths of all errors during the study period occurred during sample collection, sample handling, or product administration. In addition, serious adverse reactions such as transfusion-associated circulatory overload, acute hemolytic transfusion reaction, and transfusion-associated acute lung injury, while uncommon, were also reported. Lastly, many of the near miss errors resulted in product wastage. Although most errors were benign and did not impact the patient, these findings indicate that interventions aimed at reducing the risk of errors will likely result in the reduction of blood wastage and patient harm.

Previous studies have reported associations between the frequency of transfusion-related errors and facility characteristics. Consistent with other studies, smaller facilities in this study reported a higher proportion of incidents relative to total errors than large facilities.[17] Possible explanations include access to additional benefits that smaller facilities may not have, such as increased funding, computerized incident reporting, patient safety committees, or the ability to fund incident investigators to aid in the prevention of future transfusion-related errors.[17] Additionally, facilities with a full-time transfusion safety officer reported a higher proportion of incidents relative to errors than those without an investigator. This finding is in keeping with a Canadian report that observed facilities with a full-time

transfusion-related error investigator report a larger number of high severity-errors due to enhanced case finding efforts.[18]

Sample collection and testing errors, labeling errors, order entry discrepancies, and incorrect product release have previously been reported as common causes of ABO-incompatible blood transfusions.[1,4,19] Consistent with these reports, this study observed sample collection errors were the most frequently reported.[1] Additionally, studies in other countries have found that sample collection errors accounted for half of all reported errors in the transfusion process; sample collection errors have been observed to account for up to 62% and 79.2% of all reported errors.[20,21] Given the severity of hemolytic reactions, efforts to reduce errors which may result in these reactions would likely result in enhanced safety of transfusion recipients.

Though the Hemovigilance Module is not nationally representative, the proportion of errors identified here which resulted in adverse reactions (0.1%) is comparable to what is reported by nationally representative systems elsewhere.[22] Circulatory overload constituted half of the serious adverse reactions resulting from errors in the present study. Responding facilities reported that these occurred due to deviation from facility transfusion protocols. Additionally, the National Quality Forum has previously included misinterpretation of a test result resulting in acute hemolytic reactions, as a “never event.”[23,24] While the present study did not identify hemolytic reactions resulting from ABO/D grouping error, three acute hemolytic reactions were identified resulting from incompatibility among minor blood group antigens. These observations suggest that focused educational measures to reduce process errors may mitigate reactions such as circulatory overload. Additionally, adoption of advanced genotyping by blood centers and hospitals may reduce the occurrence of hemolytic reactions.[25]

These findings are subject to the following limitations. First, the reporting facilities represent a small fraction of US facilities that conduct inpatient transfusions.[16] Furthermore, participation in error reporting declined annually during the study period. Because manual data entry can be onerous, additional strategies to reduce the burden of reporting are being considered. Additionally, over one-third of participating facilities were in Massachusetts due to an enrollment mandate in the state.[13,26] The findings are therefore not generalizable but are generally comparable to observations reported by other hemovigilance systems worldwide.[1,6,20,27] Next, changes to reporting requirements for both errors and adverse reactions were implemented in the NHSN Hemovigilance Module since its inception.[26] Following modifications to the reporting criteria in 2013, facilities participating in the NHSN Hemovigilance Module were no longer recommended to report all errors.[26] This change might have lowered participation in error reporting post-2013 and may have contributed to the under-reporting of errors. Next, data are self-reported by facilities. The accuracy of adverse reaction and error reports depends on the ability of users to correctly describe the details of the event. Finally, the COVID-19 pandemic impacted nearly all aspects of healthcare delivery in the United States in 2020–2021. The impact on the findings here cannot be quantified but may have contributed to the decline in reporting to the Hemovigilance Module.

In conclusion, between 2014 and 2022, most reported transfusion-related errors reported to the Hemovigilance Module occurred during sample collection, sample handling, and product administration. Most errors were near misses and one in three near miss events resulted in at least one discarded blood product. Additional efforts to reduce errors may result in enhanced transfusion safety. Continued monitoring of error trends is vital in informing future blood safety interventions. CDC continues to work with partners to improve hemovigilance. Efforts are underway to evaluate Hemovigilance Module data collection efforts to reduce participation burden and improve enrollment.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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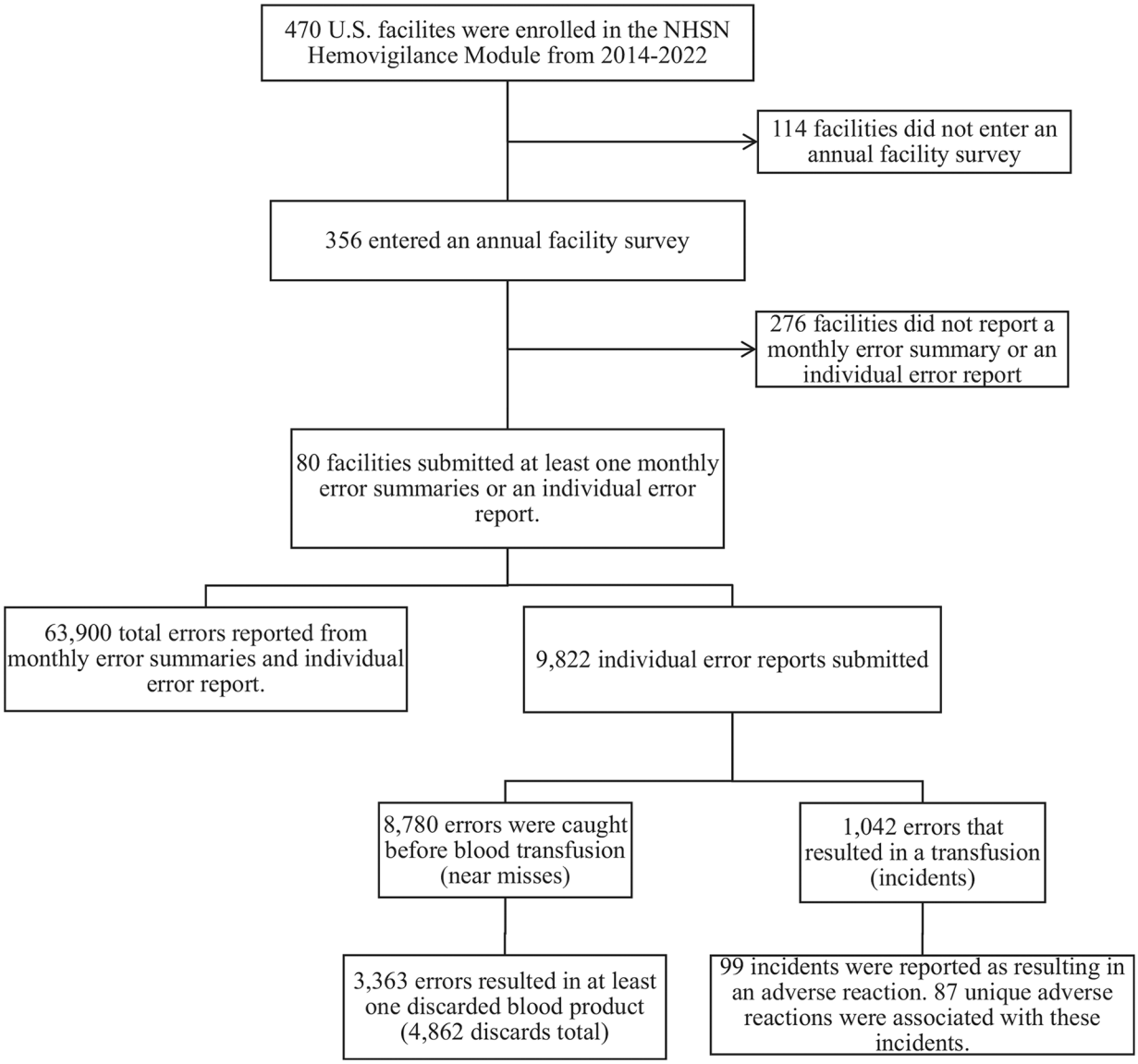

FIGURE 1.

Flow diagram of facility participation and inclusion analysis of transfusion-related errors reported to the National Healthcare Safety Network Hemovigilance Module, United States, 2014–2022.

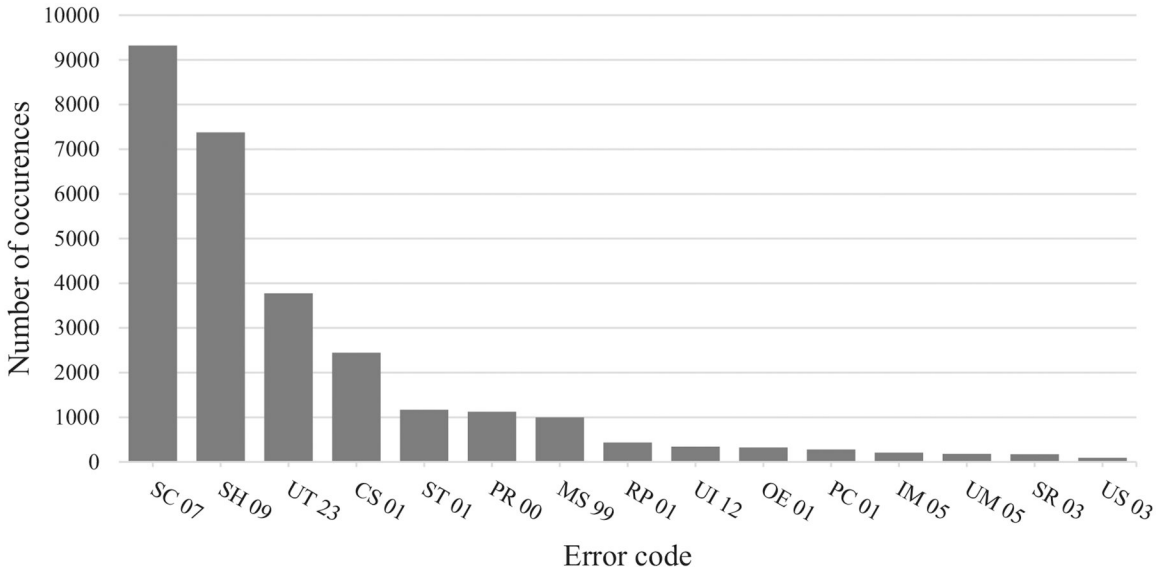

FIGURE 2.

Most reported error code per error category, National Healthcare Safety Network Hemovigilance Module, United States, 2014–2022.

TABLE 1

Characteristics of healthcare facilities that reported transfusion-related errors to the National Healthcare Safety Network Hemovigilance Module, United States, 2014–2022.

Facility characteristics	Number of facilities (%)	Total number of reported errors (%)[a]	Number of reported incidents (%)[b,c]
Total	80	63,900	1042
Total number of facility beds			
≥249	34 (42.5%)	5182 (8.1%)	206 (19.8%)
250–499	26 (32.5%)	15,343 (24%)	200 (19.2%)
500–749	9 (11.2%)	17,078 (26.7%)	509 (48.9%)
≥750	11 (13.8%)	26,297 (41.2%)	127 (12.2%)
Health facility employs a full-time staff member to investigate transfusion-related incidents			
Yes	28 (35%)	34,985 (54.8%)	760 (72.9%)
No	52 (65%)	28,915 (45.2%)	282 (27.1%)
Community setting			
Urban	41 (51.2%)	51,446 (80.5%)	579 (55.6%)
Suburban	32 (40%)	10,692 (16.7%)	400 (38.4%)
Rural	7 (8.8%)	1762 (2.8%)	63 (6.1%)
Healthcare facility's transfusion service provided by			
Blood collection center	22 (27.5%)	9322 (14.6%)	439 (42.1%)
Separate healthcare facility	1 (1.2%)	1509 (2.4%)	0
Healthcare facility	57 (71.3%)	53,069 (83.1%)	603 (57.9%)
Type of facility			
Adult	75 (93.8%)	60,745 (95.1%)	962 (92.3%)
Pediatric	5 (6.2%)	3155 (4.9%)	80 (7.7%)

[a] Error numbers include data from the monthly error summaries and detailed individual error reports.

[b] Data from detailed individual error reports only.

[c] Incidents are a subset of the total reported errors. An incident is an error or accident that was discovered after the start of a transfusion.

TABLE 2

Number of transfusion-related errors by error category as abstracted from individual error reports and monthly error summaries, National Healthcare Safety Network Hemovigilance Module, United States, 2014–2022.[a]

Category	No (%)[a]	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of facilities	80	49	41	42	27	27	26	18	19	17
Error Categories										
Sample Collection	21,761 (34.1%)	4770 (39.2%)	4014 (39.9%)	2414 (26.9%)	2337 (29.7%)	1976 (29.7%)	1859 (30.4%)	1734 (34.1%)	1615 (35.3%)	1042 (43.5%)
Sample Handling	16,277 (25.5%)	2099 (17.3%)	2072 (20.6%)	2915 (32.5%)	2633 (33.5%)	2223 (33.4%)	1863 (30.5%)	1420 (27.9%)	1010 (22.1%)	42 (1.8%)
Product Administration	8671 (13.6%)	1252 (10.3%)	1370 (13.6%)	1404 (15.6%)	1025 (13.0%)	698 (10.5%)	709 (11.6%)	760 (14.9%)	857 (18.8%)	596 (24.9%)
Product/Test Request	3631 (5.7%)	1242 (10.2%)	706 (7.0%)	346 (3.9%)	317 (4.0%)	247 (3.7%)	248 (4.1%)	199 (3.9%)	204 (4.5%)	122 (5.1%)
Satellite Storage	3300 (5.2%)	471 (3.9%)	506 (5.0%)	493 (5.5%)	498 (6.3%)	388 (5.8%)	345 (5.6%)	228 (4.5%)	215 (4.7%)	156 (6.5%)
Sample Testing	3049 (4.8%)	630 (5.2%)	325 (3.2%)	324 (3.6%)	291 (3.7%)	439 (6.6%)	362 (5.9%)	268 (5.3%)	230 (5.0%)	180 (7.5%)
Product Issue	1591 (2.5%)	284 (2.3%)	183 (1.8%)	263 (2.9%)	240 (3.1%)	151 (2.3%)	162 (2.7%)	124 (2.4%)	103 (2.3%)	81 (3.4%)
Request for Pick-up	1289 (2.0%)	279 (2.3%)	212 (2.1%)	189 (2.1%)	191 (2.4%)	159 (2.4%)	138 (2.3%)	49 (1.0%)	47 (1.0%)	25 (1.0%)
Product/Test Order Entry	1025 (1.6%)	121 (1.0%)	260 (2.6%)	282 (3.1%)	91 (1.2%)	93 (1.4%)	85 (1.4%)	49 (1.0%)	24 (0.5%)	20 (0.8%)
Other	999 (1.6%)	608 (5.0%)	165 (1.6%)	83 (0.9%)	15 (0.2%)	19 (0.3%)	24 (0.4%)	31 (0.6%)	48 (1.1%)	6 (0.3%)
Product Manipulation/ Processing/Testing	820 (1.3%)	109 (0.9%)	64 (0.6%)	114 (1.3%)	106 (1.3%)	123 (1.8%)	111 (1.8%)	77 (1.5%)	70 (1.5%)	46 (1.9%)
Product Check-in	480 (0.8%)	145 (1.2%)	48 (0.5%)	53 (0.6%)	49 (0.6%)	41 (0.6%)	52 (0.9%)	38 (0.7%)	29 (0.6%)	25 (1.0%)
Sample Receipt	414 (0.6%)	44 (0.4%)	76 (0.8%)	50 (0.6%)	46 (0.6%)	50 (0.8%)	54 (0.9%)	61 (1.2%)	22 (0.5%)	11 (0.5%)
Inventory Management	360 (0.6%)	63 (0.5%)	27 (0.3%)	24 (0.3%)	10 (0.1%)	21 (0.3%)	81 (1.3%)	36 (0.7%)	63 (1.4%)	35 (1.5%)
Product Storage	233 (0.4%)	40 (0.3%)	43 (0.4%)	27 (0.3%)	19 (0.2%)	27 (0.4%)	15 (0.2%)	18 (0.4%)	33 (0.7%)	11 (0.5%)
Total	63,900	12,157	10,071	8981	7868	6655	6108	5092	4570	2398

[a]Percentages for this table are expressed relative to all errors that occurred during the years indicated by the column total.

TABLE 3

Frequency and description of the 10 most reported transfusion-related errors, data from detailed individual error reports and monthly error summaries, National Healthcare Safety Network Hemovigilance Module, United States, 2014–2022.

Error category	Error description	Frequency (%)[a]
Sample Collection	Label incomplete/illegible/incorrect (other than patient name)	9323 (14.6%)
Sample Handling	Data entry incorrect/incomplete/not performed	7378 (11.6%)
Sample Handling	No phlebotomist/witness identification	5680 (8.9%)
Sample Collection	Sample hemolyzed	4233 (6.6%)
Product Administration	Transfusion documentation incorrect/incomplete/not performed	3775 (5.9%)
Sample Collection	Sample quantity not sufficient	3139 (4.9%)
Satellite Storage	Incorrect storage conditions of product in clinical area	2543 (4%)
Sample Collection	Detail not specified	1707 (2.7%)
Product Administration	Transfusion not performed in error	1376 (2.2%)
Sample Collection	Sample labeled with incorrect patient name	1281 (2%)

[a]Percentage based on total number of incidents (63,900).

TABLE 4

Number of transfusion-related errors, errors that led to product wastage, and wasted blood products due to errors, NHSN Hemovigilance Module, United States 2014–2022.

Error Result[a]	Number of errors (%)[b]	Number of errors that reported product wastage (# of wasted products)
Incident[c]	1042 (10.6%)	—
Product transfused; reaction	99 (1%)[e]	—
Product transfused; no reaction	943 (9.6%)	—
Near miss[d]	8780 (89.4%)	3363 (4862)
No product transfused; the incident was discovered ad hoc, by accident, serendipity, and so forth (unplanned recovery)	882 (9%)	94 (156)
No product transfused; the incident was discovered through a standardized process or barrier designed to prevent errors. (planned recovery)	7898 (80.4%)	3269 (4706)

[a] Source: https://www.cdc.gov/nhsn/pdfs/biovigilance/bv-hv-protocol-current.pdf.

[b] Percentages based off total number of individual error reports submitted (n = 9822 errors).

[c] Incident: Any error or accident that could affect the quality or efficacy of blood, blood components, or patient transfusions. It may or may not result in an adverse reaction in a transfusion recipient.

[d] Near miss: A subset of incidents that are discovered before the start of a transfusion could have led to a wrongful transfusion or an adverse reaction in a transfusion recipient.

TABLE 5

Case definition, severity, imputability, and error code designations of transfusion-related adverse reactions associated with incidents that were reported to the National Healthcare Safety Network Hemovigilance Module, United States, 2014–2022.

Adverse reaction	Number of occurrences (%)	Reactions satisfying case definition and imputability criteria	Serious reactions[a]	Error code associated with serious adverse reactions
Febrile non-hemolytic transfusion reaction	32 (36.7%)	17 (32.1%)	0	
Allergic reaction	15 (17.2%)	13 (24.5%)	0	
Delayed serologic transfusion reaction	8 (9.2%)	6 (11.3%)	0	
Transfusion-associated circulatory overload	8 (9.2%)	8 (15.2%)	3 (50%)	UT 26[b]
Other	4 (4.6%)	0	0	
Acute hemolytic transfusion reaction	3 (3.4%)	2 (3.8%)	1 (16.7%)	ST 15
Delayed hemolytic transfusion reaction	3 (3.4%)	3 (5.7%)	1 (16.7%)	ST 15
Transfusion-associated dyspnea	2 (2.2%)	2 (3.8%)	0	
Hypotensive transfusion reaction	1 (1.1%)	1 (1.9%)	0	
Transfusion-associated acute lung injury	1 (1.1%)	1 (1.9%)	1 (16.7%)	MS 99
Missing[c]	10 (11.5%)	—	—	
Total	87	53	6	

Note: Error Code Definitions: UT 26—Product Administration: Transfusion reaction protocol not followed; ST 15—Sample test result misinterpreted; MS 99—Other.

[a]Only includes adverse reactions that satisfy case definition (definite, probable) and imputability criteria (definite, probable, possible) and were designated as serious. Serious reactions include those designated as severe, life-threatening, and death.

[b]All three transfusion-associated circulatory overload reactions were associated error code UT 26.

[c]Ten adverse reactions had no information regarding the reaction other an incident associated with a reaction.