

Transfusion Transmitted Injuries Surveillance System (TTISS)

2018 - 2022

Summary Report

PROTECTING AND EMPOWERING CANADIANS TO IMPROVE THEIR HEALTH



Public Health
Agency of Canada

Agence de la santé
publique du Canada

Canada

To Promote and Protect the Health of Canadians through Leadership, Partnership, Innovation and Action in Public Health.

—Public Health Agency of Canada

Également disponible en français sous le titre :

Système de surveillance des incidents transfusionnels: Rapport 2018-2022

To obtain additional information, please contact:

Public Health Agency of Canada

Address Locator 0900C2

Ottawa, ON K1A 0K9

Tel.: 613-957-2991

Toll free: 1-866-225-0709

Fax: 613-941-5366

TTY: 1-800-465-7735

E-mail: publications@hc-sc.gc.ca

This publication can be made available in alternative formats upon request.

© Her Majesty the King in Right of Canada, as represented by the Minister of Health, 2024

Publication date: February 2025

This publication may be reproduced for personal or internal use only without permission provided the source is fully acknowledged.

Cat: HP37-19E-PDF

ISSN: 2368-4186

Pub: 260022

Forward

The Centre for Communicable Diseases and Infection Control (CCDIC) of the Public Health Agency of Canada (PHAC) is pleased to release the *Transfusion Transmitted Injuries Surveillance System (TTISS) Summary Report, 2018-2022*. This summary report presents transfusion transmitted injury surveillance data submitted by Canadian hospitals participating in the TTISS network.

PHAC established TTISS to collect non-nominal data on adverse reactions to blood transfusions. Canadian hospitals providing transfusion services across the country participate in this surveillance system.

CCDIC, in partnership with participating provinces and territories (P/Ts), is responsible for the collection, management, and analysis of data, and the production of reports to support evidence-based public health decisions. The overarching goal of TTISS is to improve blood transfusion safety and patient safety in Canadian hospitals.

Abbreviations

AHR	Acute Haemolytic Reaction
ASPT	Aseptic Meningitis
ATE	Adverse Transfusion Event
ATR	Adverse Transfusion Reaction
BACT	Bacterial Infection
DHR	Delayed Haemolytic Reaction
DSR	Delayed Serological Reaction
FNHR	Febrile Non-Hemolytic Reaction
HYPT	Hypotensive Reaction
INCMPT	Incompatible Transfusion
IVIG-HD	Intravenous Immunoglobulin Headache
SAAR	Severe Anaphylactic/Anaphylactoid Reaction
TACO	Transfusion Associated Circulatory Overload
TAD	Transfusion Associated Dyspnea
TRALI	Transfusion Related Acute Lung Injury
TTISS	Transfusion Transmitted Injuries Surveillance System
UK	Unknown
BCs	Blood Components
PDs	Plasma Derivatives

Table of Contents

Executive Summary.....	6
Introduction.....	8
Methods.....	9
Data Collection and Processing.....	9
Denominator Data.....	10
Statistical Analysis.....	10
Results	14
1. Adverse Transfusion Reactions (ATRs)	15
2. ATR Rates per Unit of Blood Component Transfusion.....	16
3. ATRs by Transfusion Imputability	19
4. ATRs by Transfusion Severity	22
a. Severe ATRs (Grade 2 Severity)	23
b. ATRs of Life-Threatening Injury (Grade 3 Severity)	25
5. ATRs by Outcome	28
5.2 ATRs Leading to Death.....	32
Summary	34
Annex A-F	

Executive Summary

Since 2001, the Transfusion Transmitted Injuries Surveillance System (TTISS) has been collecting data on reported adverse transfusion reactions (ATRs) that are due to the transfusion of blood products (blood components and plasma derivatives) in Canada. As of 2007, all provinces and territories (P/Ts), with the exception of Nunavut, provide data to TTISS. Currently, the TTISS network monitors over 95% of total blood transfusion activities in Canada.

This report presents the number of ATRs related to the transfusion of blood components and plasma derivatives. In addition, ATR rates are reported for the transfusion of blood components (BCs) only. Rates for the transfusion of plasma derivatives (PDs) are not shown due to the non-availability of denominator data.

The range of ATRs reported include transfusion-associated circulatory overload (TACO), severe anaphylactic/(anaphylactoid reaction (SAAR), hypotensive reaction (HYPT), acute and delayed haemolytic reaction (AHR and DHR), transfusion-related acute lung injury (TRALI), transfusion-associated dyspnea (TAD), intravenous immune globulin headache/hemolysis (IVIG-HD), aseptic meningitis (ASPT), bacterial infections (BACT), incompatible transfusion (INCMPT), and unusual reactions of clinical significance (Others).

A total of 4,308 ATRs were reported to TTISS during the five-year period (2018 to 2022): 64.1% (2,763) were due to transfusion of blood components and 35.9% (1,545) were due to transfusion of plasma derivatives. TACO, among transfusions of blood components, and IVIG-HD, among transfusions of plasma derivatives, were commonly reported ATRs, representing 43.7% (1,208) and 37.2% (575) respectively.

In terms of imputability (definite, probable, possible), 10.1% of ATRs were definitely imputable to transfusions. 89.9% of ATRs were probably/possibly imputable to transfusions.

ATRs, categorized by severity in terms of the level of medical care/intervention required for the patients, consisted of 68.9% that were non-severe, about one quarter (24.3%) that were severe, and 5.3% resulted in life-threatening injuries.

Of the total ATRs (n=4,308) with reported outcomes, 90.5% resulted in minimal or no harm to recipients, whereas major or long-term sequelae and deaths accounted for 3.3% and 1.8% respectively, the remaining 4.4% were not determined. Among the total number of deaths

reported during the five year period (n=79), little more than half (46, 58.2%) were reported transfusion imputability (definite, probable or possible) and (33, 41.8%) were reported non-transfusion imputability (doubtful, ruled out or not determined). TACO and TRALI were the leading causes of transfusion-related deaths.

Most deaths occurred in older patients (median age=72 years), so these may also be attributable to other causes (comorbidities). This suggests that the actual number of ATR-related deaths may be lower than the reported deaths. Further research is required to clarify the relationship between transfusions and age at death.

Introduction

Established as a pilot system in 2001, the Transfusion Transmitted Injuries Surveillance System (TTISS) has since been reporting adverse transfusions reactions (ATRs), which are defined as undesirable and unintentional incidents that occur during and/or after the administration of blood, blood components or plasma derivatives. TTISS collects non-nominal data on ATRs after the transfusion of blood components (e.g., red blood cells (RBCs), granulocytes, platelets, plasma, and cryoprecipitate) and plasma derivatives (e.g., albumin, immune globulin (IG), coagulation factors, etc.). ATRs are voluntarily reportable to TTISS by a national network of hospitals providing transfusion services across all P/Ts except Nunavut.

The TTISS National Working Group (NWG-TTISS) is comprised of representatives from each P/Ts, two blood manufacturers (Canadian Blood Services and Héma-Québec), and ex-officio representation from Health Canada's Marketed Health Products Directorate (MHPD) and Biologics and Genetic Therapies Directorate (BGTD). The NWG-TTISS, advises TTISS on its operation and direction as a national surveillance system. The objective of TTISS is to identify and estimate risks and trends of ATRs following transfusions to help improve patient safety in Canadian hospitals. This report summarizes the findings of TTISS 2018-2022 national data.

Methods

Data Collection and Processing

All participating hospitals in the TTISS network, covering more than 95% of transfusion activities in Canada, provide data to the Public Health Agency of Canada (PHAC). A set of standardized case definitions and a standardized reporting form¹ are used to record data and are transferred electronically to a centralized web-based system - *Canadian Network for Public Health Intelligence (CNPHI)*². Currently, ten of the eleven participating sites enter their data into CNPHI, and one site electronically submits their data directly to PHAC. Generally, PHAC receives annual data with a time lag of 6-12 months from participating sites (e.g., 2022 data are received in the following year by July-December of 2023). Data are reviewed for quality assurance and requests for verifications of any discrepancies are addressed with each site separately. After validations, some ATRs may be reclassified or excluded to comply with standardized case definitions. Data from all P/Ts are then combined to form a national TTISS database for analysis.

ATRs are categorised based on imputability (likelihood of being related to transfusion). The transfusion-related ATRs are defined as “definite, probable or possible”. Non-transfusion-related ATR is defined as “ruled out, doubtful or not determined”. Only transfusion-related ATRs are considered for analysis. The “severity” (the level of intervention required to respond to the adverse event and/or disability sustained) and “outcome” (whether the recipient sustained any physiological and/or physical consequence, i.e., damage/impairment of a bodily function) are also recorded. The outcome varies from minor to major/long-term sequelae, including death. In cases of death, further investigation is conducted to determine the ATR’s imputability and to establish whether the event is definitely, probably, possibly, or doubtfully related to the transfusion, or whether it is not determined or remains to be ruled out (Annex A).

ATRs collected in TTISS include severe anaphylactic/anaphylactoid reactions (SAARs), transfusion-associated circulatory overload (TACO), transfusion-related acute lung injury (TRALI) and possible TRALI, transfusion-associated dyspnea (TAD), hypotensive reactions (HYPT), intravenous immunoglobulin headache (IVIG-HD), acute and delayed haemolytic reactions (AHR and DHR),

¹ *Transfusion Transmitted Injuries Surveillance System, User's Manual, ver. 3.0, 2007. Public Health Agency of Canada.*

² CNPHI <https://www.cnphi-rcrsp.ca/cnphi/DownloadUserAgreement?lang=en>

aseptic meningitis (ASPT), bacterial infections (BACT), and incompatible transfusion (INCMPT). In addition to the above ATRs, when the recipient experienced any other types of adverse reactions e.g., severe electrolyte imbalance, atypical pain syndrome, etc., these are classified as “Other”. Minor allergic reactions, such as febrile non-haemolytic reactions (FNHR), and delayed serological reactions (DSR) are not considered in the TTISS report. If the ATR is associated with both blood components and plasma derivatives, only data from the first transfusion is included in the analysis.

Denominator Data

The total number of units of blood components transfused annually in hospitals within the TTISS network was used as the denominator to calculate rates per 100,000 units of blood components transfused. The number of units of plasma derivatives were not available from the participating sites, thus, no rate were calculated.

Statistical Analysis

Descriptive analyses were performed using the SAS EG 5.1 software. Counts and proportions of specific ATRs were calculated for blood components and plasma derivatives, during the reporting period of 2018-2022. Rates of specific ATRs and death were calculated per 100,000 units of blood components transfused.

Results

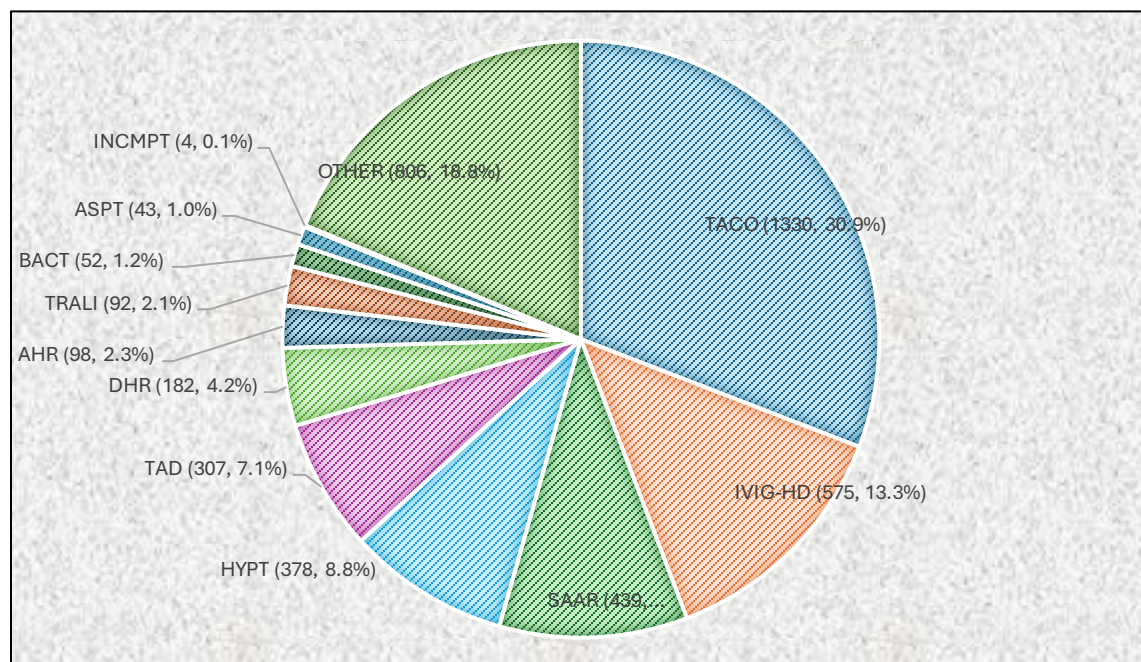
The TTISS (2018-2022) results are presented in five sections, each including the overall results, and where feasible, the separate results for blood components and plasma derivatives:

- i. Section 1: Counts and proportions of ATRs, excluding those with imputability that is deemed doubtful, ruled out, or not determined, or where this information is missing.
- ii. Section 2: ATR rates associated with blood components.
- iii. Section 3: Counts and proportions of ATRs based on the imputability of the adverse reaction.
- iv. Section 4: Counts and proportions of ATRs by severity (degree of intervention required and/or disability resulting).
- v. Section 5: Counts and proportions of ATRs by outcome (nature of the sequelae).

1. Adverse Transfusion Reactions (ATRs)

Annual numbers of ATRs are provided for the five-year period (2018-2022) in Annex B. ATRs by type reported during the five year period are shown in Figure 1A. Overall, about one third cases were TACO (30.9%, 1330/4308) followed by IVIG-HD and SAAR representing (13.3%, 575/4308) and (10.2%, 439/4308), respectively, whereas HYPT, TAD and DHR cases accounted for (8.8%, 378/4308), (7.1%, 307/4308) and (4.2%, 182/4308), respectively. The remaining ATRs type are around 2% or less. There was one case for each of Post Partum Purpura (PPT) and viral infection which are not shown in the Figure 1A.

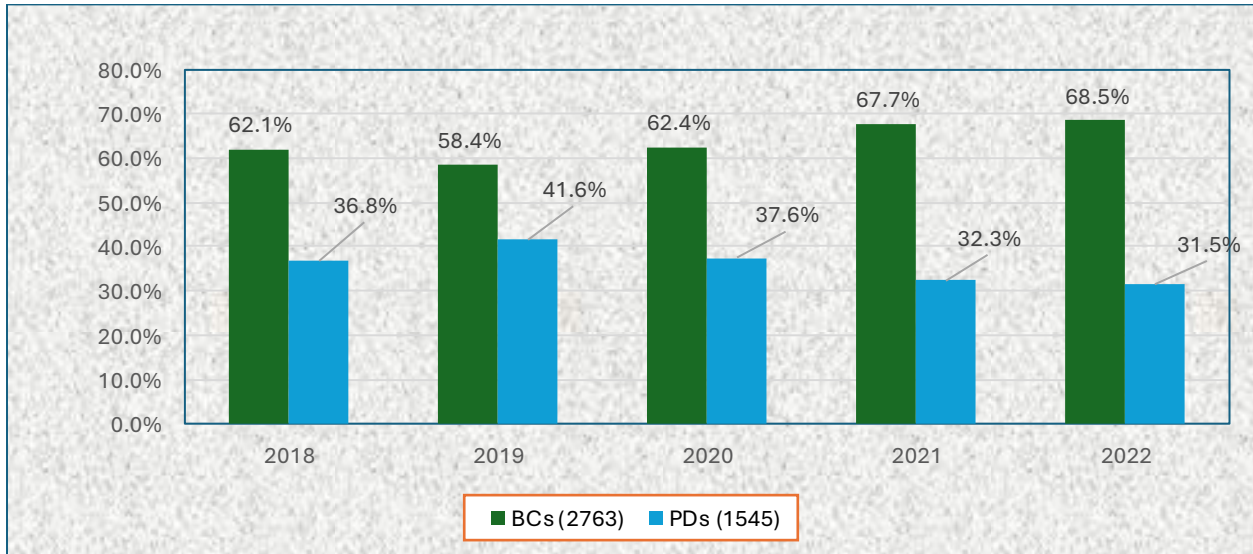
Figure 1A: ATRs (%) by Type, During the Five Year Period, TTISS 2018-2022



The yearly proportions (%) of ATRs by transfusions of blood components and plasma derivatives are presented in Figure 1B. Of the total ATRs reported (n=4,308), nearly two-thirds (64.1%, n=2,763/4,308) are due to the transfusion of blood components and a little more than one-third (35.9%, n=1,545/4,308) are due to transfusion of plasma derivatives. The yearly proportion of ATRs due to blood components and plasma derivatives are plotted in Figure 1B. The ATRs due to blood components showing one year decline from 62.1% to 58.4% between 2018 to 2019, followed an upward trend during the next four years from 2019-2022, whereas the ATRs due to plasma

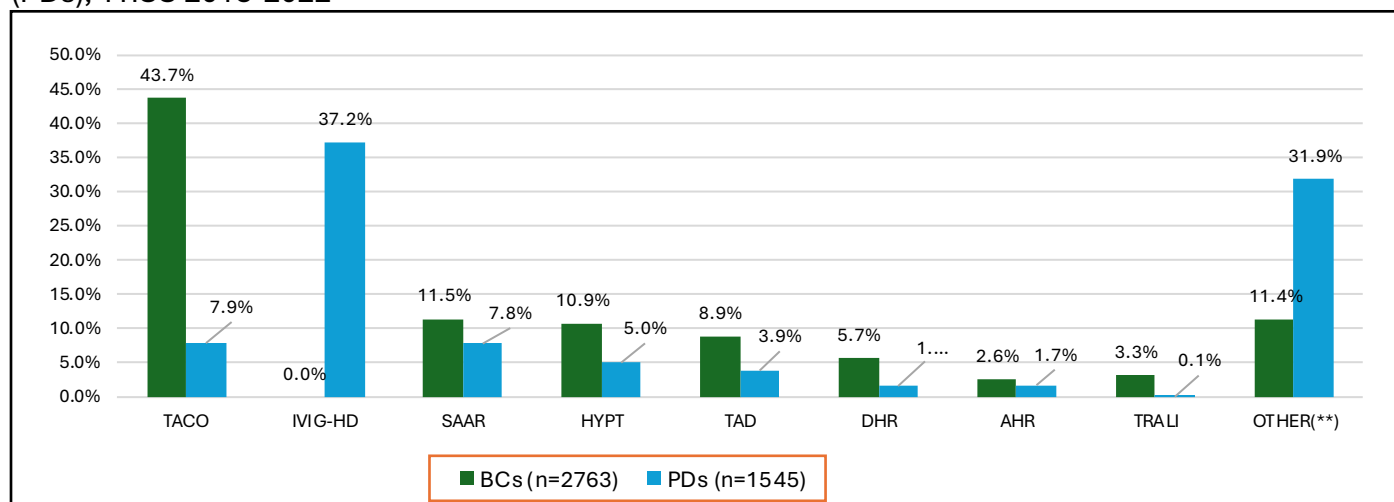
derivatives showing increase from 36.8% to 58.4% between 2018 to 2019 and then the downward trend during the next four years between 2019-2022.

Figure 1B: ATRs (%) by Year-Transfusions of Blood Components (BCs) and Plasma Derivatives (PDs), TTISS 2018-2022



The ATRs (%) by type and by transfusion of blood components and plasma derivatives is exhibited in Figure 1C. Overall, among the ATRs due to blood components, TACO is the commonly reported ATR (43.7%, n=1,208/2,673), followed by SAAR (11.5%, n=318/2,673) and HYPT (10.9%, n=300/2,673), whereas among the ATRs due to plasma derivatives, IVIG-HD is the commonly reported, followed by TACO (7.9%, 122/1,545) and SAAR (7.8%, 121/1545) respectively. ATRs with few cases BACT(1.9%, 52/2763) and INCMPT (0.1%, 4/2763) due to blood components and ASPT (2.8%, 43/1545) due to plasma derivatives are not shown in Figure 1C. One PTP case due to blood components and one VIRAL case due to plasma derivatives are also not shown in Figure 1C. The 109 unknown cases are included in OTHER category of ATRs.

Figure 1C: ATRs (%) by Transfusions of Blood Components (BCs) and Plasma Derivatives (PDs), TTISS 2018-2022



2. ATR Rates

ATR rates are calculated by considering the number of ATRs reported due to blood components as the numerator (Annex B) and the number of units of blood components transfused as denominator (Annex C), represented per 100,000 units of blood components transfused (Table 2). The overall five year ATR rate is 44.8 (yearly range: 34.6 to 50.2) cases per 100,000 units of blood components transfused. TACO consistently showed the highest rates with some yearly variation (19.6: range:13.6-23.8) cases per 100,000 units of blood components transfused. ATRs including SAAR, HYPT and TAD had annual rates around 6% or less. The yearly ATR rates for BACT and INCMPT are very low in the range of 0.0 to 1.2 cases per 100,000 units transfused.

Table 2: ATR Rates by Type per Year/100,000 Units of Blood Components Transfusion, TTISS 2018-2022

ATRs	YEAR					All
	2018	2019	2020	2021	2022	
TACO	16.7	13.6	22.8	21.9	23.8	19.6
SAAR	4.0	5.3	5.3	6.7	4.7	5.2
HYPT	4.8	2.6	6.1	5.1	5.9	4.9
TAD	3.4	3.5	3.7	4.4	5.0	4.0
DHR	2.7	2.2	3.8	1.6	2.5	2.5
TRALI	1.4	1.1	2.0	2.0	0.9	1.5
AHR	1.0	0.6	0.9	1.3	2.0	1.2
BACT	0.8	1.2	0.9	0.7	0.7	0.8
INCMPT	0.2	0.1	0.0	0.0	0.0	0.1
OTHER	5.7	4.5	3.9	6.5	4.7	5.1
Total	40.7	34.6	49.3	50.2	50.2	44.8

3. ATRs by Transfusion Imputability-Relationship

The detailed definitions of imputability are provided in Annex A. The transfusion-related nature (imputability) of ATRs are provided in Annex D. The relationships between ATRs for all transfusions and by transfusion of blood components and plasma derivatives are provided in Table 3A, and exhibited in Figure 3A for all transfusions and in Figure 3B, for transfusion of blood components and plasma derivatives. Overall, one in ten of ATRs (10.1%, n=435/4,308) were considered to be definitely associated with transfusion, and nine in ten (89.9%, n=3,873/4,308) deemed to be probably or possibly linked to transfusion. The transfusion-related nature of ATRs (all transfusions) were similar over time with small annual variations (Figure 3A). Similarly, the transfusion-related nature of ATRs due to blood components and plasma derivatives were also consistent over time (Figure 3B).

Table 3A: ATRs (%) by Year and by Transfusion Imputability - All Transfusions, Transfusions of Blood Components, and Plasma Derivatives, TTISS 2018-2022

YEAR	All Transfusions				Blood Components				Plasma Derivatives			
	Definite	Possible	Probable	N	Definite	Possible	Probable	N1	Definite	Possible	Probable	N2
2018	10.8%	46.7%	42.5%	941	10.8%	50.8%	38.4%	591	10.9%	39.7%	49.4%	350
2019	13.8%	43.3%	43.0%	719	14.3%	47.4%	38.3%	420	13.0%	37.5%	49.5%	299
2020	9.5%	44.4%	46.2%	897	10.9%	48.8%	40.4%	560	7.1%	37.1%	55.8%	337
2021	7.6%	44.3%	48.1%	885	6.7%	47.4%	45.9%	599	9.4%	37.8%	52.8%	286
2022	9.5%	44.9%	45.6%	866	9.4%	47.9%	42.7%	593	9.5%	38.5%	52.0%	273
Total	10.1%	44.8%	45.1%	4308	10.2%	48.5%	41.3%	2763	10.0%	38.1%	51.9%	1545

Figure 3A: ATRs (%) by Year and by Transfusion Imputability - All Transfusions, TTISS 2018-2022

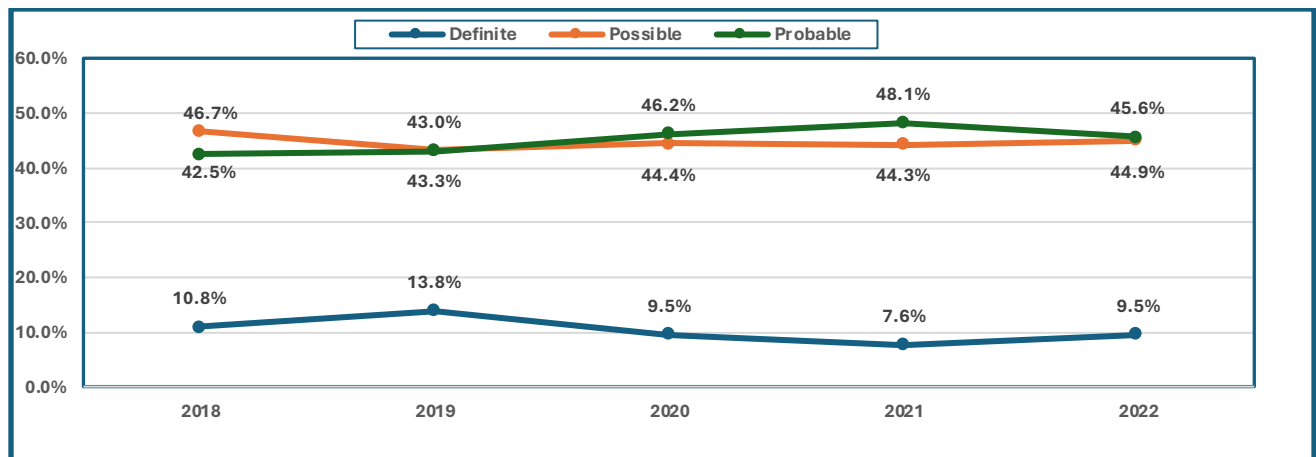


Figure 3B: ATRs (%) by Year and Transfusion Imputability – Blood Components (BCs) and Plasma Derivatives (PDs), TTISS 2018-2022

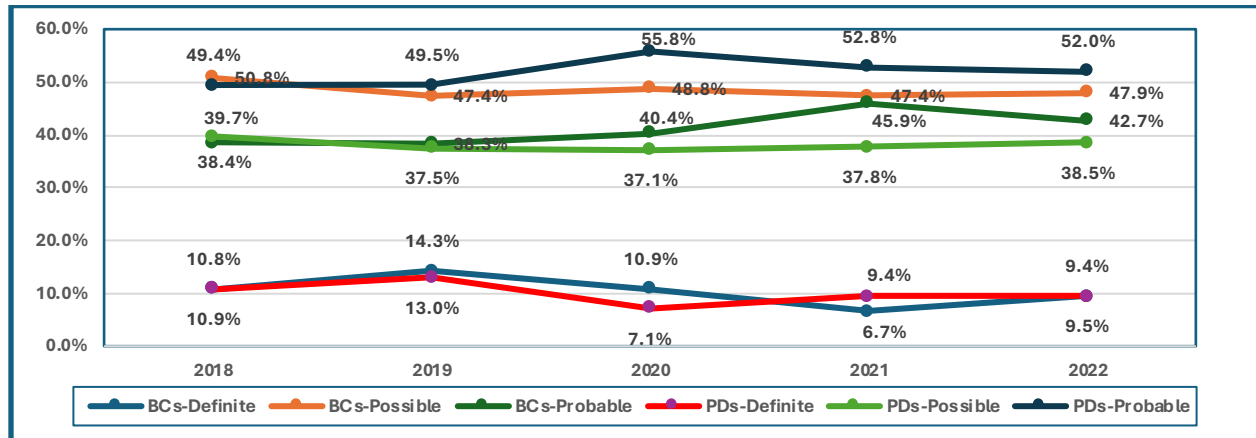


Table 3B presents the transfusion-related assessment of ATRs for the transfusions of blood components and plasma derivatives for combined five-year period (2018-2022). It is observed that among all transfusions, TACO representing overall (30.9%, 1330/4308) showed under ten percent (9.2%, 122/1330) a definite link to transfusion, whereas among the least reported ATRs such as DHR and AHR representing overall (4.2%, 182/4308) and (2.3%, 98/4308) cases showed much higher proportions with (45.1%, 82/182) and (32.7%, 32/98) definitely linked to transfusions, respectively. The SAAR cases with overall proportions of (10.2%, 439/4308) making up (15.7%, 69/439) definitely linked to transfusion.

Table 3B: ATRs (%) by Imputability - All Transfusions, Transfusion of Blood Components and Plasma Derivatives, TTISS 2018–2022

ATRs	All transfusion				Blood Components				Blood Products			
	Definite	Possible	Probable	N	Definite	Possible	Probable	N1	Definite	Possible	Probable	N2
TACO	9.2%	45.6%	45.2%	1330	9.3%	45.3%	45.4%	1208	8.2%	49.2%	42.6%	122
IVIG-HD	10.3%	26.8%	63.0%	575	-	-	-	-	10.3%	26.8%	63.0%	575
SAAR	15.7%	26.9%	57.4%	439	12.6%	26.7%	60.7%	318	24.0%	27.3%	48.8%	121
HYPT	4.0%	59.8%	36.2%	378	4.0%	62.7%	33.3%	300	3.8%	48.7%	47.4%	78
TAD	1.6%	68.1%	30.3%	307	2.0%	67.2%	30.8%	247	0.0%	71.7%	28.3%	60
DHR	45.1%	30.2%	24.7%	182	45.2%	29.9%	24.8%	157	44.0%	32.0%	24.0%	25
BACT	7.7%	82.7%	9.6%	52	7.7%	82.7%	9.6%	52	-	-	-	-
AHR	32.7%	24.5%	42.9%	98	32.4%	26.8%	40.8%	71	33.3%	18.5%	48.1%	27
TRALI	5.4%	66.3%	28.3%	92	4.4%	67.0%	28.6%	91	100.0%	0.0%	0.0%	1
ASPT	16.3%	32.6%	51.2%	43	-	-	-	-	16.3%	32.6%	51.2%	43
INCMPT	50.0%	25.0%	25.0%	4	50.0%	25.0%	25.0%	4	-	-	-	-
OTHER	4.1%	51.6%	44.3%	808	2.5%	58.1%	39.4%	315	5.1%	47.5%	47.5%	493
Total	10.1%	44.8%	45.1%	4308	10.2%	48.5%	41.3%	2763	10.0%	38.1%	51.9%	1545

4. ATRs Severity

Definitions of severity levels are provided in Annex A, and yearly reported ATRs by severity are provided in Annex E. The annual proportions of ATRs by severity are detailed in Table 4A, and are exhibited in Figure 4A for all transfusions, and in Figure 4B for transfusions of blood components and plasma derivatives. Overall, for ATRs reported during 2018-2022, two-third (68.9%, n=2968/4,308) were “non-severe”, one-fourth (24.3%, n=1,048/4308) were “severe”, and 5.3% (n=229/4,308) recorded as having “life-threatening injuries”. The ATRs by severity level exhibit a uniform yearly trend with small annual variations during the reporting period (Figure 4A).

ATRs (%) by severity levels due to transfusions of blood components and plasma derivatives also exhibit a uniform trend with small annual variations (Figure 4B). The number of ATRs deemed to be non-severe are consistently lower for blood components than for plasma derivatives, whereas the number of ATRs deemed to be severe and life-threatening injuries are consistently higher for blood components than for plasma derivatives (Figure 4B).

Table 4A: ATRs (%) by Severity and Year - All Transfusions, Transfusions of Blood Components and Plasma Derivatives, TTISS 2018-2022

YEAR	All transfusions					Blood components					Plasma derivatives				
	Non-severe	Severe	Life-threatening	Not det.	(N)	Non-severe	Severe	Life-threatening	Not det.	(N1)	Non-severe	Severe	Life-threatening	Not det.	(N2)
2018	71.0%	23.5%	4.0%	1.5%	941	65.5%	26.7%	5.9%	1.9%	591	80.3%	18.0%	0.9%	0.9%	350
2019	66.1%	26.8%	5.8%	1.3%	719	55.5%	34.0%	9.0%	1.4%	420	80.9%	16.7%	1.3%	1.0%	299
2020	67.8%	26.9%	4.1%	1.2%	897	58.4%	34.3%	5.5%	1.8%	560	83.4%	14.5%	1.8%	0.3%	337
2021	67.9%	24.7%	5.6%	1.7%	885	62.1%	28.2%	7.7%	2.0%	599	80.1%	17.5%	1.4%	1.0%	286
2022	71.1%	20.1%	7.2%	1.6%	866	69.1%	20.9%	8.1%	1.9%	593	75.5%	18.3%	5.1%	1.1%	273
Total	68.9%	24.3%	5.3%	1.5%	4308	62.6%	28.8%	7.2%	1.8%	2763	80.2%	17.0%	2.0%	0.8%	1545

Figure 4A: ATRs (%) by Severity and Year - All Transfusions, TTISS 2018-2022

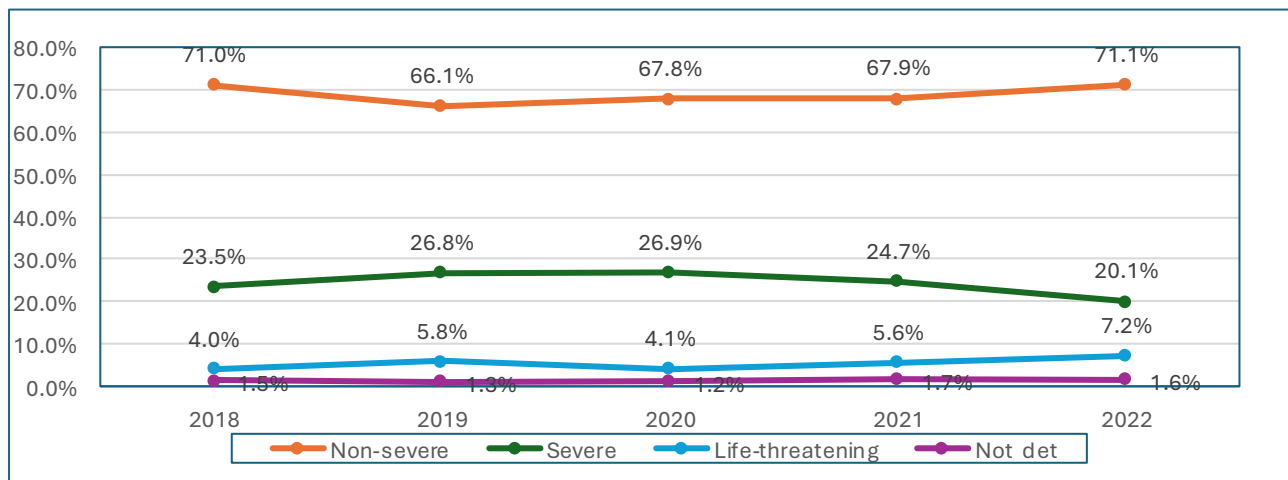
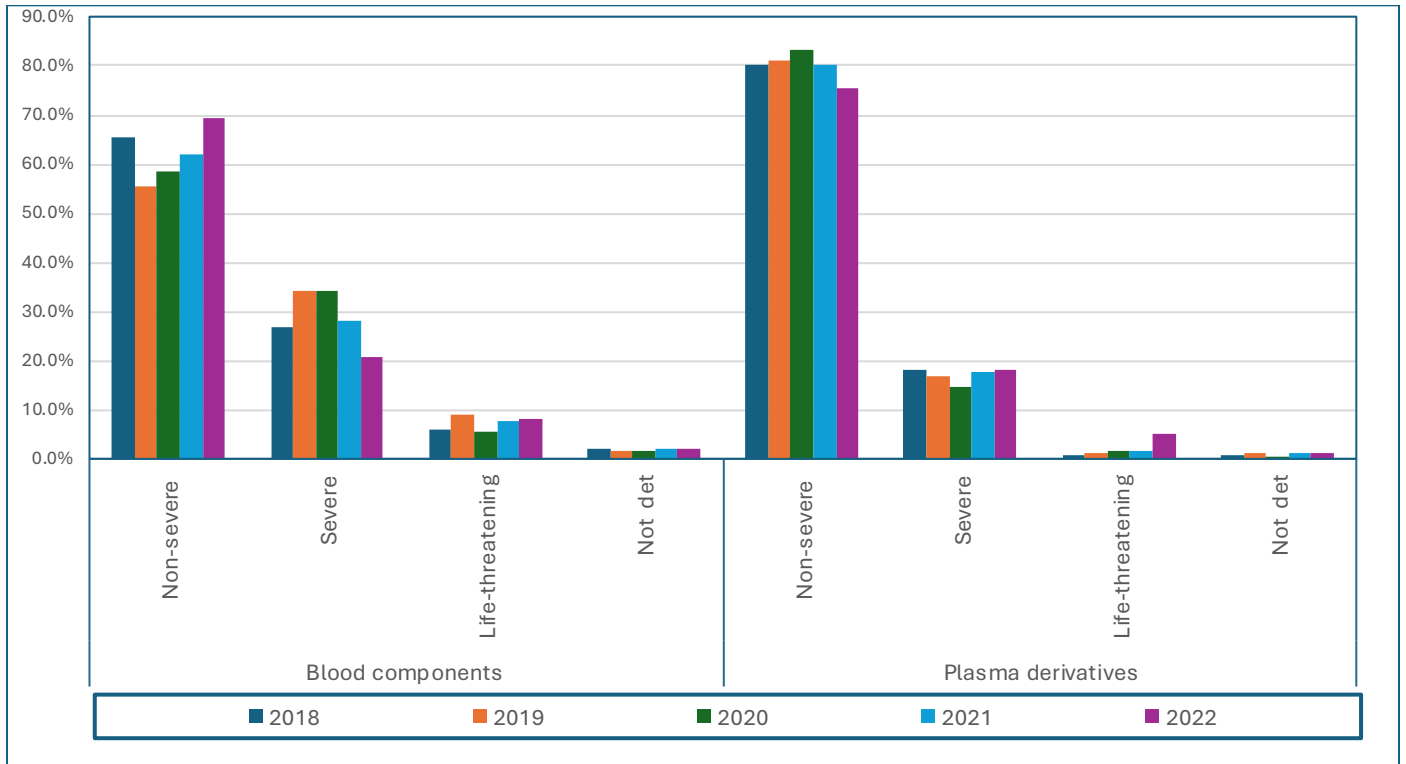


Figure 4B: ATRs (%) by Severity and Year - Transfusions of Blood Components and Plasma Derivatives, TTISS, 2018-2022



ATRs (%) by severity level for the five-year combined period (2018-2022) are detailed in Table 4B. Among the ATRs related to blood components, TACO, SAAR, and HYPT make up a larger portion of total cases, but fewer cases among these were of grade 3 (life-threatening), accounting for 6.3%, 13.8%, 4.0%, respectively, whereas TRALI makes up a smaller proportion of total ATRs (2.4%), represent only 7.6% non-sever but 54.3% and 36.3% severe and life threatening injuries. Similarly, TACO, SAAR and HYPT cases due to plasma derivatives having life-threatening injuries were 6.6%, 10.7% and 1.3%, respectively. The only case of TRALI due to plasma derivatives was non-severe and among the IVIG-HD cases, 93.0% were non-severe, 7.0% were severe and none was life-threatening (Table 4B).

Table 4B: ATRs Type (%) by Severity - All Transfusions, Transfusions of Blood Components (BCs) and Plasma Derivatives (PDs), TTISS 2018-2022

ATRs	All transfusions					Blood components					Plasma derivatives				
	Grade1	Grade2	Grade3	Not det	Total	Grade1	Grade2	Grade3	Not det	Total	Grade1	Grade2	Grade3	Not det	Total
	Non-severe	Severe	Life-threatening	Not det.	N	Non-severe	Severe	Life-threatening	Not det.	N1	Non-severe	Severe	Life-threatening	Not det.	N2
TACO	62.7%	28.7%	6.3%	2.3%	1330	63.2%	28.3%	6.3%	2.2%	1208	58.2%	32.8%	6.6%	2.5%	122
IVIG-HD	93.0%	7.0%	0.0%	0.0%	575	-	-	-	-	-	93.0%	7.0%	0.0%	0.0%	575
SAAR	34.2%	52.4%	13.0%	0.5%	439	34.0%	51.6%	13.8%	0.6%	318	34.7%	54.5%	10.7%	0.0%	121
HYPT	78.6%	16.9%	4.0%	0.5%	378	77.3%	17.3%	4.7%	0.7%	300	83.3%	15.4%	1.3%	0.0%	78
AHR	50.0%	42.9%	6.1%	1.0%	98	54.9%	38.0%	7.0%	0.0%	71	37.0%	55.6%	3.7%	3.7%	27
DHR	59.3%	31.3%	3.3%	6.0%	182	63.1%	28.7%	3.8%	4.5%	157	36.0%	48.0%	0.0%	16.0%	25
ASPT	34.9%	62.8%	2.3%	0.0%	43	-	-	-	-	-	34.9%	62.8%	2.3%	0.0%	43
TAD	75.2%	18.9%	4.6%	1.3%	307	74.9%	19.4%	4.5%	1.2%	247	76.7%	16.7%	5.0%	1.7%	60
TRALI	7.6%	54.3%	35.9%	2.2%	92	6.6%	54.9%	36.3%	2.2%	91	100.0%	0.0%	0.0%	0.0%	1
BACT	51.9%	42.3%	3.8%	1.9%	52	51.9%	42.3%	3.8%	1.9%	52	-	-	-	-	-
INCMPT	100.0%	0.0%	0.0%	0.0%	4	100.0%	0.0%	0.0%	0.0%	4	-	-	-	-	-
OTHER	88.0%	9.4%	1.4%	1.2%	808	84.4%	11.4%	2.2%	1.9%	315	90.3%	8.1%	0.8%	0.8%	493
Total	68.9%	24.3%	5.3%	1.5%	4308	62.6%	28.4%	7.2%	1.8%	2763	80.2%	17.0%	2.0%	0.8%	1545

4.1 ATRs - Grade 2* (Severe)

Annual trends of ATRs considered grade 2 severity during the five-year reporting period given in Table 4.1, is exhibited in Figure 4.1A (blood components) and Figure 4.1B (plasma derivatives). Of the total number of grade 2 severity ATRs (n=1048), three-quarters (75.0%, n=786/1048) were due to blood components and one-fourth (25.0%, n=262/1048) were due to plasma derivatives. Annual trends in grade 2 severe ATRs due to blood components, showed relatively consistent patterns with smaller variations for each ATR. TACO, followed by SAAR, consistently make up most of the total number of grade 2 severe cases (Figure 4.1A). The number of ATRs considered to be of grade 2 severity due to plasma derivatives were stable for most of the ATRs with the exception of SAAR cases, showed higher yearly fluctuations, whereas the TACO cases showed some rising trend from 7.9% in 2018 to 20.0% in 2022 (Table 4.1). The remaining ATRs showed consistent pattern with smaller yearly variations (Figure 4.1B)

Table 4.1: ATRs Type (%) of Grade 2 Severity - Transfusions of Blood Components and Plasma Derivatives, TISS 2018-2022

ATRs	All Transfusions						Blood Components						Plasma Derivatives					
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total
TACO	31.2%	31.6%	42.3%	38.4%	38.5%	36.5%	39.9%	39.9%	48.4%	42.6%	46.0%	43.5%	7.9%	8.0%	18.4%	24.0%	20.0%	15.3%
IVIG-HD	4.6%	3.6%	2.5%	3.7%	5.2%	3.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	15.9%	14.0%	12.2%	16.0%	18.0%	15.3%
SAAR	22.0%	23.8%	20.7%	23.3%	20.1%	21.9%	16.5%	25.9%	18.2%	24.9%	19.4%	20.9%	34.9%	18.0%	30.6%	18.0%	22.0%	25.2%
HYPT	9.6%	2.1%	5.0%	7.3%	6.3%	6.1%	10.8%	2.8%	4.7%	7.1%	8.1%	6.6%	6.3%	0.0%	6.1%	8.0%	2.0%	4.6%
AHR	5.5%	5.2%	2.5%	3.2%	4.0%	4.0%	5.1%	2.8%	3.1%	3.0%	3.2%	3.4%	6.3%	12.0%	0.0%	4.0%	6.0%	5.7%
DHR	5.5%	7.8%	5.0%	4.1%	5.2%	5.4%	4.4%	8.4%	6.3%	4.1%	5.6%	5.7%	7.9%	6.0%	0.0%	4.0%	4.0%	4.6%
ASPT	0.0%	4.1%	2.5%	2.7%	2.3%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.0%	12.2%	12.0%	8.0%	10.3%
TAD	4.6%	8.3%	4.6%	4.1%	6.9%	5.5%	6.3%	8.4%	4.7%	4.7%	7.3%	6.1%	0.0%	8.0%	4.1%	2.0%	6.0%	3.8%
TRALI	5.0%	2.6%	6.6%	6.4%	2.3%	4.8%	7.0%	3.5%	8.3%	8.3%	3.2%	6.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BACT	1.8%	3.1%	2.5%	1.8%	1.1%	2.1%	2.5%	4.2%	3.1%	2.4%	1.6%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
OTHER	10.1%	7.8%	5.8%	5.0%	8.0%	7.3%	7.6%	4.2%	3.1%	3.0%	5.6%	4.6%	15.9%	18.0%	16.3%	12.0%	14.0%	15.3%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
(N)	218	193	241	219	174	1048	158	143	192	169	124	786	60	50	49	50	50	262

Figure 4.1A: ATRs (%) of Grade 2 Severity - Transfusions of Blood Components, TTISS 2018-2022

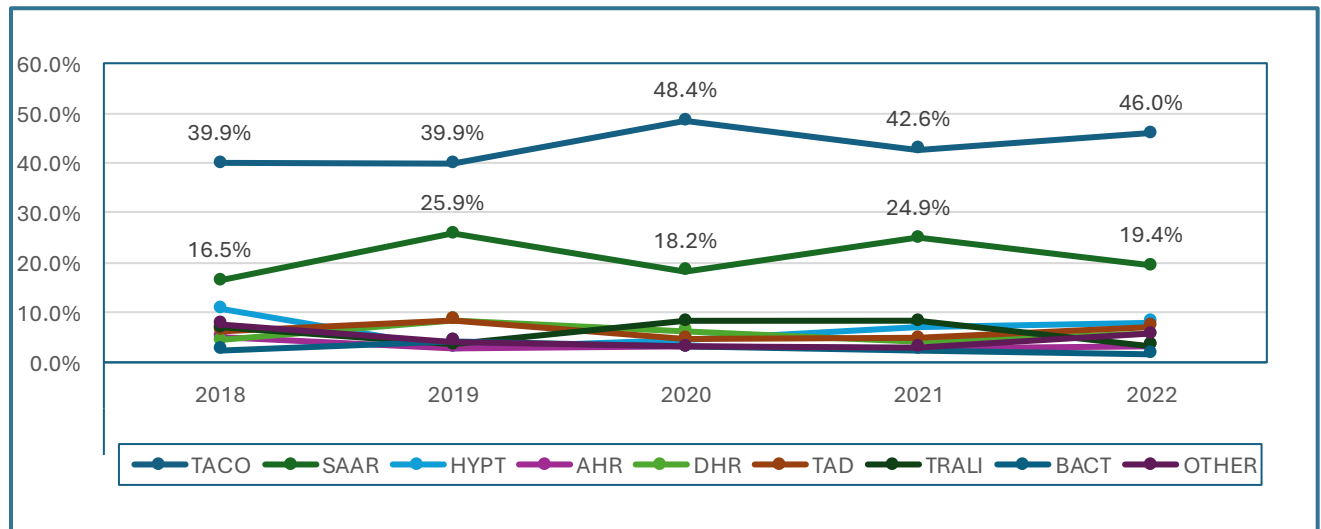
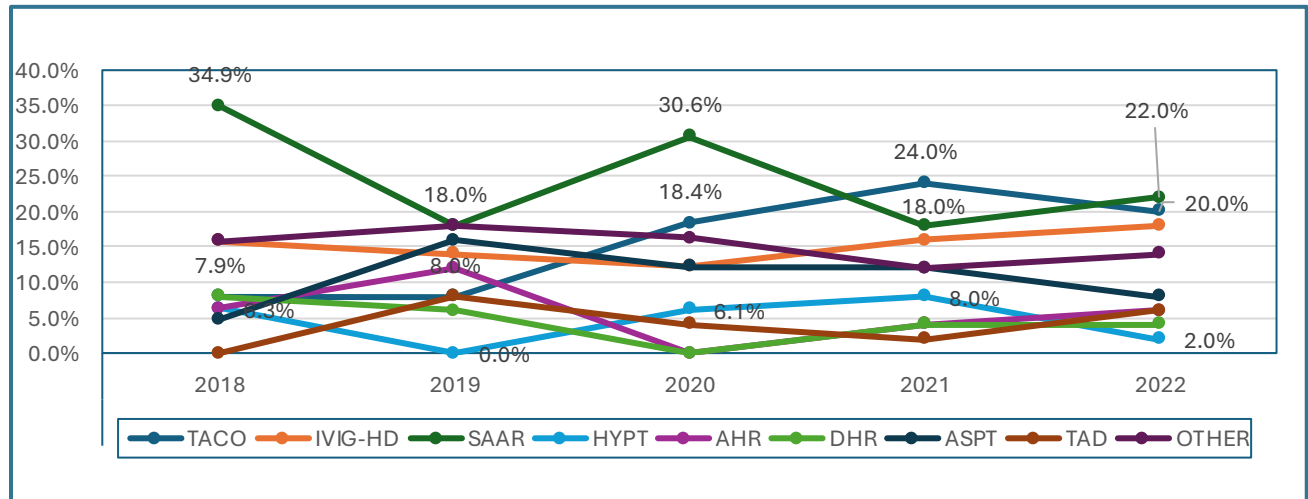


Figure 4.1B: ATRs (%) of Grade 2 Severity - Transfusions of Plasma Derivatives, TTISS 2018-2022



4.2 ATRs - Grade 3 (Life-Threatening)

The annual number of ATRs deemed of grade 3 severity (life threatening) reported during (2018 - 2022) are represented in Figures 4.2A-4.2C. Overall, the yearly number of ATRs showed some consistent trend with some fluctuations during the first three years followed by some increase in TACO and SAAR cases in the recent years of 2021 and 2022 (Figure 4.2A). Similar trend is observed for ATRs due to blood components and plasma derivatives (Figure 4.2B) and (Figure 4.2C), respectively. Of the total ATRs (n=229) considered grade 3 severe (life-threatening), the vast majority (86.5%, n=198/229) were due to transfusions of blood components, while (13.5%, n=31/229) were due to plasma derivatives (Table 4.2). TACO was commonly reported to be of grade 3 severity (36.7%, n=84/229), followed by SAAR (24.9%, n=57/229) and TRALI (14.4%, n=33/229). HYPT and TAD accounted for (6.6%, 15/229) and (6.1%, 14/229) respectively. The remaining ATRs represents under 5% of the total number of grade 3 severe.

Table 4.2: ATRs of Grade 3 (Life-threatening) Severity by Year - Transfusions of Blood Components and Plasma Derivatives, TTISS 2018-2022

ATRs	All transfusions						Blood components						Plasma derivatives					
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total
TACO	15	14	13	17	25	84	14	14	12	17	19	76	1	0	1	0	6	8
SAAR	4	14	9	11	19	57	3	12	6	9	14	44	1	2	3	2	5	13
TRALI	7	5	6	9	6	33	7	5	6	9	6	33						
HYPT	3	2	5	4	1	15	3	2	5	3	1	14	0	0	0	1	0	1
TAD	1	2	1	5	5	14	1	2	1	5	2	11	0	0	0	0	3	3
AHR	0	0	0	1	5	6	0	0	0	0	5	5	0	0	0	1	0	1
DHR	3	2	0	0	1	6	3	2	0	0	1	6						
BACT	1	0	1	0	0	2	1	0	1	0	0	2						
ASPT	1	0	0	0	0	1							1	0	0	0	0	1
OTHER	3	3	2	3	0	11	3	1	0	3	0	7	0	2	2	0	0	4
Total	38	42	37	50	62	229	35	38	31	46	48	198	3	4	6	4	14	31

Figure 4.2A: ATRs of Grade 3 (life-threatening) Severity by Year – All Transfusions, TTISS 2018-2022

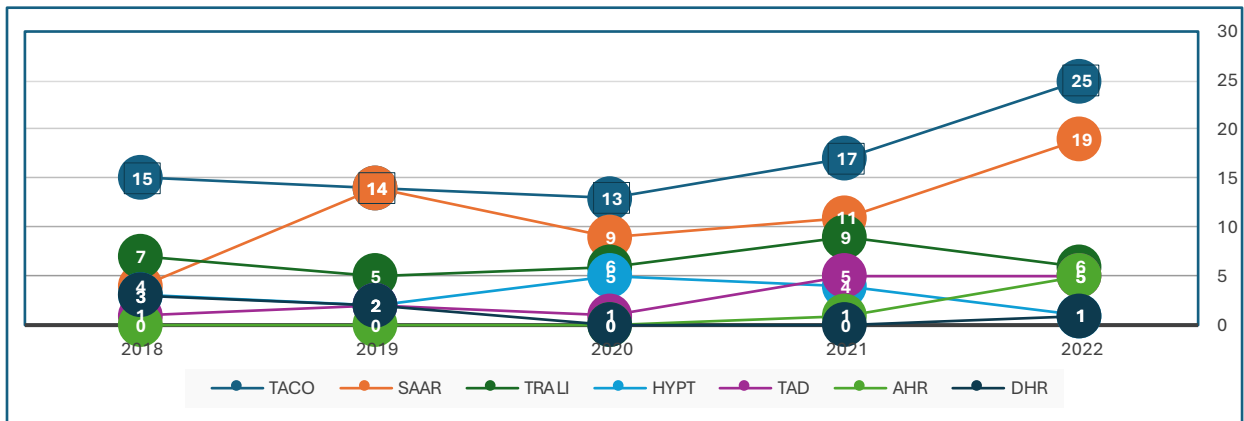


Figure 4.2B: ATRs of Grade 3 (life-threatening) Severity, due to Blood Components, TTISS 2018-2022

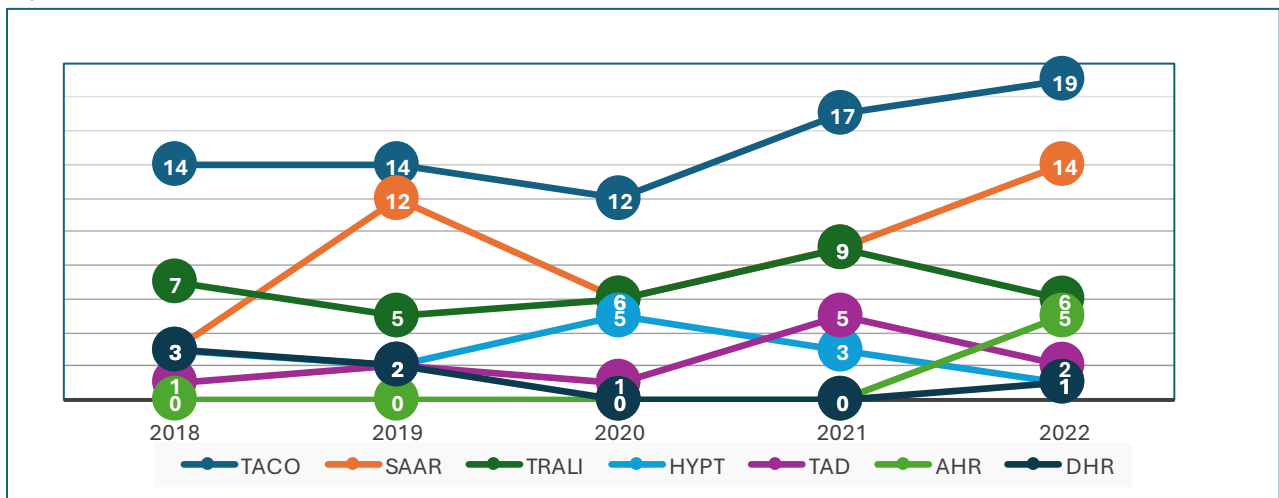
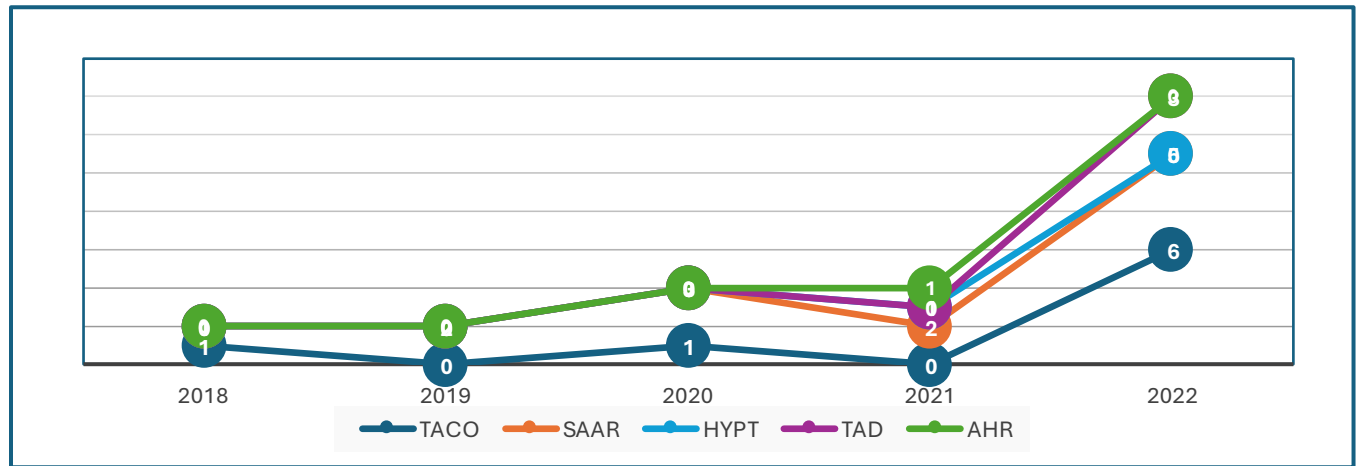


Figure 4.2C: ATRs of Grade 3 (life-threatening) Severity, due to Plasma Derivatives, TTISS 2018-2022



5. ATRs by Outcome

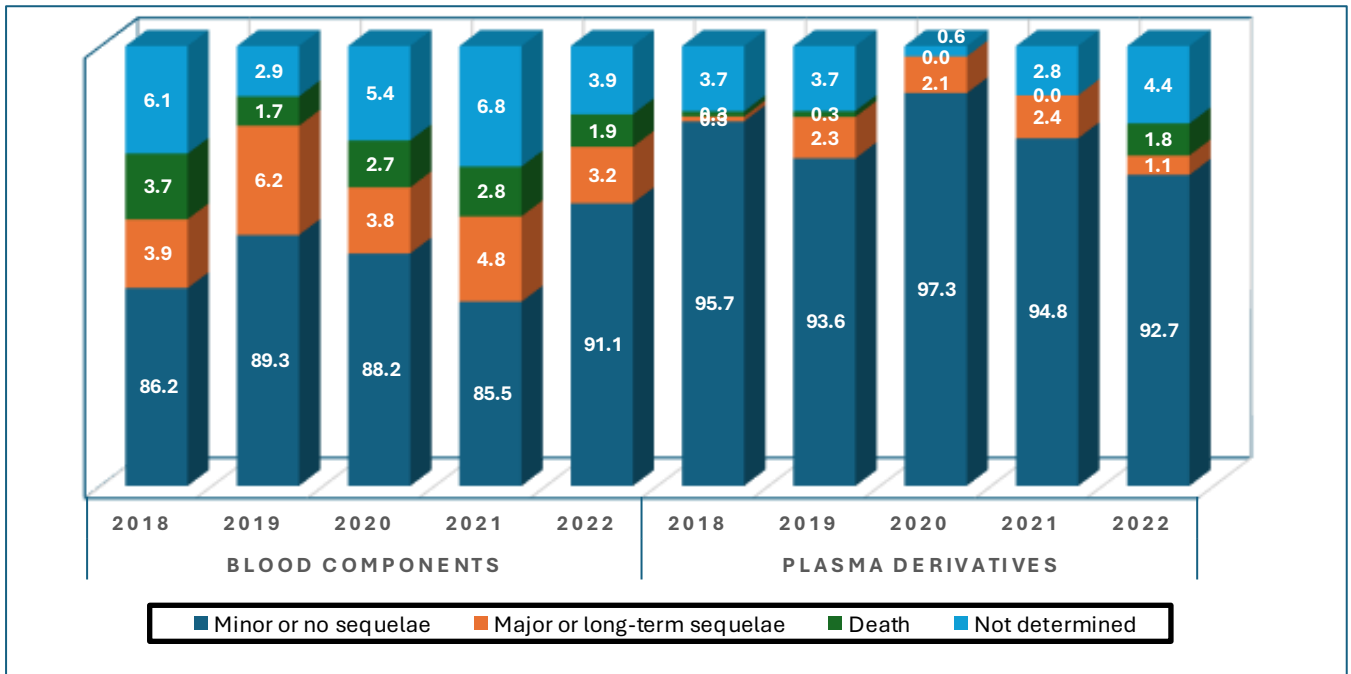
ATRs by outcome reported during the five year period (2018-2022) are presented in Annex F. The detailed definitions of outcome are provided in Annex A. The overall ATRs (%) by outcome are provided in (Table 5). Figure 5 represents for blood components and plasma derivatives.

The vast majority of ATRs resulted in minor or no sequelae (90.5%, n=3,894/4,304) followed by major or long-term sequelae 3.3% (n=143/4,304) and 1.8% (n=79/4,304) resulting in death. The ATRs by outcome showed consistent patterns with small yearly variations (Figure 5). Among the blood components, ATRs resulted-in ‘Minor or no-sequelae’ are consistently lower and ‘Major or long-term sequelae’ are consistently higher compared to outcomes for plasma derivatives (Table 5, Figure 5). Of the ATRs resulting in death, the vast majority (96.3%, 78/81) were due to blood components and only three deaths (3.7%, 3/81) were due to plasma derivatives.

Table 5: ATRs (%) by Outcome and Year - All Transfusions, Blood Components and Plasma Derivatives, TTISS 2018-2022

ATRs Outcome	All Transfusions						Blood Components						Plasma Derivatives					
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total
Minor or no sequelae	89.8	91.1	91.6	88.5	91.6	90.5	86.2	89.3	88.2	85.5	91.1	88.0	95.7	93.6	97.3	94.8	92.7	94.9
Major or long-term sequelae	2.6	4.6	3.1	4.1	2.5	3.3	3.9	6.2	3.8	4.8	3.2	4.3	0.3	2.3	2.1	2.4	1.1	1.6
Death	2.4	1.1	1.7	1.9	1.8	1.8	3.7	1.7	2.7	2.8	1.9	2.6	0.3	0.3	0.0	0.0	1.8	0.5
Not determined	5.2	3.2	3.6	5.5	4.0	4.4	6.1	2.9	5.4	6.8	3.9	5.1	3.7	3.7	0.6	2.8	4.4	3.0
Total	939	717	897	885	866	4304	589	419	560	599	593	2760	350	298	337	286	273	1544
	Frequency Missing = 4						Frequency Missing = 3						Frequency Missing = 1					

Figure 5A: ATRs (%) by Outcome and Year – for Blood Components and Plasma Derivatives, TTISS 2018-2022



5.1 ATRs Outcome Leading to ‘Major or Long-Term Sequelae’

ATRs resulting in major or long-term sequelae were rare and sparsely distributed during the five-year reporting period. Of the ATRs resulting in major or long-term sequelae, the majority (82.5%, 118/143) were related to blood components and (17.5%, 25/143) were related to plasma derivatives (Table 5.1). In terms of types of ATRs resulting in major or long-term sequelae, TACO was the highest (30.1%, 43/143) followed by SAAR (13.3%, 19/143). Yearly trend shows higher number of TACO and SAAR cases among blood components. Among plasma derivatives, five cases of SAAR, four of IVIG-HD, three of AHR, one of DHR, and two each of TAD and ASPT showed major or long-term sequelae and none of the TACO, TRALI, BACT and HYPT cases were reported during the five years period (Table 5.1).

Table 5.1: ATRs Resulting in Major or Long-Term Sequelae - All Transfusions, Transfusions of Blood Components and Plasma Derivatives, TTISS 2018 -2022

ATRs	All Transfusions						Blood Components						Plasma Derivatives					
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total
TACO	8	12	9	7	7	43	8	12	9	7	7	43	0	0	0	0	0	0
IVIG-HD	0	1	2	0	1	4	0	0	0	0	0	0	0	1	2	0	1	4
SAAR	3	2	3	7	4	19	2	2	1	7	2	14	1	0	2	0	2	5
HYPT	1	0	0	5	0	6	1	0	0	5	0	6	0	0	0	0	0	0
AHR	1	4	2	1	3	11	1	1	2	1	3	8	0	3	0	0	0	3
DHR	5	2	1	3	1	12	5	2	1	2	1	11	0	0	0	1	0	1
TAD	3	2	1	2	0	8	3	1	1	1	0	6	0	1	0	1	0	2
TRALI	1	3	6	1	0	11	1	3	6	1	0	11	0	0	0	0	0	0
BACT	1	4	0	1	2	8	1	4	0	1	2	8	0	0	0	0	0	0
ASPT	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	2	0	2
OTHER	1	3	4	7	4	19	1	1	1	4	4	11	0	2	3	3	0	8
Total	24	33	28	36	22	143	23	26	21	29	19	118	1	7	7	7	3	25

5.2 ATRs Leading to Death

Among the 79 deaths reported, more than half (58.2%, 46/79) were deemed to be “definite, probable and possible” related to transfusion and (41.8%, 33/79) were deemed to be “doubtful, ruled out, not determined” in relation to transfusion (Table 5.2A). The latter group of non-transfusion-related deaths are not considered in downstream analysis. Of the transfusion-related deaths, two were definite, eight were probable and thirty-six were possible related to transfusion (Table 5.2A).

Of the transfusion-related deaths, (87.0%, 40/46) were due to transfusion of blood components, while (13.0%, 6/46) were due to plasma derivatives (Table 5.2B). Two deaths were deemed definitely related to transfusion (one each due to blood components and plasma derivatives), while the remaining 44 deaths were deemed probably or possibly related to transfusion (39 due to blood components, 5 due to plasma derivatives).

Table 5.2A: Transfusion and Non-Transfusion-Related Deaths by Imputability, TTISS 2018 -2022

ATRs	Transfusion related deaths				Non-transfusion related deaths			
	Definite	Probable	Possible	N (%)	Doubtful	Ruled out	Not determined	N(%)
TACO	1	6	13	20 (43.5)	8	7	4	19 (57.6)
TRALI	0	2	8	10 (21.7)	4	0	1	5 (15.2)
TAD	0	0	7	7 (15.2)	1	1	0	2 (6.1)
SAAR	1	0	1	2 (4.3)	0	1	0	1 (3.0)
AHR	0	0	1	1 (2.2)	1	0	0	2 (3.0)
DHR	0	0	1	1 (2.2)	0	1	0	3 (3.0)
HYPT	0	0	1	1 (2.2)	0	2	0	2 (6.1)
BACT	0	0	1	1(2.2)	1	0	0	3 (3.0)
OTHER	0	0	3	3 (6.5)	0	1	0	3 (3.0)
Total	2	8	36	46 (100)	15	13	5	33 (100)

Among the transfusion of blood components, TACO, TRALI and TAD were the leading causes of death (45.0%, n=18/40) and (25.0%, 10/40) and (12.5%, 5/40), respectively, whereas AHR, DHR,

BACT and HYPT each accounted one death during the five year period. Of the six deaths reported due to plasma derivatives, TACO, TAD and SAAR accounted two deaths each (Table 5.2B).

Table 5.2B: ATRs Resulted in Transfusion-Related Deaths and Imputability - Blood Components and Plasma Derivatives, TTISS 2018 -2022

ATRs	Blood components				Plasma derivatives			
	Definite	Probable	Possible	Total	Definite	Possible	Probable	Total
TACO	1	5	12	18	0	1	1	2
TRALI	0	2	8	10	0	0	0	0
TAD	0	0	5	5	0	2	0	2
SAAR	0	0	0	0	1	1	0	2
AHR	0	0	1	1	0	0	0	0
DHR	0	0	1	1	0	0	0	0
BACT	0	0	1	1	0	0	0	0
HYPT	0	0	1	1	0	0	0	0
OTHER	0	0	3	3	0	0	0	0
Total	1	7	32	40	1	4	1	6

The number of deaths by ATR type and year are detailed in Table 5.2C. The average number of deaths was 9.2/year varying from 11 deaths dropping to 4 deaths in the following year and rising to 7 deaths in 2020, then 12 deaths each in subsequent year 2021 and 2022. TACO, TRALI and TAD were the leading causes of deaths with an average of 4.0 deaths/year (Range: 1-6 deaths), 2.0 deaths /year (Range: 1-3 deaths), and 1.4 deaths/year (range:1-3 deaths) respectively.

Of the blood components related deaths, the average number of deaths was 8/year (range 2 -12), with some falling and rising trend over the five years period. Of the plasma related deaths, six deaths reported in five year period were due to SAAR (n=2), TACO (n=2) and TAD (n=2). The changes over time in the number of deaths should be interpreted with caution given the small number of cases reported and inherent variations in annual reporting.

Table 5.2C: ATRs by Annual Number of Deaths, TTISS 2018 -2022

ATRs	Blood components						Plasma derivatives					
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total
TACO	5	1	4	6	2	18	0	0	0	0	2	2
TRALI	3	1	2	1	3	10	0	0	0	0	0	0
TAD	1	0	0	3	1	5	0	0	0	0	2	2
SAAR	0	0	0	0	0	0	0	1	0	0	1	2
AHR	0	0	0	0	1	1	0	0	0	0	0	0
DHR	1	0	0	0	0	1	0	0	0	0	0	0
BACT	0	0	1	0	0	1	0	0	0	0	0	0
HYPT	0	0	0	1	0	1	0	0	0	0	0	0
OTHER	1	1	0	1	0	3	0	0	0	0	0	0
Total	11	2	7	12	7	40	0	1	0	0	5	6

To consider the relationship between age and transfusion-related deaths, the median age was calculated for recipients reported ATRs and deaths (Table 5.2C). Overall, the median age was 65

years. The median age of male and female recipients were 67 and 64 years, respectively. Although male patients were 3 year older than female, it was not significantly different ($p=0.0010$). The median age of recipients reported ATRs due to blood components was 69 years for both male and female, whereas the median age of recipients reported ATRs due of plasma derivatives was 58 years. The male was four years older than female with median age of 61.0 and 57.0, but was not significantly different ($p=0.0010$).

The median age at death of recipients with ATRs was 71.0 years, 72.0 for males and 71.0 for females (Table 5.2C). The median age at death of recipients of blood components was 71.0 years, where 73.0 for male and 71.0 for female.

These findings suggest that ATR-related deaths generally occur at much older ages where other underlying morbidities conditions in addition to transfusions may have contributed to these deaths.

Table 5.2C: Annual Number of Deaths, Median Age (Years) at Transfusion and at Death, TTISS 2018 -2022

Transfusion product	Sex	Recipients Age at ATR		Recipients Age at Death	
		N	Median Age	N	Median Age
All Transfusions	All	4308	65	46	71
	Male	1889	67	26	72
	Female	2362	64	20	71
Blood Components	All	2763	69	40	71
	Male	1305	69	20	73
	Female	1418	69	20	71
Plasma derivatives	All	1545	58	6	69.5
	Male	584	61	6	69.5
	Female	944	57	0	0

Summary

Among the total ATRs reported during the five-year period (2018-2022):

- Overall, more than sixty percent (64.1%) of ATRs were related to the transfusion of blood components and 35.9% were related to plasma derivatives.
- TACO and IVIG-HD were the most commonly reported ATRs among recipients of both blood components and plasma derivatives.
- Overall, one in ten of ATRs was definitely, and nine in ten were probably or possibly, related to transfusion.
- Of the overall deaths reported, more than half (58.2%) were likely transfusion-related and less than half (41.8%) were non-transfusion-related.

- Among the transfusion-related deaths, majority (87.0%) were due to blood components and 13.0% were due to plasma derivatives.
- TACO and TRALI were the leading causes of deaths.
- TTISS findings demonstrate the trends and outcomes similar to those reported by other developed countries.

Note: The changes over time in the number of deaths should be interpreted with caution given the small number of cases reported and inherent variations in annual reporting.

Annexure A: Case Definitions-Severity, Imputability, Outcome

Severity Levels of Adverse Transfusion Reactions (ATRs)

Severity Levels of ATRs	Definitions
Grade 1 (Non-severe)	<i>No permanent damage or impairment of a bodily function.</i>
Grade 2 (Severe)	<i>Patient required in-patient hospitalization or prolongation of hospitalization directly attributable to the reaction; or the adverse reaction resulted in persistent/ significant disability or incapacity; or it necessitated medical/surgical intervention to preclude permanent/significant damage or impairment of a bodily function.</i>
Grade 3 (Life-threatening)	<i>Patient required major intervention following the transfusion (vasopressors, intubation, transferred to intensive care).</i>
Grade 4 (Death)	<i>Patient's death was suspected to be the consequence of the transfusion reaction.</i>
Not determined	<i>Consequences of the transfusion reaction were not certain.</i>

Imputability Level (Relationship) of Adverse Transfusion Reaction (ATRs)

Imputability Levels of ATRs	Definitions
Definite	<i>Clinical and/or laboratory event occurred within a time frame consistent with the administration of the blood, blood component, or plasma derivatives and was proven by investigation to have been caused by transfusion.</i>
Probable	<i>Clinical and/or laboratory event occurred within a time frame consistent with the administration of the blood, blood component, or plasma derivatives and did not seem to be explainable by any other cause.</i>
Possible	<i>Clinical and/or laboratory event occurred within a time frame consistent with the administration of the blood, blood component, or plasma derivatives but could be explained by concurrent disease(s) or by the administration of a drug or other agent.</i>
Doubtful	<i>Clinical and/or laboratory event occurred within a reasonable time frame in relation to the transfusion but the preponderance of data supports an alternative explanation.</i>
Ruled out	<i>Clinical and/or laboratory event occurred within a time frame inconsistent with the administration of the blood, blood component, or plasma derivatives or, if it occurred within a consistent time period but it was proven to have no relationship to the transfusion.</i>
Not determined	<i>It remains to be determined whether the event was related to the administration of the blood, blood component or plasma derivatives. Further information is forthcoming however was not available at time of data provision.</i>

Outcome Levels of Adverse Transfusion Reactions (ATRs)

Outcome of ATRs	Definition
Minor sequelae	<i>Patient had no sequelae or permanent disability from the reaction or developed antibodies to low/medium frequency antigens (< 95%).</i>
Major sequelae	<i>Patient developed either an infection with a persistent infectious agent (HIV, HBV or HCV), or a transfusion reaction with major or long-term sequelae; or the anticipation of difficulties with future transfusions (e.g., development of antibodies to antigens present in more than 95% of donations).</i>
Death	
Not determined	<i>The outcome of the adverse event was deemed uncertain.</i>

Imputability Levels (relationship) of Transfusion Related Deaths

Imputability-Relationship of ATRs	Definition
Definite	<i>Death occurred within a time frame consistent with the administration of the blood, blood component, or plasma derivatives and was proven by investigation to have been caused by transfusion.</i>
Probable	<i>Death occurred within a time frame consistent with the administration of the blood, blood component, or plasma derivatives and did not seem to be explainable by any other cause.</i>
Possible	<i>Death occurred within a time frame consistent with the administration of the blood, blood component, or plasma derivatives but could be explained by concurrent disease(s) or by the administration of a drug or other agent.</i>
Doubtful	<i>Death occurred within a reasonable time frame in relation to the transfusion but the preponderance of data supports an alternative explanation.</i>
Ruled out	<i>Death occurred within a time frame inconsistent with the administration of the blood, blood component, or plasma derivatives, if it occurred within a consistent time period but it was proven to have no relationship to the transfusion.</i>
Not determined	<i>It could not be determined if the death was related to transfusion.</i>

Annexure B: Annual Number of ATRs by Transfusion of Blood Products (Blood Components and Plasma Derivatives), TTISS (2018-2022)

ATRs	All Transfusions						Blood Components						Plasma Derivatives					
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total
TACO	260	186	280	287	317	1330	242	165	259	261	281	1208	18	21	21	26	36	122
IVIG-HD	141	128	114	95	97	575	0	0	0	0	0	0	141	128	114	95	97	575
SAAR	89	82	88	98	82	439	58	64	60	80	56	318	31	18	28	18	26	121
HYPT	90	34	87	79	88	378	69	31	69	61	70	300	21	3	18	18	18	78
AHR	20	18	10	21	29	98	15	7	10	15	24	71	5	11	0	6	5	27
DHR	46	35	44	25	32	182	39	27	43	19	29	157	7	8	1	6	3	25
TAD	66	54	49	62	76	307	50	43	42	53	59	247	16	11	7	9	17	60
TRALI	20	14	23	24	11	92	20	13	23	24	11	91	0	1	0	0	0	1
ASPT	7	11	10	10	5	43	0	0	0	0	0	0	7	11	10	10	5	43
BACT	12	14	10	8	8	52	12	14	10	8	8	52	0	0	0	0	0	0
INCMPT	3	1	0	0	0	4	3	1	0	0	0	4	0	0	0	0	0	0
PTP	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0
VIRAL	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1
OTHER	187	142	182	174	121	806	83	55	44	77	55	314	104	87	138	97	66	492
Total	941	719	897	885	866	4308	591	420	560	599	593	2763	350	299	337	286	273	1545

Annexure C: Annual Number of Units of Blood Components Transfused, TTISS 2018-2022

<i>Province / Territory</i>	2018	2019	2020	2021	2022
<i>British Columbia</i>	170,373	161,296	159,779	168,849	162,376
<i>Yukon Territory</i>	579	733	884	858	889
<i>Alberta</i>	118,626	111,431	104,762	101,376	122,286
<i>Saskatchewan</i>	35,979	31,603	30,460	36,292	32,335
<i>Manitoba</i>	50,379	48,197	40,882	43,801	43,208
<i>Ontario</i>	513,301	475,493	438,286	462,115	451,710
<i>Québec</i>	297,780	299,880	280,487	294,906	285,256
<i>New Brunswick</i>	26,812	27,674	26,442	28,584	28,817
<i>Newfoundland & Labrador</i>	20,288	17,426	15,680	18,003	15,877
<i>Nova Scotia</i>	34,213	32,557	33,087	34,164	34,059
<i>Prince Edward Island</i>	3,791	3,824	3,502	4,034	4,255
<i>Northwest Territories</i>	488	518	635	822	862
Total	1,272,609	1,210,633	1,134,886	1,193,834	1,181,035

Annexure D: The Annual Number of ATRs by Transfusion Imputability-Relationship to Transfusion of Blood Products, TTISS 2018-2022

ATRs	All Transfusions																	
	Definite						Probable						Possible					
	2018	2019	2020	2021	2022	Total	####	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total
TACO	22	30	21	22	27	122	116	78	131	127	149	601	122	78	128	138	141	607
IVIG-HD	13	18	11	8	9	59	87	78	68	53	76	362	41	32	35	34	12	154
SAAR	15	22	11	10	11	69	52	43	50	54	53	252	22	17	27	34	18	118
HYPT	6	2	4	1	2	15	28	11	30	32	36	137	56	21	53	46	50	226
AHR	10	3	4	7	8	32	9	8	4	9	12	42	1	7	2	5	9	24
DHR	22	14	22	7	17	82	12	11	8	5	45	12	10	14	9	10	55	
TAD	0	1	1	3	0	5	18	15	18	24	18	93	48	38	30	35	58	209
TRALI	0	2	3	0	0	5	5	1	7	7	6	26	15	11	13	17	5	61
ASPT	1	2	1	2	1	7	1	7	6	5	3	22	5	2	3	3	1	14
BACT	0	0	1	1	2	4	1	1	2	1	0	5	11	13	7	6	6	43
INCMPT	2	0	0	0	0	2	1	0	0	0	0	1	0	1	0	0	0	1
OTHER	11	5	6	6	5	33	70	56	90	105	37	358	106	81	86	65	79	417
Total	102	99	85	67	82	435	400	309	414	426	395	1944	439	311	398	392	389	1929
ATRs	Blood Components																	
	Definite						Probable						Possible					
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total
TACO	22	28	21	19	22	112	108	70	119	115	137	549	112	67	119	127	122	547
SAAR	9	16	4	5	6	40	34	34	38	49	38	193	15	14	18	26	12	85
HYPT	5	2	2	1	2	12	18	11	23	23	25	100	46	18	44	37	43	188
AHR	8	1	4	4	6	23	6	1	4	8	10	29	1	5	2	3	8	19
DHR	18	10	22	5	16	71	11	8	8	8	4	39	10	9	13	6	9	47
TAD	0	1	1	3	0	5	13	14	14	20	15	76	37	28	27	30	44	166
TRALI	0	1	3	0	0	4	5	1	7	7	6	26	15	11	13	17	5	61
BACT	0	0	1	1	2	4	1	1	2	1	0	5	11	13	7	6	6	43
INCMPT	2	0	0	0	0	2	1	0	0	0	0	1	0	1	0	0	0	1
OTHER	0	1	3	2	2	8	30	21	11	44	18	124	53	33	30	32	35	183
Total	64	60	61	40	56	281	227	161	226	275	253	1142	300	199	273	284	284	1340
ATRs	Plasma Derivatives																	
	Definite						Probable						Possible					
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total
TACO	0	2	0	3	5	10	8	8	12	12	12	52	10	11	9	11	19	60
IVIG-HD	13	18	11	8	9	59	87	78	68	53	76	362	41	32	35	34	12	154
SAAR	6	6	7	5	5	29	18	9	12	5	15	59	7	3	9	8	6	33
HYPT	1	0	2	0	0	3	10	0	7	9	11	37	10	3	9	9	7	38
AHR	2	2	0	3	2	9	3	7	0	1	2	13	0	2	0	2	1	5
DHR	4	4	0	2	1	11	1	3	0	1	1	6	2	1	1	3	1	8
ASPT	1	2	1	2	1	7	1	7	6	5	3	22	5	2	3	3	1	14
TAD	0	0	0	0	0	0	5	1	4	4	3	17	11	10	3	5	14	43
TRALI	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	11	4	3	4	3	25	40	35	79	61	19	234	53	48	56	33	44	234
Total	38	39	24	27	26	154	173	148	188	151	142	802	139	112	125	108	105	589

Annexure E: The Annual Number of ATRs by Severity Levels and Transfusion of Blood Products, TTISS 2018-2022

ATRs	All transfusions																								
	Grade 1 (Non-Severe)						Grade 2 (Severe)						Grade 3 (Life-threatening)						Not determined						
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	
TACO	172	110	158	177	217	834	68	61	102	84	67	382	15	14	13	17	25	84	5	1	7	9	8	30	
MIG-HD	131	121	108	87	88	535	10	7	6	8	9	40	0	0	0	0	0	0	0	0	0	0	0	0	
SAAR	37	20	29	36	28	150	48	46	50	51	35	230	4	14	9	11	19	57	0	2	0	0	0	2	
HYPT	65	28	70	58	76	297	21	4	12	16	11	64	3	2	5	4	1	15	1	1	0	1	0	2	
AHR	8	9	4	13	17	49	12	10	6	7	9	42	0	0	0	1	5	6	0	0	0	0	0	1	
DHR	29	13	29	14	18	108	12	15	12	9	9	57	3	2	0	0	1	6	2	0	3	3	2	11	
TAD	54	33	37	48	59	231	10	15	11	9	12	58	1	2	1	5	5	12	1	1	3	0	0	4	
TRALI	2	4	0	1	0	7	11	5	16	14	4	50	7	5	6	9	6	33	0	0	1	0	1	2	
ASPT	3	3	4	4	1	15	3	8	6	6	4	27	1	0	0	0	0	1	0	0	0	0	0	0	
BACT	6	8	3	4	6	27	4	6	6	4	2	22	1	0	1	0	0	2	1	0	0	0	0	1	
INCMPT	3	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
OTHER	158	122	166	159	106	711	22	15	14	11	14	76	3	3	2	3	0	11	4	2	0	3	1	10	
Total	668	475	608	601	616	2968	221	193	241	219	174	1048	38	42	37	50	62	229	14	9	11	15	14	63	

ATRs	Blood Components																								
	Grade 1 (Non-Severe)						Grade 2 (Severe)						Grade 3 (Life-threatening)						Not determined						
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	
TACO	160	93	148	164	198	763	63	57	93	72	57	342	14	14	12	17	19	76	5	1	6	8	7	27	
SAAR	29	13	19	29	18	108	26	37	35	42	24	164	3	12	6	9	14	44	0	2	0	0	0	2	
HYPT	48	25	55	45	59	232	17	4	9	12	10	52	3	2	5	3	1	14	1	0	0	1	0	2	
AHR	7	3	4	10	15	39	8	4	6	5	4	27	0	0	0	0	5	5	0	0	0	0	0	0	
DHR	28	13	28	12	18	99	7	12	12	7	7	45	3	2	0	0	1	6	1	0	3	0	3	7	
TAD	38	27	32	40	48	185	10	12	9	8	9	48	1	2	1	5	2	11	1	2	0	0	0	3	
TRALI	2	3	0	1	0	6	11	5	16	14	4	50	7	5	6	9	6	33	0	0	1	0	1	2	
BACT	6	8	3	4	6	27	4	6	6	4	2	22	1	0	1	0	0	2	1	0	0	0	0	1	
INCMPT	3	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
OTHER	66	47	38	67	48	266	12	6	6	5	7	36	3	1	0	3	0	7	2	1	0	3	0	6	
Total	387	233	327	372	410	1729	158	143	192	169	124	786	35	38	31	46	48	198	11	6	10	12	11	50	

ATRs	Plasma Derivatives																								
	Grade 1 (non-severe)						Grade 2 (severe)						Grade 3 (Life-threatening)						Not determined						
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	
TACO	12	17	10	13	19	71	5	4	9	12	10	40	1	0	1	0	6	8	0	0	1	1	1	3	
MIG-HD	131	121	108	87	88	535	10	7	6	8	9	40	0	0	0	0	0	0	0	0	0	0	0	0	
SAAR	8	7	10	7	10	42	22	9	15	9	11	66	1	2	3	2	5	13	0	0	0	0	0	0	
HYPT	17	3	15	13	17	65	4	0	3	4	1	12	0	0	0	0	1	0	0	0	0	0	0	0	
AHR	1	4	0	3	2	10	4	6	0	2	3	15	0	0	0	1	0	1	0	1	0	0	0	1	
DHR	1	5	1	2	0	9	5	3	0	2	2	12	0	0	0	0	0	0	1	0	0	2	1	4	
TAD	16	6	5	8	11	46	0	4	2	1	3	10	0	0	0	0	3	3	0	1	0	0	0	1	
TRALI	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ASPT	3	3	4	4	1	15	2	8	6	6	4	27	1	0	0	0	0	1	0	0	0	0	0	1	
BACT	92	75	128	92	58	445	10	8	8	6	7	40	0	2	2	0	0	4	2	7	1	0	0	4	
OTHER	92	75	128	92	58	445	10	8	8	6	7	40	0	2	2	0	0	4	2	7	1	0	0	4	
Total	281	242	281	229	206	1239	63	50	49	50	50	262	3	4	6	4	14	31	3	3	1	3	3	13	

Annexure F: The Annual Number of ATRs by Outcome and Transfusion of Blood Products, TTISS 2018-2022

ATRs	All transfusions																								
	Minor or no sequelae						Major or long-term sequelae						Death						Not determined						
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	
TACO	227	163	249	249	285	1173	8	12	9	7	7	43	10	3	10	9	7	39	14	7	12	22	18	73	
MIG-HD	140	127	112	94	94	567	0	1	2	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	
SAAR	81	74	85	88	74	402	3	2	3	7	4	19	0	2	0	0	0	1	3	5	4	0	3	15	
HYPT	85	34	83	72	87	361	1	0	0	5	0	6	1	0	1	1	0	3	3	0	3	1	1	8	
AHR	16	12	6	17	23	74	1	4	2	1	3	11	1	0	0	0	0	1	2	2	2	2	3	11	
DHR	33	32	39	21	27	152	5	2	1	3	1	12	1	0	0	0	1	2	6	1	4	1	3	15	
TAD	59	50	46	57	73	285	3	2	1	2	0	8	2	1	0	0	3	9	2	1	2	0	0	5	
TRALI	11	6	9	10	6	42	1	3	6	1	0	11	5	1	3	3	3	15	3	3	5	10	2	23	
ASPT	5	10	10	8	5	38	0	0	0	2	0	2	0	0	0	0	0	0	2	1	0	0	0	3	
BACT	9	10	8	6	6	39	1	4	0	1	2	8	1	0	1	0	0	2	1	0	1	1	0	3	
INCMPT	3	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
OTHER	174	134	175	161	113	757	1	3	4	7	4	19	2	1	0	1	0	4	10	4	3	7	4	28	
Total	843	653	822	783	793	3894	24	33	28	36	22	143	23	8	15	17	16	79	49	23	32	49	35	188	

ATRs	Blood components																								
	Minor or no sequelae						Major or long-term sequelae						Death						Not determined						
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	
TACO	211	144	228	224	255	1062	8	12	9	7	7	43	9	3	10	9	5	36	13	6	12	21	14	66	
SAAR	52	59	59	71	52	293	2	2	1	7	2	14	0	1	0	0	0	1	4	2	0	2	2	10	
HYPT	64	31	65	55	69	284	1	0	0	5	0	6	1	0	1	1	0	3	3	0	3	0	1	7	
AHR	11	6	6	12	18	53	1	1	2	1	3	8	1	0	0	0	0	1	2	2	0	2	2	8	
DHR	29	25	38	17	25	134	5	2	1	2	1	11	1	0	0	0	1	2	3	0	4	0	2	9	
TAD	43	40	39	49	58	229	3	1	1	1	0	6	2	1	0	3	1	7	2	1	2	0	0	5	
TRALI	11	5	9	10	6	41	1	3	6	1	0	11	5	1	3	3	3	15	3	3	5	10	2	23	
ASPT	5	10	10	8	5	38	0	0	0	2	0	2	0	0	0	0	0	0	2	1	0	0	0	3	
BACT	9	10	8	6	6	39	1	4	0	1	2	8	1	0	1	0	0	2	1	0	1	1	0	3	
INCMPT	3	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
OTHER	75	53	42	68	51	289	1	1	1	4	4	11	2	1	0	1	0	4	5	0	1	5	0	11	
Total	508	374	494	512	540	2428	23	26	21	29	19	118	22	7	15	17	11	72	36	12	30	41	23	142	

ATRs	Plasma derivatives																								
	Minor or no sequelae						Major or long-term sequelae						Death						Not determined						
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2									

Annexure G: Deaths by Transfusion Imputability due to Blood Products (Blood Components, Plasma Derivatives), TTISS (2018-2022)

ATRS	Definite						Probable						Possible						Doubtful						Ruled out						Not determined					
	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total	2018	2019	2020	2021	2022	Total
AHR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
BACT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
DHR	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
HYPT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	2	0	0	0	0	0	0
OTHER	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	3	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
SAAR	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
TACO	0	1	0	0	0	1	2	0	1	2	1	6	3	0	3	4	3	13	2	0	4	1	1	8	2	2	1	1	1	7	1	0	1	1	1	4
TAD	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	3	7	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0
TRALI	0	0	0	0	0	0	1	0	1	0	0	2	2	1	1	1	3	8	1	0	1	2	0	4	0	0	0	0	0	0	1	0	0	0	0	1
Total	0	2	0	0	0	2	3	0	2	2	1	8	8	2	5	1	11	36	5	1	5	3	1	1	5	3	2	1	1	5	3	2	1	2	1	