NZBLOOD
Te Ratonga Toto O Aotearoa

National Haemovigilance Programme

Annual Report 2014

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Disclaimer

Haemovigilance has been declared a protected quality assurance activity under Section 54 of the Health Practitioners Competency Assurance Act 2003 as notified by the Health Practitioners Notice 2006, published in the New Zealand Gazette on 6 April 2006. The effect of this declaration is that subject to certain circumstances:

- Any information that becomes known solely as the result of Haemovigilance is confidential; and
- Any documents brought into existence solely for the purposes of Haemovigilance are confidential; and
- The persons who engage in Haemovigilance in good faith are immune from civil liability.

Cover photograph: NZBS Christchurch staff at the opening of the new Christchurch NZBS Donor Centre, 10 November 2014

Contents

Foreword

This is the 10th Annual Haemovigilance Report for New Zealand, marking a decade since the programme began. Support for the programme remains strong and I would like to thank everyone contributing to the completion and submission of adverse event forms, and for providing additional clinical information when necessary for accurate event classification.

I would like to acknowledge the longstanding commitment of Dr Krishna Badami and Mr John Dagger to the programme, both having been involved with NZ Haemovigilance from its infancy. Mr John Dagger, head of the Haemovigilance Office in Wellington, has once again collated the data and played a major role in drafting the Annual Report. His contribution to the programme throughout the year is greatly appreciated.

Patient blood management guidelines continue to reflect an increasingly restrictive red cell transfusion policy. This has lead to a gradual reduction in mean pre-transfusion haemoglobin value to 76g/L in the recipients of red cells reported to NZ Haemovigilance in 2014. The change in local clinical practice has contributed to a 16% decline in the number of annual red cell transfusions and annual total blood component use in NZ since 2010. The rate of decline is however falling, with only a further 1% drop in annual red cell transfusions since 2013. A similar plateau is appearing in the use of fresh frozen plasma. Largely as a result of these changing demand-patterns for fresh blood components, the number of reported transfusion events has declined by 24% since 2010.

However, annual use of fractionated plasma products, predominantly intravenous immunoglobulin (IVIg), continues to rise in New Zealand. A similar trend is occurring internationally, as there is an increasing spectrum of conditions where IVIg-immunomodulation may be beneficial. It is therefore timely that the 2014 Report introduces an expanded section on transfusion-related adverse events occurring with fractionated products.

Local demand for IVIg has contributed to the steady increase in plasmapheresis collections and the annual number of plasmapheresis donations has more than doubled since 2010. NZ Haemovigilance has since its inception in 2005 recorded donation-related adverse events and continues to actively monitor both apheresis and whole blood donations. Apheresis procedures are associated with a high frequency of adverse events and among these are events related to hypocalcaemia from citrate anticoagulant. In 2014, a national protocol was introduced for the calcium supplementation of plateletpheresis donors. Following this, and compared to data from 2013, there has been a reduction by one third in the number of events due to citrate toxicity.

Blood transfusion in NZ is very safe. Severe adverse events, predominantly allergic reactions and circulatory overload (TACO), are reported for 0.02% of components transfused and in 0.09% of transfusion recipients. Transfusion-related acute lung injury (TRALI) and infection are very rare events. The Report contains a new section on residual risk of viral infection from transfusion, along with recently updated calculations of residual risk estimates.

I hope you will find the report informative and look forward to your on-going support of the programme.

Dr Daren Buhrkuhl
Transfusion Medicine Specialist
NZBS Wellington

Abbreviations and Glossary

1

Albumex®20	20% albumin solution for intravenous infusion
Albumex®4	4% albumin solution for intravenous infusion
APH	Apheresis
Biostate®	Coagulation factor VIII and von Willebrand factor complex
Blood Components	Portions of a unit of whole blood – red cells, fresh frozen plasma, platelets, cryoprecipitate prepared by NZBS for transfusion
BNP	Brain Natriuretic Peptide
CAG	Clinical Advisory Group
DAT	Direct Antiglobulin Test
DHB	District Health Board
DHTR	Delayed Haemolytic Transfusion Reaction
DSTR	Delayed Serological Transfusion Reaction
Evogam®	Normal Immunoglobulin solution for subcutaneous administration
FFP	Fresh Frozen Plasma
FNHTR	Febrile Non-Haemolytic Transfusion Reaction
Hb	Haemoglobin
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
IAT	Indirect Antiglobulin Test
IBCT	Incorrect Blood Component Transfused
Intragam®P	Normal Immunoglobulin solution for intravenous infusion
LDH	Lactate Dehydrogenase
NAT	Nucleic Acid Amplification Test
NHI	National Health Index
NZBS	New Zealand Blood Service
PAS	Platelet Additive Solution
Prothrombinex®-VF	Coagulation factors II, IX and X and low levels of factors V and VII
RhD Immunoglobulin-VF	Human Anti-D Immunoglobulin solution for intramuscular injection
TACO	Transfusion-Associated Circulatory Overload
TAD	Transfusion-Associated Dyspnoea
TMS	Transfusion Medicine Specialist
TRAE	Transfusion-Related Adverse Events
TRALI	Transfusion-Related Acute Lung Injury
TTI	Transfusion-Transmitted Infection
UCT	Unclassifiable Complication of Transfusion
Zoster Immunoglobulin-VF	Zoster Immunoglobulin solution for intramuscular injection

2 Introduction

COUNCIL OF EUROPE DEFINITION OF HAEMOVIGILANCE

"…. The organised surveillance procedures related to serious or unexpected events or reactions in donors or recipients and the epidemiological follow up of donors …"

The New Zealand National Haemovigilance Programme was established in 2005. This is the tenth Annual Haemovigilance Report for New Zealand.

The National Haemovigilance Office receives reports from Blood Bank Scientists and Transfusion Nurse Specialists from hospitals within New Zealand. The reporting form (Appendix I) includes a severity scale, an imputability scale and definitions of transfusion-related adverse events (TRAE) based on those agreed upon by the International Society of Blood Transfusion Working Party on Haemovigilance in collaboration with the International Haemovigilance Network (ISBT/IHN).

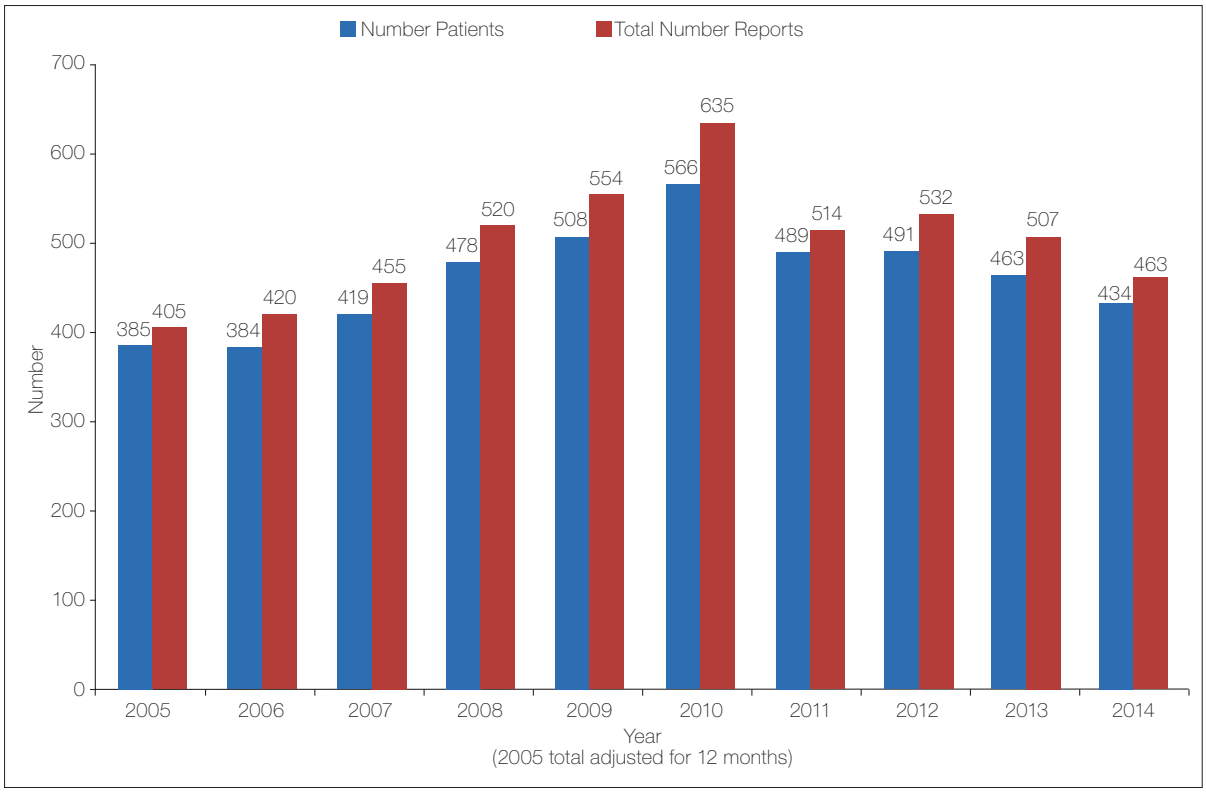
All reports received at the Haemovigilance Office are reviewed by a Team comprising a number of Transfusion Medicine Specialists and an experienced Scientist who is also responsible for overall management of the scheme. Where required, additional information is sought from the submitter of the report in order to accurately classify the type of adverse event, imputability and severity scores. The data is entered into a secure database in which clinician and patient names are not included. Upon publication of the Annual Haemovigilance Report the paper records are destroyed and the unique patient identifier is then deleted from the database.

The reporting of TRAE to the National Haemovigilance Programme is voluntary. During 2014 there were 463 TRAE reported involving 434 patients. Compared to 2013, there has been a 9% reduction in the total number of reported events. The reduction in TRAE most likely reflects the reduction in transfused components over the same period as demonstrated by a relatively stable ratio of the number of reports to number of components transfused (Table 2.1). The year on year number of events and patients is shown in Figure 2.1.

TABLE 2.1 COMPARISON HAEMOVIGILANCE REPORTS : COMPONENTS TRANSFUSED 2007 – 2014

	Year							
	2007	2008	2009	2010	2011	2012	2013	2014
Total Components Transfused	155,673	158,181	162,587	159,568	151,919	149,668	136,995	135,135
Number Haemovigilance Reports Received	455	520	554	635	514	532	507	463
Percentage Change From Previous Year								
Components Transfused		1.6%	2.8%	-1.9%	-4.8%	-1.5%	-8.5%	-1.4%
Haemovigilance Reports		14.3%	6.5%	14.6%	-19.1%	3.5%	-4.7%	-8.6%
Reports : Components Transfused	**1:342**	**1:304**	**1:293**	**1:251**	**1:296**	**1:281**	**1:270**	**1:292**

FIGURE 2.1 ANNUAL NUMBER OF TRANSFUSION-RELATED ADVERSE EVENTS 2005 – 2014



3 Trends in Blood Component Transfusion in New Zealand

Table 3.1 shows the annual number of blood components transfused. Comparing the number of red cell units transfused in 2014 to the number transfused in 2010, there has been a 16.3% reduction. The rate of red cells transfused in 2014 is 22.9 / 1,000 of the New Zealand population (Table 3.2). There has been a 42.3% increase in the number of cryoprecipitate units transfused which likely reflects the introduction of massive transfusion protocols in a number of hospitals and the use in cardiovascular surgery.

TABLE 3.1 ANNUAL NUMBER OF BLOOD COMPONENTS TRANSFUSED 2009 – 2014

Blood Component	2009	2010	2011	2012	2013	2014	% Change 2014 compared to 2010
Red Cells	123,979	122,745	116,071	113,014	103,565	102,718	
Red Cells Neo	1,840	1,898	1,749	1,732	1,664	1,553	
Total Red Cells	**125,819**	**124,643**	**117,820**	**114,746**	**105,229**	**104,271**	**-16.3%**
Platelets - APH	7,571	7,576	6,661	2,117	487	523	
Platelets - Pooled	5,325	5,403	2,349	614	0	0	
Platelets - APH PAS			774	5,354	5,627	4,033	
Platelets - Pooled PAS		48	2,988	5,037	6,457	7,429	
Platelets - Neo	485	589	485	661	817	616	
Total Platelets	**13,381**	**13,616**	**13,257**	**13,783**	**13,388**	**12,601**	**-7.5%**
Fresh Frozen Plasma	19,874	17,685	16,736	16,524	13,528	13,400	
Fresh Frozen Plasma Neo	127	187	127	200	175	151	
Total Fresh Frozen Plasma	**20,001**	**17,872**	**16,863**	**16,724**	**13,703**	**13,551**	**-24.2%**
Cryoprecipitate	2,869	2,951	3,228	3,745	4,167	4,198	**42.3%**
Cryodepleted Plasma	517	486	751	670	508	514	**5.8%**
Total Components	**162,587**	**159,568**	**151,919**	**149,668**	**136,995**	**135,135**	**-15.3%**

TABLE 3.2 ANNUAL RATE BLOOD COMPONENTS TRANSFUSED PER 1,000 NEW ZEALAND POPULATION 2009 – 2014

	Components Transfused per 1,000 Population					
	2009	2010	2011	2012	2013	2014
Red Cells	29.0	28.5	26.8	25.9	23.5	22.9
Platelets	3.1	3.1	3.0	3.1	3.0	2.8
Fresh Frozen Plasma	3.1	3.1	3.0	3.1	3.0	2.8
Cryoprecipitate	0.7	0.7	0.7	0.8	0.9	0.9
All Components	**37.5**	**36.5**	**34.5**	**33.8**	**30.6**	**29.7**
Population Estimate*	4,332,100	4,373,900	4,399,400	4,425,900	4,475,800	4,553,700

** www.stats.govt.nz*

The decrease in the number of red cell, platelet and FFP units transfused is reflected by a similar decrease in the number of recipients of these components (Table 3.3). Compared to 2010, there has been a 13.4% reduction in the number of recipients of red cells.

TABLE 3.3 ANNUAL NUMBER OF RED CELL, PLATELET AND FRESH FROZEN PLASMA RECIPIENTS 2009 – 2014

Component	Number of Recipients (Percentage Change from Previous Year)						% change 2014 from 2010
	2009	2010	2011	2012	2013	2014	
Red Cells	28,118	28,130 (0.04%)	27,101 (0.7%)	26,673 (-1.6%)	24,978 (-6.4%)	24,349 (-2.5%)	-13.4%
Platelets	3,535	3,703 (4.8%)	3,623 (-0.2%)	3,531 (-2.5%)	3,272 (-7.3%)	3,190 (-2.5%)	-13.9%
Fresh Frozen Plasma	4,941	4,317 (-12.6%)	3,850 (-0.8%)	3,749 (-2.6%)	3,172 (-15.4%)	2,898 (-8.6%)	-32.9%

Table 3.4 shows the number of blood components transfused and the transfusion rate for all New Zealand District Health Boards in 2014.

TABLE 3.4 BLOOD COMPONENT TRANSFUSION RATES BY DISTRICT HEALTH BOARD 2014

District Health Board	Population*	Number Components Transfused		Transfusion Rate Per 10,000 Population	
		All Components	Red Cells	All Components	Red Cells
Waitemata DHB	481,611	9,078	8,232	188	171
Canterbury DHB	466,407	14,975	11,989	321	257
Counties Manukau DHB	433,086	13,475	11,125	311	257
Auckland DHB	404,619	29,469	18,870	728	466
Waikato DHB	339,192	14,760	10,673	435	315
Southern DHB	286,224	8,109	6,091	283	213
Capital and Coast DHB	266,658	11,333	7,963	425	299
Bay of Plenty DHB	194,931	6,056	5,307	311	272
MidCentral DHB	158,841	5,179	3,968	326	250
Northland DHB	148,440	3,355	2,839	226	191
Hawkes Bay DHB	148,248	4,100	3,377	277	228
Hutt Valley DHB	136,101	2,444	2,263	180	166
Nelson Marlborough DHB	130,062	3,598	3,235	277	249
Taranaki DHB	104,277	2,284	2,078	219	199
Lakes DHB	98,319	2,072	1,814	211	185
Whanganui DHB	62,211	926	890	149	143
South Canterbury DHB	53,877	1,469	1,251	273	232
Tairāwhiti DHB	44,463	758	677	170	152
Wairarapa DHB	38,613	1,097	1,057	284	274
West Coast DHB	31,326	598	572	191	183

**www.health.govt.nz/nz-health-statistics/health-statistics-and-data-sets (Published 3 October 2014)*

4 Recipients of Blood Components

Table 4.1 below provides information on the recipients of red cell, platelet and FFP blood components transfused during 2014.

TABLE 4.1 RECIPIENTS OF BLOOD COMPONENTS 2014

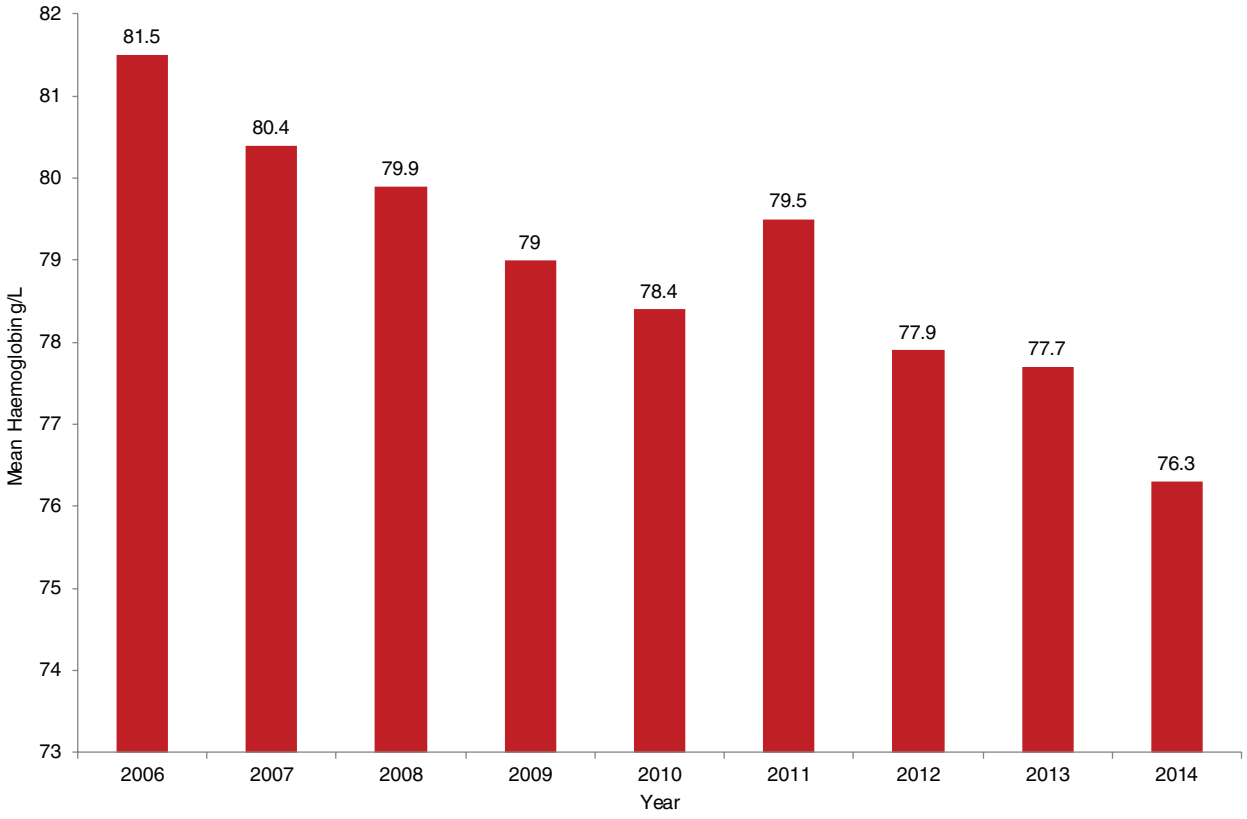
		Blood Component		
		Red Cells	Platelets	FFP
Recipient Gender (Number)	Female	13899	1239	1228
	Male	10427	1951	1669
	Unknown	23	0	1
	Total	**24349**	**3190**	**2898**
Recipient Age (Years)	Mean	62	54	59
	Median	69	61	65
	Maximum	105	100	104
	Minimum	0	0	0
Units Transfused per Recipient	Mean	4	4	5
	Median	2	2	2
	Maximum	178	110	314
	Minimum	1	1	1

Table 4.2 and Figure 4.1 show the yearly mean pre-transfusion haemoglobin from 2006 to 2014 for recipients of red cells where an adverse event was reported. There has been a significant decrease (p=<0.001) from 2006 (81.5g/L) to 2014 (76.3g/L).

TABLE 4.2 ANNUAL MEAN PRE-TRANSFUSION HAEMOGLOBIN CONCENTRATION 2006 – 2014

Year	Number	Mean Hb g/L	SD
2006	255	81.5	14.8
2007	290	80.4	13.5
2008	322	79.9	11.5
2009	357	79.0	11.5
2010	404	78.4	11.1
2011	306	79.5	11.2
2012	347	77.9	12.4
2013	351	77.7	11.2
2014	241	76.3	11.2

FIGURE 4.1 ANNUAL MEAN PRE-TRANSFUSION HAEMOGLOBIN CONCENTRATION 2006 – 2014

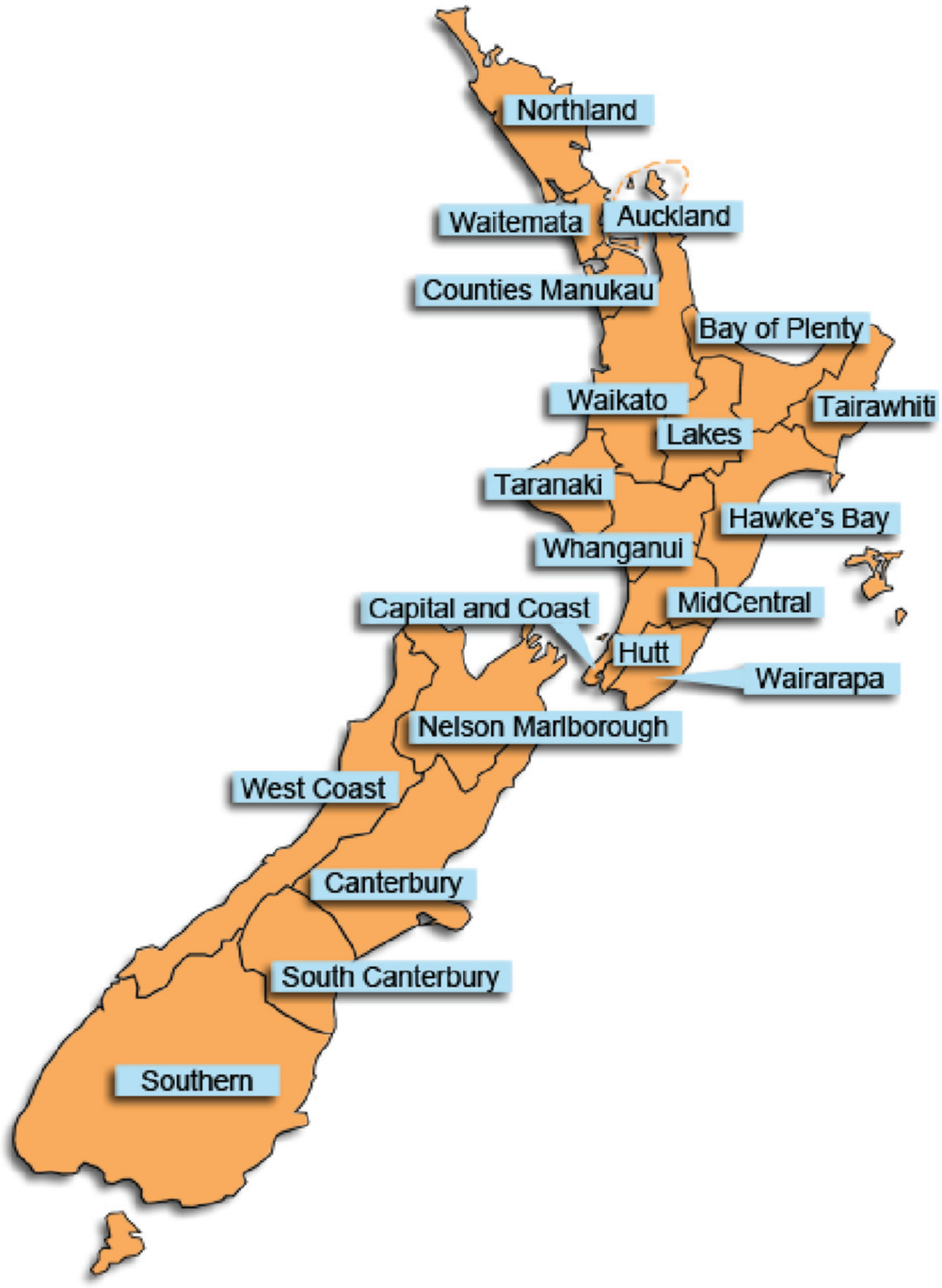


5 Transfusion-Related Adverse Events: Reporting District Health Boards

FIGURE 5.1 DISTRICT HEALTH BOARD BOUNDARIES

(www.health.govt.nz/new-zealand-health-system)

During 2014 transfusion-related adverse events (TRAE) were reported from all New Zealand District Health Boards except Whanganui. The number of events of imputability ≥3 per District Health Board and the event rate per 10,000 component units transfused are shown in Table 5.1 and Figure 5.2. The 2014 national TRAE rate was 26.4 per 10,000 component units transfused compared to 31.8 per 10,000 components transfused in 2013.

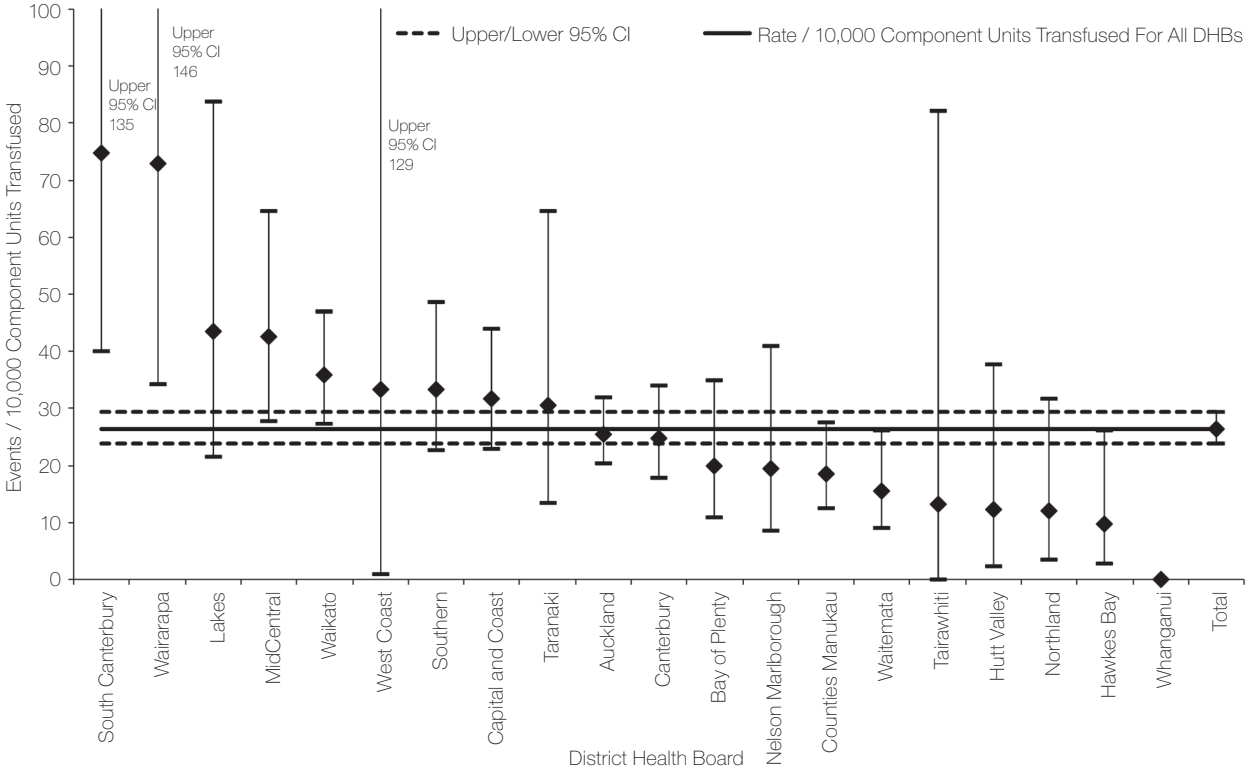


Transfusion-Related Adverse Events: Reporting District Health Boards continued

TABLE 5.1 TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2014 BY REPORTING DISTRICT HEALTH BOARD

District Health Board	Events	Units Transfused	Frequency	Rate / 10,000 Units Transfused (95%CI)
South Canterbury DHB	11	1,469	1:134	74.9 (40.1 to 135.4)
Wairarapa DHB	8	1,097	1:137	72.9 (34.3 to 145.9)
Lakes DHB	9	2,072	1:230	43.4 (21.5 to 83.7)
MidCentral DHB	22	5,179	1:235	42.5 (27.7 to 64.6)
Waikato DHB	53	14,760	1:278	35.9 (27.4 to 47.0)
West Coast DHB	2	598	1:299	33.4 (0.9 to 129.4)
Southern DHB	27	8,109	1:300	33.3 (22.7 to 48.6)
Capital and Coast DHB	36	11,333	1:315	31.8 (22.8 to 44.1)
Taranaki DHB	7	2,284	1:326	30.6 (13.5 to 64.5)
Auckland DHB	75	29,469	1:393	25.5 (20.3 to 31.9)
Canterbury DHB	37	14,975	1:405	24.7 (17.8 to 34.1)
Bay of Plenty DHB	12	6,056	1:505	19.8 (10.9 to 35.0)
Nelson Marlborough DHB	7	3,598	1:514	19.5 (8.5 to 41.0)
Counties Manukau DHB	25	13,475	1:539	18.6 (12.4 to 27.5)
Waitemata DHB	14	9,078	1:648	15.4 (8.9 to 26.1)
Tairāwhiti DHB	1	758	1:758	13.2 (-5.5 to 82.2)
Hutt Valley DHB	3	2,444	1:815	12.3 (2.4 to 37.8)
Northland DHB	4	3,355	1:839	11.9 (3.4 to 31.8)
Hawkes Bay DHB	4	4,100	1:1025	9.8 (2.8 to 26.0)
Whanganui DHB		926		
Total	**357**	**135,135**	**1:379**	**26.4 (23.8 to 29.3)**

FIGURE 5.2 TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2014 PER 10,000 COMPONENT UNITS TRANSFUSED BY REPORTING DISTRICT HEALTH BOARD



6 Transfusion-Related Adverse Events: Imputability

During 2014 a total of 463 TRAE were reported to the National Haemovigilance programme. A total of 106 (23.0%) had a low ≤2 imputability score and were excluded from the analysis since they were unlikely to be attributable to transfusion. Excluded events were predominantly reported as either febrile non-haemolytic transfusion reactions (FNHTR) or unclassifiable complications of transfusion (UCT). Imputability score definitions (ISBT/IHN) are provided in Table 6.1.

TABLE 6.1 IMPUTABILITY SCORE DEFINITIONS

Imputability Score Definitions		
NA	Not assessable	When there is insufficient data for imputability assessment.
1	Excluded	When there is conclusive evidence beyond reasonable doubt for attributing the event to alternative causes.
2	Unlikely	When the evidence is clearly in favour of attributing the event to causes other than transfusion.
3	Possible	When the evidence is indeterminate for attributing the event either to the transfusion or alternative causes.
4	Likely, probable	When the evidence is clearly in favour of attributing the event to the transfusion.
5	Certain	When there is conclusive evidence beyond reasonable doubt for attributing the event to the transfusion.

The number of reported events excluded due to low ≤2 imputability per year from 2008 to 2014 are shown in Table 6.2.

TABLE 6.2 TRANSFUSION-RELATED ADVERSE EVENTS OF LOW ≤2 IMPUTABILITY 2008 – 2014

	2008	2009	2010	2011	2012	2013	2014
Total Events	520	554	635	514	532	507	463
Number of Imputability ≤2	73	66	80	72	90	71	106
Percentage	14.0%	11.9%	12.6%	14.0%	16.9%	14.0%	23%

Table 6.3 shows all reported events in 2014 by event type and imputability score.

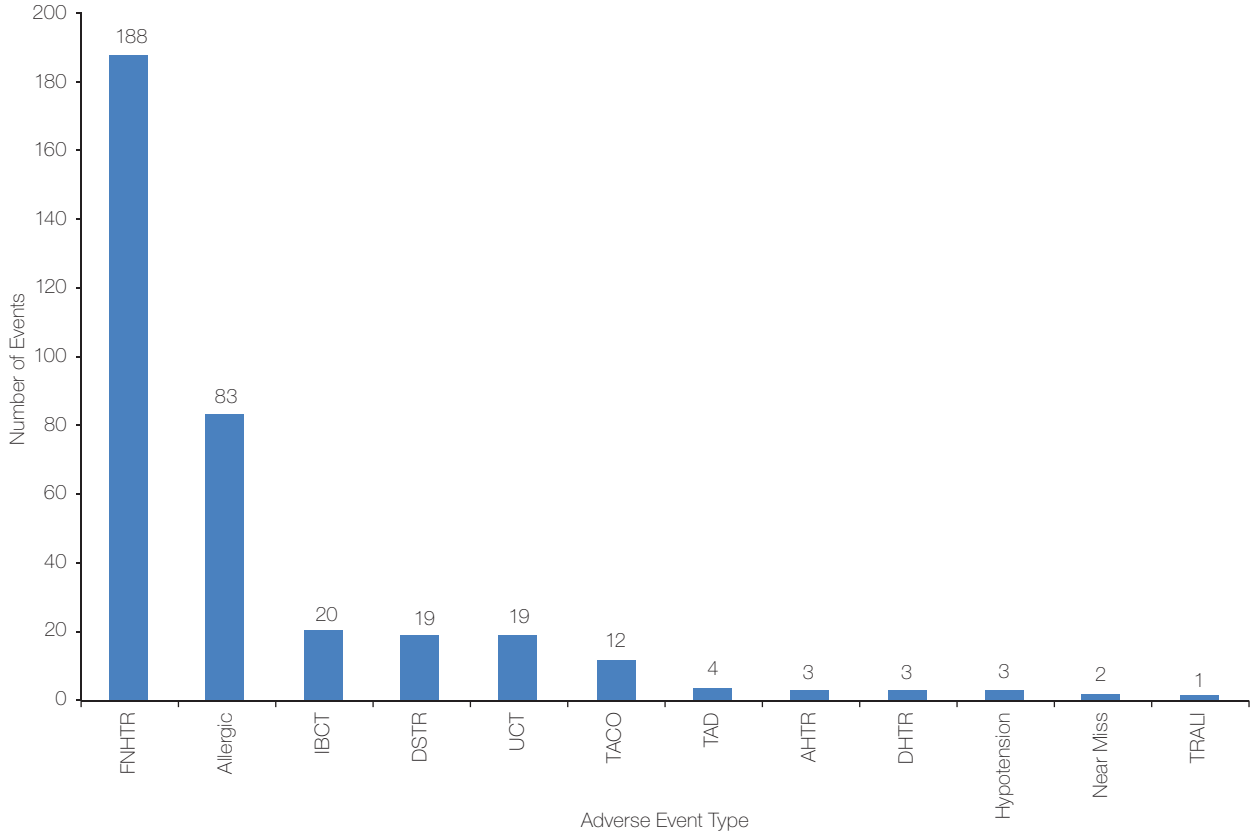
TABLE 6.3 TRANSFUSION-RELATED ADVERSE EVENTS 2014 BY EVENT TYPE AND IMPUTABILITY SCORE

Event Type	Imputability Score						
	1	2	3	4	5	Total	Total ≥3
FNHTR	30	38	145	43		254	188
Allergic		2	31	42	10	85	83
IBCT	1		2		18	21	20
DSTR			3	2	14	19	19
UCT	16	12	17	2		47	19
TACO			5	3	4	12	12
TAD		1	3	1		5	4
AHTR	1			3		4	3
DHTR			2		1	3	3
Hypotensive	2	1	3			6	3
Near Miss					2	2	2
TRALI	2			1		3	1
Total	**52**	**54**	**211**	**97**	**49**	**461**	**357**
Percentage Events	11.3%	11.7%	45.6%	20.8%	10.6%	100.0%	77.0%

Data analysed and included in the remainder of the Annual Haemovigilance Report is for events of imputability ≥3 only. Figure 6.1 and 6.2 show the distribution of the 357 events (imputability ≥3) by event type. Febrile non-haemolytic and allergic transfusion reactions are the most frequently reported events.

Transfusion-Related Adverse Events: Imputability continued

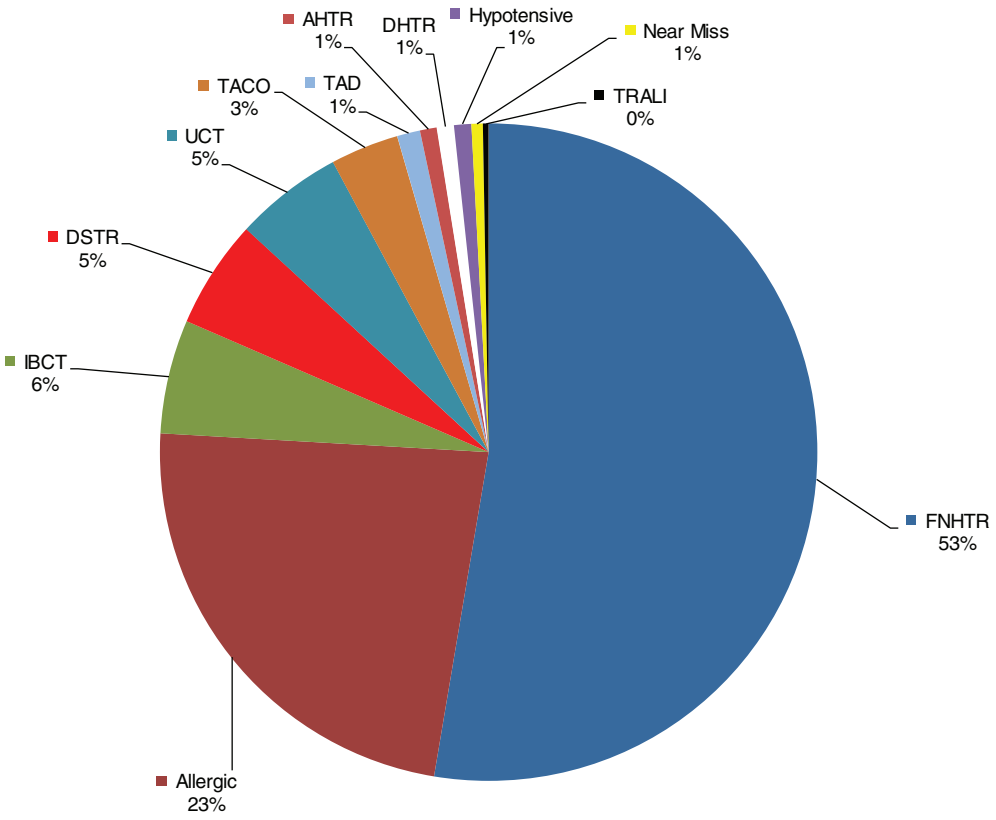
FIGURE 6.1 TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2014 BY EVENT TYPE



Key:

FNHTR	*Febrile non-haemolytic transfusion reaction*
Allergic	*Allergic transfusion reaction*
TACO	*Transfusion-associated circulatory overload*
IBCT	*Incorrect blood component transfused*
UCT	*Unclassifiable complication of transfusion*
TAD	*Transfusion-associated dyspnoea*
DSTR	*Delayed serologic transfusion reaction*
DHTR	*Delayed haemolytic transfusion reaction*
AHTR	*Acute haemolytic transfusion reaction*
TRALI	*Transfusion-related acute lung injury*

FIGURE 6.2 TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2014 BY EVENT TYPE



There were 331 transfusion recipients associated with the 357 reported events included in the analysis. Table 6.4 shows the events by recipient gender along with data on recipient age.

TABLE 6.4 TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2014 BY RECIPIENT GENDER

	Number	Age (years)		
		Mean	Minimum	Maximum
Female	178	53	1 month	99
Male	179	59	1 day	90
Total	**357**	**56**	**1 day**	**99**

Multiple TRAE were reported in 21 patients (Table 6.5).

TABLE 6.5 NUMBER OF RECIPIENTS HAVING MULTIPLE TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2014

	Total	Events			
		1 Event	2 Events	3 Events	4 Events
Recipient Number	331	310	17	3	1

For the one recipient where 4 TRAE were reported, 2 were recorded as UCT and 2 as FNHTR. For the three recipients where 3 events were reported, all were recorded as FNHTR.

Table 6.6 shows the total number of TRAE by type from 2009 to 2014 and Table 6.7 the yearly number and percentage of TRAE by type from 2009 to 2014.

TABLE 6.6 TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2009 – 2014 BY EVENT TYPE

Event Type	Number	Percentage
FNHTR	1,169	42.95%
Allergic	844	31.01%
UCT	167	6.14%
IBCT	134	4.92%
TACO	111	4.08%
DSTR	79	2.90%
TAD	74	2.72%
Hypotensive	58	2.13%
Near Miss	24	0.88%
DHTR	20	0.73%
Acute[1]	15	0.55%
TRALI	11	0.40%
Pain	10	0.37%
TTI	6	0.22%
Total	**2,722**	

[1] *Prior to 2013, acute haemolytic (AHTR) and other severe acute transfusion reactions (not otherwise classifiable) were included in the event category 'acute'.*

TABLE 6.7 ANNUAL NUMBER OF TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2009 – 2014 BY EVENT TYPE

TRAE	Number (Percentage)						
	2009	2010	2011	2012	2013	2014	Total
FNHTR	212 (43.35%)	223 (40.11%)	175 (39.41%)	175 (39.86%)	196 (44.85%)	188 (52.66%)	1169 (42.95%)
Allergic	148 (30.27%)	203 (36.51%)	163 (36.71%)	130 (29.61%)	117 (26.77%)	83 (23.25%)	844 (31.01%)
UCT	26 (5.32%)	37 (6.65%)	30 (6.76%)	26 (5.92%)	29 (6.64%)	19 (5.32%)	167 (6.14%)
IBCT	29 (5.93%)	29 (5.22%)	13 (2.93%)	19 (4.33%)	24 (5.49%)	20 (5.60%)	134 (4.92%)
TACO	24 (4.91%)	13 (2.34%)	19 (4.28%)	27 (6.15%)	16 (3.66%)	12 (3.36%)	111 (4.08%)
DSTR	13 (2.66%)	9 (1.62%)	12 (2.70%)	14 (3.19%)	12 (2.75%)	19 (5.32%)	79 (2.90%)
TAD	14 (2.86%)	9 (1.62%)	6 (1.35%)	15 (3.42%)	26 (5.95%)	4 (1.12%)	74 (2.72%)
Hypotensive	13 (2.66%)	14 (2.52%)	12 (2.70%)	14 (3.19%)	2 (0.46%)	3 (0.84%)	58 (2.13%)
Near Miss	2 (0.41%)	2 (0.36%)	3 (0.68%)	4 (0.91%)	11 (2.52%)	2 (0.56%)	24 (0.88%)
DHTR	3 (0.61%)	2 (0.36%)	2 (0.45%)	8 (1.82%)	2 (0.46%)	3 (0.84%)	20 (0.73%)
Acute[1]	1 (0.20%)	1 (0.18%)	5 (1.13%)	4 (0.91%)	1 (0.23%)	3 (0.84%)	15 (0.55%)
TRALI	1 (0.20%)	3 (0.54%)	3 (0.68%)	2 (0.46%)	1 (0.23%)	1 (0.28%)	11 (0.40%)
Pain	2 (0.41%)	8 (1.44%)	0	0	0	0	10 (0.37%)
TTI	1 (0.20%)	3 (0.54%)	1 (0.23%)	1 (0.23%)	0	0	6 (0.22%)
Total	**489**	**556**	**444**	**439**	**437**	**357**	**2,722**

[1] *Prior to 2013, acute haemolytic (AHTR) and other severe acute transfusion reactions (not otherwise classifiable) were included in the event category 'acute'.*

7 Transfusion-Related Adverse Events: Severity

The severity score definitions for TRAE developed by ISBT/IHN are shown in Table 7.1. Of the reported events with imputability score ≥3, 92.7% were assessed as non-severe (grade 1). Severe (grade 2) events were 6.2% of all events and 68% of these were either allergic or TACO in nature (Table 7.2). Of the TACO adverse events, 83% were of grade ≥2 severity and there was one TACO event implicated in the death (grade 4) of an 86 year old male (Table 7.2).

TABLE 7.1 SEVERITY SCORE DEFINITIONS FOR TRANSFUSION-RELATED ADVERSE EVENTS 2013

Grade 1	The recipient may have required treatment but lack of such would not have resulted in permanent damage or impairment of a body function.
Grade 2 (severe)	The recipient required hospitalisation or prolongation of hospitalisation directly attributable to the event; and/or the adverse event resulted in persistent or significant disability or incapacity; or the event necessitated medical or surgical intervention to preclude permanent damage or impairment.
Grade 3 (life-threatening)	The recipient required major intervention following the transfusion (e.g., vasopressors, intubation, transfer to intensive care) to prevent death.
Grade 4 (death)	The recipient died following an adverse transfusion reaction. Grade 4 should only be used if death is probably or definitely related to transfusion. If the patient died of another cause, the severity should be graded as 1, 2 or 3.

TABLE 7.2 TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2014 BY EVENT TYPE AND SEVERITY

TRAE	Severity				
Event Type	Grade 1	Grade 2	Grade 3	Grade 4	Total
FNHTR	187	1			188
Allergic	76	5	2		83
IBCT	20				20
DSTR	19				19
UCT	15	3	1		19
TACO	2	9		1	12
TAD	3	1			4
AHTR	2	1			3
DHTR	3				3
Hypotensive	2	1			3
Near Miss	2				2
TRALI		1			1
Total	**331**	**22**	**3**	**1**	**357**
Percentage	92.7%	6.2%	0.8%	0.3%	

Transfusion-Related Adverse Events: Severity continued

Table 7.3 shows the severity score of TRAEs with an imputability ≥3 by event type from 2009 to 2014.

TABLE 7.3 TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2009 – 2014 BY EVENT TYPE AND SEVERITY

TRAE Event Type	Severity Grade					Severity Grade ≥2		
	1	2	3	4	Total	Number	% Grade ≥2 Events	% All Event
FNHTR	943	14			957	14	5.45%	1.47%
Allergic	571	112	13		696	125	48.64%	17.96%
UCT	130	8	3		141	11	4.28%	7.80%
IBCT	105				105	0		
TACO	38	40	7	2	87	49	19.07%	56.32%
DSTR	64	2			66	2	0.78%	3.03%
TAD	46	11	3		60	14	5.45%	23.33%
Hypotensive	28	14	3		45	17	6.61%	37.78%
Near Miss	22				22	0		
DHTR	13	4			17	4	1.56%	23.53%
Acute[1]	5	9			14	9	3.50%	64.29%
TRALI		6	3	1	10	10	3.89%	100%
Pain	8				8	0		
TTI	3	2			5	2	0.78%	40.00%
Total	**1,976**	**222**	**32**	**3**	**2,233**	**257**		
Percentage	88.49%	9.94%	1.43%	0.13%		11.51%		

[1] *Prior to 2013, acute haemolytic (AHTR) and other severe acute transfusion reactions (not otherwise classifiable) were included in the event category 'acute'.*

8 Transfusion-Related Adverse Events: Implicated Blood Components

A total of 135,135 blood component units were transfused in 2014. Of these, 359 units were implicated in the 357 reported adverse events. The overall adverse event rate in 2014 was 1 in 376 units transfused (26.6 per 10,000 units transfused, 95% CI 24 to 29.5). Table 8.1 shows the adverse event rate for the individual blood component types in 2014 and Table 8.2 for the time period 2009 - 2014.

TABLE 8.1 TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2014 BY BLOOD COMPONENT TYPE

Component	Units Implicated in TRAE[1]	Units Transfused	Frequency	Rate / 10,000 Units Transfused (95%CI)
Platelets Apheresis PAS	23	4,033	1:175	57.0 (37.6 to 85.9)
Platelets Pooled PAS	20	7,429	1:371	26.9 (17.2 to 41.8)
Red cells	280	104,271	1:372	26.9 (23.9 to 30.2)
Platelets Apheresis Plasma[2]	3	1,139	1:380	26.3 (5.1 to 81.0)
Cryodepleted Plasma	1	514	1:514	19.5 (-8.1 to 120.9)
Fresh Frozen Plasma	25	13,551	1:542	18.4 (12.4 to 27.4)
Cryoprecipitate	7	4,198	1:600	16.7 (7.3 to 35.1)
Total	**359**	**135,135**	**1:376**	**26.6 (24.0 to 29.5)**

[1] *Includes TRAE where multiple component types transfused.*

[2] *Includes 616 units Platelets - Neonatal.*

TABLE 8.2 TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY ≥3) 2009 – 2014 BY BLOOD COMPONENT TYPE

Component	Units Implicated in TRAE[1]	Units Transfused	Frequency	Rate / 10,000 Units Transfused (95%CI)
Platelets Apheresis PAS	93	15,788	1:170	58.9 (48.1 to 72.2)
Platelets Pooled PAS	59	21,959	1:372	26.9 (20.8 to 34.7)
Red Cells	2,042	692,528	1:339	29.5 (28.2 to 30.8)
Platelets Apheresis Plasma[2]	183	28,588	1:156	64.0 (55.4 to 74.0)
Cryodepleted Plasma	23	3,446	1:150	66.7 (44.0 to 100.5)
Fresh Frozen Plasma	261	98,714	1:378	26.4 (23.4 to 29.8)
Cryoprecipitate	36	21,158	1:588	17.0 (12.2 to 23.6)
Platelets Pooled Plasma	116	13,691	1:118	84.7 (70.6 to 101.6)
Total	**2,813**	**895,872**	**1:318**	**31.4 (30.3 to 32.6)**

[1] *Includes TRAE where multiple component types transfused.*

[2] *Includes 3,653 units Platelets - Neonatal.*

Transfusion-Related Adverse Events: Implicated Blood Components continued

Table 8.3 provides detail on TRAE by the event type and type of blood component involved.

TABLE 8.3 TRANSFUSION-RELATED ADVERSE EVENTS (IMPUTABILITY SCORE ≥3) 2014 BY EVENT TYPE AND BLOOD COMPONENT TYPE

	Red Cells	Fresh Frozen Plasma	Platelets Apheresis	PAS Platelets Apheresis	PAS Platelets Pooled	Cryoprecipitate	Cryodepleted Plasma	Fractionated Plasma Products[1]	Multiple Components	Other[2]
Number Units Transfused	104,271	13,551	1,139	4,033	7,429	4,198	514			
FNHTR	173	1	1	6	5				2	
Allergic	34	16	1	12	10	2	1		6	1
DSTR	20									
UCT	17			1					1	
TACO	12									
IBCT	6	1			1	1		11		
AHTR	3									
TAD	3				1					
DHTR	2									
Hypotensive	2									1
Near Miss	1							1		
TRALI	1									
Total	**274**	**18**	**2**	**19**	**17**	**3**	**1**	**12**	**9**	**2**

[1] *Events, other than ICBT and near miss, associated with fractionated plasma products are detailed in Chapter 18.*

[2] *Events associated with transfusion of granulocytes and autologous salvage red cells.*

9 Febrile Non-Haemolytic Transfusion Reactions (FNHTR)

DEFINITION

Fever (≥38°C and a change of ≥1°C from pre-transfusion value) and/or chills/rigors occurring during or within 4 hours of transfusion without any other cause such as haemolytic transfusion reaction, bacterial contamination or underlying condition.

Febrile reactions were the most frequently reported type of TRAE (52%). A total of 256 reports of FNHTR were received, 188 were of imputability ≥3 and included in the analysis. The remaining 30 were of low ≤2 imputability and probably due to the patient's underlying medical condition. An additional 38 submitted reports of febrile reactions did not meet criteria for FNHTR and thus were excluded by the Haemovigilance Programme. Table 9.1 shows FNHTR events by recipient gender along with data on recipient age.

TABLE 9.1 FNHTR EVENTS (IMPUTABILITY ≥3) 2014 BY RECIPIENT GENDER

	Number	Age (years)		
		Mean	Minimum	Maximum
Female	82	60	2 weeks	99
Male	106	58	1 day	88
All	**188**	**59**	**1 day**	**99**

In addition to fever and chills/rigors, other clinical features associated with FNHTR are summarised in Table 9.2. An increase in blood pressure, restlessness or anxiety, dyspnoea, flushing and chest pain are not uncommon symptoms in transfusion recipients with FNHTR.

TABLE 9.2 FNHTR EVENTS (IMPUTABILITY ≥3) 2014 BY ASSOCIATED SIGNS AND SYMPTOMS

Symptom	Number			% Events		
	Female (n=82)	Male (n=106)	Total (n=188)	Female	Male	Total
Chills / Rigors	38	59	97	46.3%	55.7%	51.6%
Increase in blood pressure	13	14	27	15.9%	13.2%	14.4%
Restlessness / Anxiety	9	15	24	11.0%	14.2%	12.8%
Dyspnoea	8	14	22	9.8%	13.2%	11.7%
Flushing	4	14	18	4.9%	13.2%	9.6%
Chest pain	7	8	15	8.5%	7.5%	8.0%
Tachycardia	5	4	9	6.1%	3.8%	4.8%
Vomiting	6	0	6	7.3%	0.0%	3.2%
Stridor / Wheeze	1	4	5	1.2%	3.8%	2.7%
Hypoxaemia	2	3	5	2.4%	2.8%	2.7%
Urticaria	1	4	5	1.2%	3.8%	2.7%
Loin pain	1	3	4	1.2%	2.8%	2.1%
Fall in blood pressure	0	2	2		1.9%	1.1%
Mean temperature rise	1.5°C	1.8°C	1.7°C			

Febrile Non-Haemolytic Transfusion Reactions (FNHTR) continued

Of the reported FNHTR events, 16 met ISBT criteria for serious FNHTR. The ISBT Working Party on Haemovigilance (July 2011) defines FNHTR as serious when accompanied by:

Fever ≥39°C oral (or equivalent) and a change of ≥2°C from pre-transfusion value, and chills/rigors.

Table 9.3 shows serious FNHTR events by recipient gender along with data on change in temperature and recipient age.

TABLE 9.3 SERIOUS FNHTR EVENTS (IMPUTABILITY ≥3) 2014 BY RECIPIENT GENDER

	Number	Temperature Rise (°C)			Age (Years)		
		Mean	Min	Max	Mean	Min	Max
Female	3	2.4	2.0	2.6	57	14	99
Male	8	2.5	2.0	3.1	49	20	77
Total	**11**	**2.4**	**2.0**	**3.1**	**52**	**14**	**99**

10 Allergic Transfusion Reactions

DEFINITION

Mucocutaneous signs and symptoms during or within 4 hours of transfusion: morbilliform rash with pruritus, urticaria, localised angioedema, oedema of lips, tongue and uvula, periorbital pruritus, erythema and oedema, conjunctival oedema. ***Anaphylactic reaction*** *is when, in addition to mucocutaneous symptoms, there is airway compromise or cardiovascular involvement. Laryngeal symptoms include throat tightness, dysphagia, dysphonia, hoarseness, stridor. Pulmonary symptoms include dyspnoea, cough, wheeze/bronchospasm, hypoxaemia. Cardiovascular symptoms include hypotension, syncope.*

Allergic reactions are frequently reported after blood transfusions. They are most often mild reactions but may cause significant distress to recipients of blood transfusions and occasionally even significant morbidity.

During 2014 there were 83 (23%) events classified as allergic in nature. Of these, 76 (92%) were non-severe and the remaining 7 (8%) were severe or life-threatening. Table 10.1 shows allergic events by recipient gender along with data on recipient age.

TABLE 10.1 ALLERGIC EVENTS (IMPUTABILITY ≥3) 2014 BY RECIPIENT GENDER

	Number	Age (years)		
		Mean	Minimum	Maximum
Female	45	42	2	87
Male	38	49	2	86
All	**83**	**45**	**2**	**87**

Table 10.2 provides information on signs and symptoms associated with non-severe (grade 1) allergic events compared to severe and life threatening (grade 2 and 3) events reported in 2014.

TABLE 10.2 ALLERGIC EVENTS (IMPUTABILITY ≥3) 2014 BY ASSOCIATED SIGNS AND SYMPTOMS

Symptom	Allergic Events					
	Grade 1 (n=76)			Grade 2 & 3 (n=7)		
	Number	% Symptoms	% Grade 1 Events	Number	% Symptoms	% Grade 2 & 3 Events
Urticaria	62	51.7%	81.6%	5	17.9%	71.4%
Facial oedema	9	7.5%	11.8%	1	3.6%	14.3%
Stridor / Wheeze	7	5.8%	9.2%	4	14.3%	57.1%
Restlessness / Anxiety	7	5.8%	9.2%	4	14.3%	57.1%
Flushing	7	5.8%	9.2%	1	3.6%	14.3%
Chills / Rigors	5	4.2%	6.6%	0	0.0%	0.0%
Non-urticarial	5	4.2%	6.6%	1	3.6%	14.3%
Abdominal pain	5	4.2%	6.6%	2	7.1%	28.6%
Increase in blood pressure	4	3.3%	5.3%	0	0.0%	0.0%
Cough	4	3.3%	5.3%	1	3.6%	14.3%
Fall in blood pressure	3	2.5%	3.9%	3	10.7%	42.9%
Tachycardia	1	0.8%	1.3%	3	10.7%	42.9%
Dyspnoea	1	0.8%	1.3%	3	10.7%	42.9%

Allergic Transfusion Reactions continued

Table 10.3 below shows the data for allergic events reported from 2009 to 2014. Restlessness or anxiety, stridor or wheeze, dyspnoea, tachycardia, a fall in blood pressure, chest pain and desaturation are more likely to be seen with severe reactions.

TABLE 10.3 ALLERGIC EVENTS (IMPUTABILITY ≥3) 2009 – 2014 BY ASSOCIATED SIGNS AND SYMPTOMS

	Severity Grade			
	Grade 1 (n = 610)		Grade 2 and 3 (n=138)	
Symptom	Number	%	Number	%
Urticaria	461	75.6%	99	71.7%
Restlessness / Anxiety	91	14.9%	48	34.8%
Non-urticarial	81	13.3%	9	6.5%
Stridor / Wheeze	51	8.4%	55	39.9%
Chills / Rigors	42	6.9%	15	10.9%
Dyspnoea	35	5.7%	36	26.1%
Increase in blood pressure	34	5.6%	7	5.1%
Tachycardia	25	4.1%	27	19.6%
Fall in blood pressure	18	3.0%	49	35.5%
Chest pain	11	1.8%	12	8.7%
Fever	5	0.8%	2	1.4%
GI symptoms	5	0.8%	2	1.4%
Fall in O_2 saturations	4	0.7%	9	6.5%
Loin pain	2	0.3%	3	2.2%

The frequency of allergic events and, for those events where a single blood component was implicated, the rate per 10,000 component units transfused is shown in Table 10.4.

TABLE 10.4 ALLERGIC EVENTS (IMPUTABILITY ≥3) 2014 BY BLOOD COMPONENT TYPE

Component	Number Events	Number Units Transfused	Frequency	Rate / 10,000 Units Transfused (95%CI)
Platelets Apheresis PAS	12	4,033	1:336	29.8 (16.4 to 52.6)
Cryodepleted Plasma	1	514	1:514	19.5 (-8.1 to 120.9)
Platelets Pooled PAS	10	7,429	1:743	13.5 (6.9 to 25.1)
Fresh Frozen Plasma	16	13,551	1:847	11.8 (7.1 to 19.3)
Platelets Apheresis Plasma	1	1,139	1:1,139	8.8 (-3.7 to 54.8)
Cryoprecipitate	2	4,198	1:2,099	4.8 (0.1 to 18.6)
Red Cells	34	104,271	1:3,067	3.3 (2.3 to 4.6)
Total	**76**	**135,135**	**1:1,778**	**5.6 (4.5 to 7.0)**

10 Allergic Transfusion Reactions continued

NZBS commenced introduction of pooled platelets suspended in Platelet Additive Solution (PAS) in late 2010 and apheresis PAS platelets in 2011. This significant change in production method was made with the specific purpose of reducing the amount of plasma in platelets. The expected benefits from this change were both the recovery of additional plasma for fractionation and a reduction in the frequency of allergic reactions to platelets. The haemovigilance data indicates that this latter goal has been achieved. Table 10.5 compares the number of allergic events for the different platelet component types from 2009 to 2014. There is a significant reduction (p = 0.001) in the rate of allergic events with platelets suspended in PAS compared to platelets suspended in plasma. There is no significant difference (p = 0.15) in the rate of allergic events with apheresis or pooled platelets suspended in PAS.

TABLE 10.5 PLATELET-RELATED ALLERGIC EVENTS (IMPUTABILITY ≥3) 2009 – 2014

Platelet Component Type	Number Events	Number Units Transfused	Frequency	Rate / 10,000 Units Transfused (95%CI)
Apheresis Plasma[1]	157	43,907	1:280	35.8 (30.6 to 41.8)
Pooled Plasma	89	23,597	1:265	37.7 (30.6 to 46.4)
Apheresis PAS	30	15,788	1:526	19.0 (13.2 to 27.2)
Pooled PAS	32	21,959	1:686	14.6 (10.3 to 20.6)
All Plasma Platelets[1]	246	67,504	1:274	36.4 (32.2 to 41.3)
All PAS Platelets	62	37,747	1:609	16.4 (12.8 to 21.1)
Total	**308**	**105,251**	**1:342**	**29.3 (26.2 to 32.7)**

[1] *Includes Platelets - Neonatal.*

Table 10.6 compares the number of allergic events for the different non-platelet component types from 2009 to 2014.

TABLE 10.6 NON-PLATELET-RELATED ALLERGIC EVENTS (IMPUTABILITY ≥3) 2009 – 2014

Component	Number Events	Number Units Transfused	Frequency	Rate / 10,000 Units Transfused (95%CI)
Fresh Frozen Plasma[1]	163	98,714	1:606	16.5 (14.2 to 19.3)
Cryoprecipitate	9	21,158	1:2,351	4.3 (2.1 to 8.2)
Cryodepleted Plasma	18	3,446	1:191	52.2 (32.5 to 83.0)
Red Cells[1]	317	692,528	1:2,185	4.6 (4.1 to 5.1)

[1] *Includes neonatal components.*

Acute Haemolytic Transfusion Reactions (AHTR)

11

DEFINITION

A reaction in which symptoms and clinical or laboratory signs of increased red cell destruction occur at any time up to 24 hours following the transfusion of blood or a blood component.

Acute haemolytic transfusion reactions occur following the transfusion of immunologically incompatible red cells or due to mechanical red cell destruction.

Features of a haemolytic transfusion reaction include:

- Fever, tachycardia, change in blood pressure, flank or back pain
- Inadequate rise in haemoglobin after the transfusion or a drop in haemoglobin
- Rise in LDH, bilirubin
- Haemoglobinura
- Decrease in haptoglobin

There were three reported events during 2014 classified as acute haemolytic transfusion reactions. The details are provided below.

CASE A

A 19 year old previously well female presented with pancytopenia of unclear cause. A bone marrow biopsy was normal.

Thirty minutes following transfusion of a single red cell unit the patient developed a mild fever and tachycardia without any other symptoms. On a post-transfusion sample there were no blood group anomalies. The pre-transfusion DAT was positive for IgG 1+, C3d negative. The post-transfusion DAT was positive for IgG 2+, C3d negative. An anti-AHG antibody was identified. In the post-transfusion eluate anti-Wra, an antibody to a low incidence antigen, was identified.

There was an acceptable immediate post-transfusion increment in Hb from 85 to 103 g/L. The next day the Hb had fallen to 94 g/L. Post-transfusion the LDH was 540 however there was no pre-transfusion value for comparison. The bilirubin rose from 4 to 21 g/L post-transfusion and then returned to baseline 2 days later.

The event was recorded as an acute haemolytic transfusion reaction due to anti-Wra, grade 1 in severity and of probable imputability. Anti-Wra is a recognised but uncommon cause of acute haemolytic transfusion reactions. Anti-Wra reacts with a low frequency blood group antigen, Wra, which has a population frequency of less than 1:1,000 and anti-Wra will not be identified by routine blood group antibody screening.

CASE B

A 68 year old splenectomised female was admitted for blood transfusion due to decompensated warm-type autoimmune haemolytic anemia, Hb 88 g/L. The patient had numerous other autoimmune conditions including SLE complicated by pulmonary fibrosis, antiphospholipid syndrome and autoimmune cholangiopathy. On warfarin for recurrent thromboses. Three red cell units were administered via a blood warmer over 1-2 hours with no delay.

During transfusion of the third red cell unit the patient became acutely breathless, anxious and restless, vomited, and developed a 3ºC rise in temperature accompanied by tachycardia 130/min. A computed tomographic pulmonary angiography demonstrated stabile chronic pulmonary fibrosis without evidence of acute pulmonary embolism or oedema. On a post-transfusion sample there were no blood group anomalies. The pre- and post-transfusion monospecific DAT was positive with IgG 3+ and C3d 1+. A red cell antibody screen performed after autoabsorption on a pre-transfusion sample was negative. There was an acceptable immediate post-transfusion increment in Hb from 88 to 120 g/L. The following day the Hb had however fallen to 94 g/L and for the subsequent 48 hours remained stable. The serum bilirubin rose from 34 g/L pre-transfusion to 127 g/L the next day followed by a return to baseline over the next 48 hours.

There was a strong temporal relationship to the blood transfusion and there was convincing evidence to support the event being recorded as an acute haemolytic transfusion reaction of probable imputability. Serologic incompatibility was not demonstrated. Mechanical red cell haemolysis due to improper use of a blood warmer or exacerbation of immune-mediated haemolysis as a result of the transfusion are possible explanations.

CASE C

A 79 year old male presented with symptomatic anaemia Hb 70 g/L and evidence of haemolysis with high LDH and unconjugated hyperbilirubinaemia. Past history of steroid- and rituximab-refractory warm-type autoimmune haemolytic anaemia. On warfarin for previous retinal vein thrombosis, deep vein thrombosis and pulmonary embolus.

During transfusion of two red cell units the patient developed a tachyarrhythmia and also noted dark red urine with the urine dipstick positive for “blood”. No urine microscopy was done. The patient historically has a positive urinary haemosiderin test consistent with chronic intravascular haemolysis. On a post-transfusion sample there were no blood group anomalies. The pre- and post-transfusion DAT was negative, as was the antibody screen. A further rise in serum bilirubin was documented. There was an acceptable immediate post-transfusion increment in Hb from 70 to 91 g/L and no further serial measurements were taken. Tests for paroxysmal nocturnal haemoglobinuria by flow cytometry were negative.

Although there was a strong temporal relation to the transfusion, the results of investigations left a number of diagnostic uncertainties. The event was recorded as an acute haemolytic transfusion reaction without evidence of serological incompatibility, grade 1 in severity and of probable imputability.

Transfusion-Related Acute Lung Injury (TRALI)

12

DEFINITION

New acute lung injury (ALI): acute onset during or within 6 hours of completion of transfusion, hypoxaemia (PaO_2/FiO_2 < 300 mmHg, oxygen saturation < 90% on room air, or other clinical evidence), bilateral infiltrates on frontal chest radiograph, no left atrial hypertension or other evidence of circulatory overload, no temporal relationship to an alternative risk factor for ALI.

During 2014 there was one reported event of TRALI in New Zealand. The case is summarised below:

CASE D

A 75 year old female with myelofibrosis had a stable uncomplicated transfusion programme of two red cell units every 3 weeks. The patient also had a history of well-controlled coronary artery disease and heart failure. Shortly following completion of one transfusion episode and prior to discharge from the day ward, the patient developed mild breathlessness. Over the subsequent 2 days at home the patient experienced escalating symptoms before presenting to the emergency department with pulmonary oedema requiring non-invasive ventilatory support and admission to hospital. Echocardiography revealed preserved LV function. There was a slow response to diuretic therapy. The respiratory failure was suspected to be multi-factorial and treatment was also given for an atypical pneumonia.

The donor of one of the red cell units was demonstrated to have multiple HLA class I & II antibodies, including HLA DR13. HLA antibody screen of the patient was negative and the patient was positive for the HLA DR13 antigen. Granulocyte antibody screen performed on the patient and donor was negative.

The event has been classified as a life-threating TRALI reaction of probable imputability. The donor of the implicated red cell unit has been permanently deferred.

12 Transfusion-Related Acute Lung Injury (TRALI) continued

Figure 12.1 shows the number of TRALI events reported each year since 2005. Overall, the number of reported events has declined. NZBS has implemented a number of measures to reduce the risk of TRALI. Production of clinical FFP from male-only donors was implemented in 2008 and thereafter HLA-antibody screening of female plateletpheresis donors in July 2012. The male-only policy was extended to include cryoprecipitate and cryodepleted plasma by 2013.

FIGURE 12.1 ANNUAL NUMBER OF TRALI EVENTS 2005 – 2014

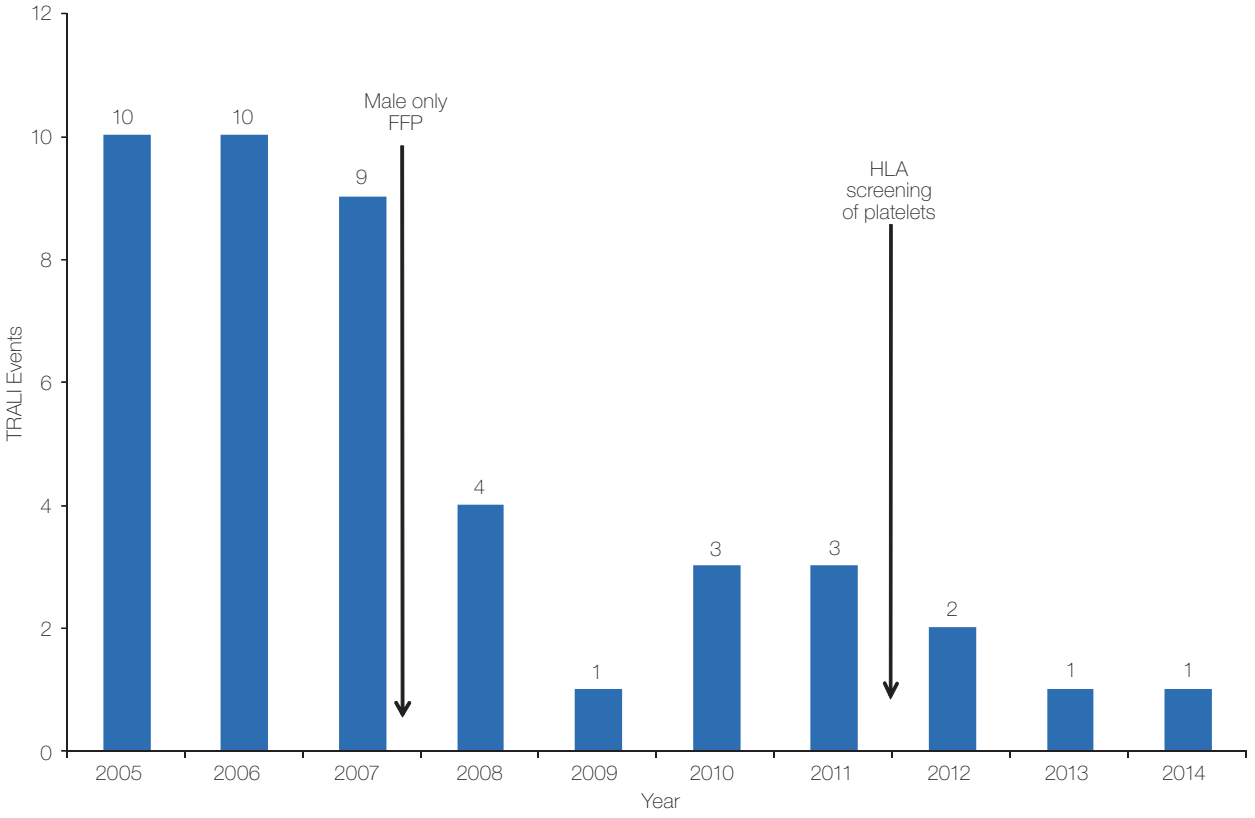


Table 12.1 shows the recorded clinical features of the TRALI events reported from 2005 to 2014.

TABLE 12.1 TRALI EVENTS (IMPUTABILITY ≥3) 2005 – 2014 BY ASSOCIATED SIGNS AND SYMPTOMS

Symptom	Number	% TRALI Events
Dyspnoea	30	68.2%
Fall in O_2 saturation	26	59.1%
Decrease in blood pressure	14	31.8%
Pulmonary oedema	14	31.8%
Restlessness / Anxiety	10	22.7%
Tachycardia	9	20.5%
Stridor / Wheeze	7	15.9%
Hypoxaemia	7	15.9%
Increase in blood pressure	5	11.4%
Chills / Rigors	4	9.1%
Patient under general anaesthetic[1]	8	18.2%

[1] *Typical signs and symptoms may be modified or absent.*

Transfusion-Related Acute Lung Injury (TRALI) continued

The components implicated yearly in TRALI events between 2005 and 2014 are detailed in Table 12.2.

TABLE 12.2 COMPONENTS IMPLICATED IN TRALI EVENTS 2005 – 2014

Year	Number TRALI Reports	Implicated Components (multiple components implicated in a number of events)							
		Red Cells	Fresh Frozen Plasma	Apheresis Platelets Plasma	Pooled Platelets Plasma	Apheresis Platelets PAS	Pooled Platelets PAS	Cryoprecipitate	Cryodepleted Plasma
2005	10	7	5	3	1			1	1
2006	10	4	5	5	2			1	
2007	9	4	6						
2008	4	2		1	1				
2009	1	1							
2010	3	2		1					
2011	3		2		1				
2012	2		1			1	2		
2013	1	1							
2014	1	1							
Totals	**44**	**22**	**19**	**10**	**5**	**1**	**2**	**2**	**1**
Percentage		51%	44%	23%	12%	2%	5%	5%	2%

13 Transfusion-Associated Circulatory Overload (TACO)

DEFINITION

Any 4 of the following occurring within 6 hours of completion of transfusion: acute respiratory distress, tachycardia, increased blood pressure, acute or worsening pulmonary oedema on frontal chest radiograph, evidence of positive fluid balance. An elevated BNP may be supportive of TACO.

During 2014, there were 12 reported TACO events (3.4% of total events). Two (17%) were non-severe, 8 (75%) were of grade 2 severity, 1 was life-threating and 1 was implicated in the death of a patient. Table 13.1 shows the TACO events by recipient gender along with data on recipient age.

TABLE 13.1 TACO EVENTS (IMPUTABILITY ≥3) 2014 BY RECIPIENT GENDER

		Age (Years)		
	Number	Mean	Minimum	Maximum
Female	3	71	64	82
Male	9	80	62	90
All	**12**	**78**	**62**	**90**

Table 13.2 shows the recorded clinical features of the TACO events reported during 2014.

TABLE 13.2 TACO EVENTS (IMPUTABILITY ≥3) 2014 BY ASSOCIATED SIGNS AND SYMPTOMS

Symptom	Number			% TACO Events
	Female	Male	Total	
Dyspnoea	1	8	9	75%
Stridor / Wheeze	3	4	7	58%
Increase in blood pressure	3	3	6	50%
Tachycardia	1	2	3	25%
Chest pain	1	2	3	25%
Restlessness / Anxiety	1	3	3	25%
Fall in O_2 saturation	1	2	3	25%
Pulmonary oedema		2	2	17%

Transfusion-Associated Circulatory Overload (TACO) continued

Table 13.3 shows the number of TACO events reported each year from 2010 to 2014.

TABLE 13.3 ANNUAL NUMBER OF TACO EVENTS (IMPUTABILITY ≥3) 2010 – 2014

Year	Reported TACO Events	Total Component Units Transfused	Frequency	Rate / 100,000 Units Transfused (95%CI)
2010	13	159,568	1:12,274	8.1 (4.6 to 14.1)
2011	19	151,919	1:7,996	12.5 (7.9 to 19.7)
2012	27	149,668	1:5,543	18.0 (12.3 to 26.4)
2013	16	136,995	1:8,562	11.7 (7.0 to 19.1)
2014	12	135,135	1:6,875	11.9 (9.6 to 14.6)
Total	**87**	**733,285**	**1:8,429**	**11.9 (9.6 to 14.6)**

From 2010 to 2014, three percent of all reported events were classified as TACO, however they were responsible for 19% of events graded with a severity score ≥2 (Table 13.4).

TABLE 13.4 SEVERE TACO EVENTS (IMPUTABILITY ≥3) 2010 – 2014

		Severity Grade			Total
		Grade 2 (Severe)	Grade 3 (Life Threatening)	Grade 4 (Death)	
All Adverse Events	Number	223	32	3	258
TACO Events	Number	40	7	2	49
	Percentage of Grade	18%	22%	66%	19%

TACO occurs predominantly in older recipients in whom careful consideration of total volume and rate of transfusion is particularly important along with judicious use of diuretics to avoid fluid overload.

CASE E

An 86 year old male with a background of advanced chronic obstructive pulmonary disease, essential hypertension, ischaemic heart disease and prior myocardial infarction was admitted with a two day history of chest tightness and increasing shortness of breath. The chest radiograph was unremarkable and ECG unchanged from earlier examinations. Serial cardiac troponins were elevated, falling from 367 to 291 ng/L. Serum creatinine was normal 63 mmol/L. The patient was anaemic Hb 68 g/L and received 3 units of red cells over 10 hours. A clinical review was performed after the second unit. Shortly following the third unit the patient became acutely breathless and wheezy. The baseline heart rate increased from 82 to 118/minute, blood pressure from 148/65 to 200/90 mmHg, respiratory rate from 20 to 40/minute and oxygen saturation fell from 99% to 67% on room air. A bedside chest radiograph showed bilateral patchy perihilar infiltrates and a small left sided pleural effusion consistent with pulmonary oedema. NT-proBNP was raised at 525 pmol/L. Supplemental oxygen therapy and furosemide were given without clinical improvement and non-invasive ventilatory support was considered inappropriate. Palliative care was administered and the patient died the following day.

The event has been classified as a grade 4 TACO reaction of probable imputability.

14 Transfusion-Associated Dyspnoea (TAD)

DEFINITION

Respiratory distress within 24 hours of transfusion that does not meet the criteria of TRALI, TACO, or allergic reaction and is not explained by the patient's underlying condition.

During 2014 there were 4 events classified as TAD. Two involved female recipients and two involved male recipients. The mean age was 76 years (range 62 – 82). Three of the events were classified as non-severe (grade 1) and one was classified as severe with a severity score ≥2. The clinical features are summarised in Table 14.1.

TABLE 14.1 TAD EVENTS (IMPUTABILITY ≥3) 2014 BY ASSOCIATED SIGNS AND SYMPTOMS

Symptom	Number
Dyspnoea	4
Chills Rigors	3
Increase in blood pressure	3
Stridor / Wheeze	3
Hypoxaemia	2
Restlessness / Anxiety	2
Chest pain	1

Table 14.2 shows the number of TAD events reported each year from 2008 to 2014.

TABLE 14.2 ANNUAL NUMBER OF TAD EVENTS (IMPUTABILITY ≥3) 2008 – 2014

Year	TAD Events	Total Component Units Transfused	Frequency	Rate / 100,000 Units Transfused (95%CI)
2008	8	158,181	1:19,773	5.1 (2.4 to 10.2)
2009	13	162,587	1:12,507	8.0 (4.5 to 13.8)
2010	9	159,568	1:17,730	5.6 (2.8 to 10.9)
2011	6	151,919	1:25,320	3.9 (1.6 to 8.8)
2012	15	149,668	1:9,978	10.0 (5.9 to 16.7)
2013	26	136,995	1:5,269	19.0 (12.8 to 27.9)
2014	4	135,135	1:33,784	3.0 (0.9 to 7.9)
Total	**81**	**1,054,053**	**1:13,013**	**7.7 (6.2 to 9.6)**

Hypotensive Transfusion Reactions 15

DEFINITION

Decrease in systolic and/or diastolic blood pressure of >30 mmHg occurring during or within one hour of completing transfusion. All other categories of adverse reactions presenting with hypotension must have been excluded together with underlying conditions that could explain hypotension.

During 2014 there were three events classified as hypotensive transfusion reactions. Red cell units transfused were implicated in two TRAE and autologous salvaged red cells in the other. The two patients transfused with allogeneic red cells were female and their ages were 42 and 88 years. The TRAE with autologous salvaged red cells was in a male aged 77 years. The severity grade of the reaction with autologous salvaged red cells was severe (grade 2) while the other two events with allogeneic red cells were non-severe (grade 1).

Delayed Haemolytic / Serologic Transfusion Reactions (DHTR / DSTR) 16

DEFINITION

A delayed haemolytic transfusion reaction is one in which symptoms and clinical or laboratory signs of increased red cell destruction occur between 24 hours and 28 days following the transfusion of blood or a blood component. If markers of increased red cell destruction are unavailable or not supportive of a haemolytic process, the event is classified as a delayed serological transfusion reaction.

These events are normally identified by the blood bank when repeat testing identifies a new blood group antibody and a positive DAT in a patient recently transfused. Haemolysis is suggested by a poor post-transfusion haemoglobin increment, clinical jaundice or a raised serum bilirubin, raised LDH and low/undetectable serum haptoglobin levels.

During 2014 there were two reports of DHTR and 19 reports of DSTR of imputability ≥3. Table 16.1 shows these events by recipient gender along with data on recipient age. Table 16.2 details the specificities of the blood group antibodies implicated in the DHTR and DSTR events.

TABLE 16.1 DELAYED TRANSFUSION REACTIONS (IMPUTABILITY ≥3) 2014 BY EVENT TYPE AND RECIPIENT GENDER

		Number	Age (years)		
			Mean	Minimum	Maximum
DHTR	Female	1	37		
	Male	1	68		
DSTR	Female	13	62	24	94
	Male	6	73	64	80

TABLE 16.2 DELAYED TRANSFUSION REACTIONS (IMPUTABILITY ≥3) 2014 BY SPECIFICITY OF RED CELL ANTIBODY

Antibody Specificity	Number (Percentage)		
	Delayed Haemolytic	Delayed Serological	Total
Anti-Fy^{a}	2 (67%)	4 (21%)	6 (27%)
Anti-c + E	1 (33%)		1 (5%)
Anti-Jk^{b}		3 (16%)	3 (14%)
Anti-Jk^{a}		2 (11%)	2 (9%)
Anti-C		2 (11%)	2 (9%)
Anti-K		2 (11%)	2 (9%)
Anti-Lu^{a}		2 (11%)	2 (9%)
Anti-E		1 (5%)	1 (5%)
Anti-E + K		1 (5%)	1 (5%)
Anti-Fy^{b}		1 (5%)	1 (5%)
Anti-M		1 (5%)	1 (5%)
Total	**3**	**19**	**22**
Blood Group System			
Duffy	2 (67%)	5 (25%)	7 (30%)
Rh	1 (33%)	4 (20%)	5 (22%)
Kidd		5 (25%)	5 (22%)
Kell		3 (15%)	3 (13%)
MNSs		1 (5%)	1 (4%)
Lutheran		2 (10%)	2 (9%)

CASE F

A 68 year old female with a positive red cell antibody screen (RCAS) and identifiable anti-c+E+S, was transfused with three units of red cells that phenotyped negative for the corresponding antigens c, E and S.

Twelve days following the transfusion the direct antiglobulin test (DAT) had become positive for IgG. Anti-c+E+S+Fya were identified in the patient's plasma and anti-Fya eluted off red cells from the patient sample.

The haemoglobin, bilirubin, LDH and haptoglobin results following the transfusion are detailed in the table below.

	Pre-Transfusion	Days Post-Transfusion				
		Day 1	Day 2	Day 9	Day 11	Day 12
Haemoglobin (g/L)	89	108	105	111	95	75
Bilirubin (µmol/L)	19	19	19	79	98	94
LDH (U/L)					2224	
Haptoglobin (g/L)						<0.5

The event was classified as a non-severe (grade 1) DHTR. The imputability score was classified as certain.

CASE G

A 68 year old male was transfused with one unit of un-crossmatched emergency red cells of blood group O RhD negative and C-c+E-e+, before pre-transfusion testing was completed. The patient had received three units of red cells five months previously and the red cell antibody screen was negative at that time.

Anti-c+E was subsequently identified in the pre-transfusion plasma sample and the emergency red cell unit transfused was incompatible by IAT. A further three units of c-E- units were transfused two hours following the transfusion of the incompatible red cell unit.

Five days later the DAT was positive for IgG with anti-c+E eluted. The haemoglobin and bilirubin results post-transfusion of the incompatible red cell unit are detailed in the table below. LDH and haptoglobin levels were not tested.

	Days Post-Transfusion of the Incompatible Red Cell Unit					
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Haemoglobin (g/L)	79	80	88	83	78	85
Bilirubin (µmol/L)	25	39	42	38	54	58
Compatible Red Cells Units Transfused		1				1

The event was classified as a non-severe (grade 1) DHTR. The imputability score was classified as certain. Elution of anti-E may be explained by the Matuhasi-Ogata phenomenon, which is considered a nonspecific uptake of some IgG by red cells in the presence of another antibody that is specifically targeted against antigens on those red cells - see more at: http://www.bbguy.org/education/glossary/index.aspx?alphabet=M&id=184#sthash.JGRu9Bvm.dpuf

Table 16.3 details the specificities of the blood group antibodies implicated in the DHTR and DSTR events 2009 to 2014.

TABLE 16.3 DELAYED TRANSFUSION REACTIONS (IMPUTABILITY ≥3) 2009 – 2014 BY SPECIFICITY OF RED CELL ANTIBODY

Antibody Specificity	Number (Percentage)		
	Delayed Haemolytic	Delayed Serological	Total
Anti-Fy^{a}	5 (25%)	8 (10%)	13 (13%)
Anti-Jk^{a}	4 (20%)	17 (22%)	21 (21%)
Anti-c	2 (10%)	3 (4%)	5 (5%)
Anti-K	2 (10%)	6 (8%)	8 (8%)
Antibody to low frequency antigen	1 (5%)		1 (1%)
Anti-c + E	1 (5%)	7 (9%)	8 (8%)
Anti-C + e + Jk^{b}	1 (5%)	0 (0%)	1 (1%)
Anti-Fy^{b}	1 (5%)	3 (4%)	4 (4%)
Anti-Jk3	1 (5%)	1 (1%)	2 (2%)
Anti-Jkb	1 (5%)	10 (13%)	11 (11%)
Anti-K + Fy^{a} + S	1 (5%)		1 (1%)
Anti-E		11 (14%)	11 (11%)
Anti-Lu^{a}		3 (4%)	3 (3%)
Anti-M		3 (4%)	3 (3%)
Anti-E + K		2 (3%)	2 (2%)
Anti-S		2 (3%)	2 (2%)
Anti-E + S		1 (1%)	1 (1%)
Anti-E + c		1 (1%)	1 (1%)
Anti-Fy^{a} + Jk^{b}		1 (1%)	1 (1%)
Total	**20**	**79**	**99**
Blood Group			
Duffy	7 (30%)	12 (15%)	19 (18%)
Kidd	7 (30%)	29 (35%)	36 (34%)
Rh	4 (17%)	25 (30%)	29 (28%)
Kell	3 (13%)	8 (10%)	11 (10%)
MNSs	1 (4%)	5 (6%)	6 (6%)
Low frequency antigen	1 (4%)		1 (1%)
Lutheran		3 (4%)	3 (3%)

Unclassifiable Complications of Transfusion (UCT)

17

DEFINITION

Occurrence of an adverse effect or reaction temporally related to transfusion, which cannot be classified according to an already defined event, with no risk factor other than transfusion.

During 2014 there were 47 reports received of adverse events which could not be classified into a definitive category. Twenty eight of these were excluded from the analysis on the basis that the event could be attributable to a cause other than the transfusion. The remaining 19 events included in the analysis involved 14 female and 5 male recipients. Eighteen events involved red cell components and one event involved PAS apheresis platelets. The predominant clinical features of these UCT events are summarised in Table 17.1.

TABLE 17.1 UCT EVENTS (IMPUTABILITY ≥3) 2014 BY ASSOCIATED SIGNS AND SYMPTOMS

Symptom	Number of Events
Chest Pain	6
Dyspnoea	4
Hypertension	2
Other	2
Confusion	1
Infusion pain	1
Nausea	1
Tachycardia	2
Total	**19**

Reports Involving Paediatric Patients

18

During 2014 there were 26 events (7.3% of all events) involving recipients aged 15 years or younger. FNHTR reactions were the most frequent adverse event reported in this age group (58%). Table 18.1 details the event type and severity of adverse events occurring in paediatric patients.

TABLE 18.1 ADVERSE EVENTS (IMPUTABILITY ≥3) 2014 IN RECIPENTS ≤15 YEARS AGE BY EVENT TYPE

Event Type	Number	Percentage of Events	Gender		Severity Score		
			Female	Male	1	2	3
FNHTR	15	58%	6	9	14	1	
Allergic	8	31%	4	4	7		1
IBCT	2	8%	1	1	2		
UCT	1	4%		1	1		
Total	**26**		**11**	**15**	**24**	**1**	**1**

19 Adverse Events Associated with Fractionated Plasma Products

Adverse events associated with fractionated plasma products have a separate reporting procedure from those associated with fresh blood components (Appendix II). NZBS receives reports from clinicians and these are forwarded to the manufacturer, CSL Behring (Australia) Pty Ltd. Periodic reports are provided to the Centre for Adverse Reaction Monitoring (CARM). Since 2011 a causality score for adverse events associated with fractionated plasma products has been recorded.

During 2014 there were reports of 36 adverse events associated with fractionated plasma products. Of the 36 events, 32 involved adverse reactions and the remaining 4 reports involved administration of an incorrect product or dose. The events associated with an incorrect product or dose are described in Chapter 21: Incorrect Blood Components Transfused (IBCT).

All but six of the adverse events were classified as non-severe. Severe events were associated with the infusion of Intragam®P, Albumex®4 and Zoster Immunoglobulin-VF and were classified with a causality of possible or likely/probable. Two reports involved the transfusion of Albumex®4 to one patient.

CASE H. Life Threatening Event Involving Intragam®P

A 73 year old patient with a monoclonal gammopathy of uncertain significance (MGUS) and acquired von Willebrand Disease had previously been treated with IVIg to manage the von Willebrand related bleeding, with good clinical effect. He first received treatment in June 2012 when he received 180g Intragam®P over 2 days. He received a further dose of 90g Intragam®P in August 2012. It is reported that he was admitted to hospital in October 2012 with an allergic reaction but an association with Intragam®P was not made. In September 2014 he received a further dose of Intragam®P. The next day he developed itching on his arms and was started on antihistamines. Progressive erythema developed and he was admitted under Dermatology care with generalised erythroderma and was treated with Prednisone 60mg/day and wet wraps. Symptoms recurred after steroids were withdrawn and he was re-admitted. Skin biopsy showed superficial perivascular lymphohistiocytic inflammation, focal parakeratosis with mild spongiosis of the epidermis; summarised as subacute dermatitis with dermal hypersensitivity reaction. The most likely explanation was considered to be an adverse drug reaction to Intragam®P but other agents could not be excluded. Causality is highly probable.

CASE I. Severe Event Involving Albumex®4

A patient developed severe hypotension during infusion of a second 500 mL bottle of Albumex®4 as part of treatment for hypotension following an acute Bentalls procedure. The patient had a similar but milder reaction to Albumex®4 when administered on an earlier occasion. Causality is highly probable.

CASE J. Thrombotic Event Involving Prothrombinex®-VF

A 69 year old female with a background of SLE and antiphospholipid syndrome with recurrent thromboses was receiving warfarin prophylaxis when she presented to the emergency department with a 2-3 week history of melaena and falling haemoglobin. One week previously Hb 92 g/L. On presentation Hb 70 g/L and INR 3.6. Two units of red cells were transfused. Warfarin was discontinued and a dose of 4500 IU Prothrombinex®-VF (42 IU/kg) was administered with some difficulty due to ward technical issues. The first vial was infused over 6 minutes and the remainder, after a delay of several hours for re-supply, was infused over a less clearly defined period due to IV pump problems. The next day the INR was 1.1. An ultrasound performed the same day for increasing leg swelling showed extensive proximal venous thrombosis of the leg extending to the pelvic veins. Superficial thrombophlebitis of the arm was also noted. The platelet count fell from 273 to 97, and reached a nadir of 39 x 109/L three days after the Prothrombinex®-VF. As Prothrombinex®-VF contains small amounts of heparin, an antibody screen for heparin-induced thrombocytopenia (HIT) was performed and found to be negative. Intragam® P (2g/kg) and corticosteroids were given for possible post-transfusion purpura or immune thrombocytopenia. The patient received unfractionated heparin therapy followed later by re-introduction of warfarin. Leg swelling was decreasing when discharged 10 days after presentation and the thrombocytopenia had resolved. The event was considered a thrombotic complication of Prothrombinex®-VF. Causality is highly probable.

CASE K. Severe Event Involving Intragam®P

A 75 year old female developed rigors and hypotension that became progressively more severe after receiving Intragam®P. The patient had a background medical history of non-ischaemic dilated cardiomyopathy with mild LV systolic impairment, hypertension on therapy, paroxysmal atrial fibrillation and type II diabetes mellitus. A clinical diagnosis of anaphylaxis was considered. Volume overload was raised as a possible diagnosis. Causality is highly probable.

CASE L. Severe Event Involving Intragam®P

A 68 year old male with insulin-dependent diabetes mellitus, chronic renal failure, hypertension, cardiomyopathy and obesity developed septicaemia of suspected urinary tract origin. A second diagnosis of acute inflammatory demyelinating polyneuropathy/Guillain-Barré syndrome (AIDP/GBS) was subsequently made and treatment commenced with Intragam®P. The patient deteriorated during the latter stage of the first infusion of 39g. Ventricular tachycardia (VT) developed, resuscitation attempts were unsuccessful and the patient died. Causality is possible.

CASE M. Serious Event Involving Zoster Immunoglobulin-VF

A 10 year old child with acquired immune deficiency received Zoster Immunoglobulin-VF prophylaxis but subsequently developed chickenpox. Treatment with Acyclovir was provided and no further complication developed. Insufficient effect of Zoster Immunoglobulin-VF is noted. Causality is highly probable.

19 Adverse Events Associated with Fractionated Plasma Products continued

Table 19.1 shows the 36 adverse events by fractionated plasma product type. Additional information on events associated specifically with administration of Intragam®P is provided in Table 19.2.

TABLE 19.1 TRANSFUSION-RELATED ADVERSE EVENTS (ANY CAUSALITY) 2014 ASSOCIATED WITH FRACTIONATED PLASMA PRODUCTS

Product Type	Event Type	Number of Reports
Intragam®P	Various, see Table 20.2	24
Albumex®4	Hypotensive (2), allergic, tingling & erythema, wrong blood product	5
Albumex®20	Febrile	2
Prothrombinex®-VF	Thrombotic	1
RhD Immunoglobulin-VF	Wrong blood product	1
Evogam® (IV Immunoglobulin)	Muscle ache	1
Zoster Immunoglobulin-VF	Wrong dose	1
Biostate®	Chest pain	1
Total		**36**

TABLE 19.2 TRANSFUSION-RELATED ADVERSE EVENTS (ANY CAUSALITY) 2014 ASSOCIATED WITH INTRAGAM®P

Type of Reaction	Total	Causality				Severity		
		Unlikely	Possible	Probable	Highly probable	Non-severe	Severe	Life-threatening
Allergic	8	1	1	6		8		
Febrile	4		3	1		4		
Haemolytic	2			2		2		
Muscle pain	2			2		2		
Abdominal pain; felt hot	1		1			1		
Allergic, exfoliative dermatitis	1			1				1
Complex case with cardiac arrest	1		1				1	
Fatigue and possible haemolytic reaction	1		1			1		
Febrile event with severe hypotension	1			1			1	
Headache	1			1		1		
Pain	1		1			1		
Wrong dose	1				1	1		
Total	**24**	**1**	**8**	**14**	**1**	**21**	**2**	**1**

Summary of Adverse Events Associated with Fractionated Plasma

Between 2001 and 2014 a total of 317 adverse events associated with transfusion of fractionated plasma products have been reported. Intravenous immunoglobulin was implicated in 215 of the 317 (68%) reported TRAE (Table 20.1).

TABLE 20.1 TRANSFUSION-RELATED ADVERSE EVENTS ASSOCIATED WITH FRACTIONATED PLASMA PRODUCTS 2001 – 2014

	Products Associated with Reported Events												
	High volume IV or SC Immunoglobulins		Albumin Products		Coagulation Factor Concentrates			Small Volume Immunoglobulin Products					
Year	Intragam®P, Privigen, NextGen 16% Ig	Evogam®	Albumex®4	Albumex®20	Prothrombinex-HT / Prothrombinex®-VF	Biostate® / AHF	MonoFIX®-VF	Normal Immunoglobulin	Tetanus Immuno-globulin	Hepatitis B Immuno-globulin	Zoster Immunoglobulin	RhD Immunoglobulin / WinRho / RhoPhylac*	Total Reported for Year
2001	6		0	1	0	0	1	0	0	0	0	0	8
2002	8		0	1	0	0	0	0	0	0	0	0	9
2003	7		0	0	0	0	0	0	0	0	0	0	7
2004	4		1	0	0	0	0	0	0	0	0	0	5
2005	11		0	1	0	1	0	0	0	0	0	1	14
2006	13		0	1	1	2	0	0	1	0	0	2	20
2007	24		1	0	0	0	0	0	0	0	0	4	29
2008	15		6	0	0	0	0	0	0	0	0	0	21
2009	15		2	0	2	0	0	0	0	0	0	0	19
2010	26		3	0	2	2	2	0	1	0	0	10	46
2011	13		2	3	4	2	0	0	0	0	0	3	27
2012	16		3	4	1	0	0	1	0	0	0	8	33
2013	33		1	2	3	0	0	0	1	1	0	2	43
2014	24	1	5	2	1	1	0	0	0	0	1	1	36
Total	**215**	**1**	**24**	**15**	**14**	**8**	**3**	**1**	**3**	**1**	**1**	**31**	**317**
Percent	68%	0.3%	8%	5%	4%	3%	1%	0.3%	1%	0.3%	0.3%	10%	

** The majority of events involving RhD Immunoglobulin were 'exposure' type IBCT events in which a recipient received the product when it was not required or the wrong dose was administered.*

20 Summary of Adverse Events Associated with Fractionated Plasma continued

Of the 139 reported events from 2011 to 2014, only 8 (6%) were recorded as unlikely to have been associated with the transfusion of fractionated plasma products (Table 20.2).

TABLE 20.2 TRANSFUSION-RELATED ADVERSE EVENTS ASSOCIATED WITH FRACTIONATED PLASMA PRODUCTS 2011 – 2014 BY CAUSALITY

Year	Causality of Adverse Events Notified				Other issue including wrong product or dose	Total
	Unlikely	Possible	Probable	Highly probable		
2001- 2010	Causality not recorded prior to 2011					
2011	1	8	5	9	4	27
2012	2	6	3	11	11	33
2013	2	6	5	26	4	43
2014	3	10	0	18	5	36
Total	**8**	**30**	**13**	**64**	**24**	**139**
Percentage	6%	22%	9%	46%	17%	

Of the 317 TRAE associated with fractionated plasma products, allergic events were the most common (35%) followed by FNHTR (16%) (Table 20.3).

TABLE 20.3 TRANSFUSION-RELATED ADVERSE EVENTS ASSOCIATED WITH FRACTIONATED PLASMA PRODUCTS 2001 – 2014 BY EVENT TYPE

Year	Adverse Event Type										Total Reported Events
	FNHTR	Allergic	Pain	Thrombotic	Hypotensive	Haemolytic	Aseptic meningitis	Volume overload	Wrong product or dose	Other adverse events	
2001	2	5	0	0	0	1	0	0	0	0	8
2002	3	0	0	0	0	5	0	0	0	1	9
2003	0	4	0	0	0	3	0	0	0	0	7
2004	1	1	0	0	0	1	0	0	0	2	5
2005	2	4	0	0	0	1	3	0	0	4	14
2006	1	11	1	1	1	1	1	0	0	3	20
2007	5	15	1	0	1	0	1	1	0	5	29
2008	2	8	3	1	3	1	0	1	0	2	21
2009	1	14	2	1	0	1	0	0	0	0	19
2010	7	16	1	0	1	1	1	2	14	3	46
2011	7	7	0	1	0	1	0	0	4	7	27
2012	5	8	1	0	0	6	1	1	7	4	33
2013	7	9	14	1	0	4	0	0	3	5	43
2014	7	10	5	1	2	2	0	0	4	5	36
Total	**50**	**112**	**28**	**6**	**8**	**28**	**7**	**5**	**32**	**41**	**317**
Percentage	16%	35%	9%	2%	3%	9%	2%	2%	10%	13%	100%

Summary of Adverse Events Associated with Fractionated Plasma continued

When comparing the mean age of transfusion recipients by event type (Table 20.4) with that of the total reported events (43 years), a significant difference is seen only in events associated with fluid overload (p=<0.001). Although there is a significant difference when comparing the mean age of recipients of wrong product or dose (29 years) with that of all reported events, the product involved was mainly RhD Immunoglobulin and includes administration to both mothers and babies.

TABLE 20.4 TRANSFUSION-RELATED ADVERSE EVENTS ASSOCIATED WITH FRACTIONATED PLASMA PRODUCTS 2001 – 2014 BY EVENT TYPE ALONG WITH THE MEAN AGE OF TRANSFUSION RECIPIENTS

Year	Adverse Event Type										
	Febrile	Allergic	Pain	Thrombotic	Hypotensive	Haemolytic	Aseptic meningitis	Volume overload	Wrong product or dose	Other adverse events	Total Reported Events
2001	36	45	-	-	-	81	-	-	-	-	47
2002	43	-	-	-	-	38	-	-	-	78	44
2003	-	34	-	-	-	31	-	-	-	-	33
2004	1	21	-	-	-	28	-	-	-	51	30
2005	23	59	-	-	-	13	17	-	-	27	32
2006	60	46	31	73	-	92	32	-	-	41	46
2007	32	43	44	-	48	-	44	59	-	48	43
2008	50	45	57	70	36	0	-	67	-	47	46
2009	80	48	52	82	-	52	-	-	-	-	52
2010	38	45	18	-	49	47	38	50	25	44	37
2011	63	34	-	25	-	30	-	-	28	54	45
2012	52	44	43	-	-	37	45	66	35	19	40
2013	32	60	57	0	-	41	-	-	20	64	49
2014	48	66	37	70	76	56	-	-	35	54	54
Mean age	**43**	**45**	**42**	**53**	**42**	**42**	**35**	**61**	**29**	**48**	**43**

21 Incorrect Blood Component Transfused (IBCT)

DEFINITION

IBCT is the transfusion of a blood component or product that was intended for another patient or one that did not meet the patient's requirements.

During 2014 there were 20 IBCT events reported (Table 21.1). This compares to 25 IBCT events reported in 2013.

TABLE 21 .1 IBCT EVENTS 2014

IBCT Event Type of Product	Description	Site of Error
Incorrect product/dose Red Cells (5) RhD Immunoglobulin-VF (3) Cryoprecipitate (1) Intragam®P (1)	Fibrinogen reported as <0.3.g/L. When queried, laboratory investigation showed the correct result to be >10g/L. Error source was found to be at result entry into laboratory IS system as the code G10 was used instead of >10, translating the result <0.3g/L to hospital records. Cryoprecipitate transfused on the result of <0.3g/L.	Laboratory
	Incorrect dose RhD Immunoglobulin-VF issued & administered. (3 events).	Laboratory
	Red cell unit expired at midnight. Removed from issuing refrigerator 0825hrs next morning by hospital staff member. Checked by two staff prior to administration but still transfused.	Clinical
	Prescription for Intragam®P was ambiguous. Staff interpreted dose to be given weekly rather than monthly.	Clinical
	Red cell unit (group O RhD positive) issued for Patient A (female group O RhD positive) was transfused to Patient B (male group A RhD positive).	Clinical
	Red cell unit (group A RhD negative) issued for Patient E (group A RhD negative) was transfused to Patient P (group A RhD positive).	Clinical
	Anti-K identified 1997 under surname AAAXAAA. In 2014 a search for historical information under surname entered as AAAAAA failed to detect the earlier result. A red cell antibody screen was negative and 6 red cell units transfused. Error discovered 3 days later. One of 6 units found to be K positive, all units transfused were found retrospectively to be IAT compatible. At this point the red cell antibody screen was negative however DAT IgG 1+ positive and anti-K eluted. Six days post transfusion anti-K identified in patient's plasma.	Laboratory
	A male patient was grouped as A RhD negative but entered manually into the National Blood Management System, eProgesa, as A RhD positive. Transfused with 2 units group A RhD positive red cells. Anti-CDE subsequently identified. Two staff determined separately the ABO RhD group of the patient but, contrary to standard operatory procedure, the same person entered both groups incorrectly into eProgesa and then issued the two units of red cells.	Laboratory
Non-irradiated components transfused Red cells (1)	Patient required irradiated components, non-irradiated red cells issued and transfused.	Laboratory
Inappropriate transfusion RhD Immunoglobulin-VF (6) Platelets (1) FFP (1)	RhD Immunoglobulin-VF issued and administered to RhD negative patient previously sensitised to RhD. (3 events)	Clinical
	Jehovah Witness. Retroperitoneal haemorrhage, INR >10. Transfused with two units FFP without discussion and consent of the patient.	Clinical
	RhD Immunoglobulin-VF administered to RhD positive woman. (3 events)	Clinical (2) Laboratory (1)
	Advised to transfuse platelets only if patient's count ≤62 x 109/L. Patients platelet count pre-transfusion was 92 x 109/L and platelets transfused.	Clinical
Other Blood Product (1)	Two brothers required the same blood product. Product issued for one brother was administered to the other.	Clinical

Transfused (IBCT) continued

Issues of RhD Immunoglobulin where RhD Status of Patient Unknown

Between 2005 and 2014, 41% (20) of the reported IBCT events relating to the administration of RhD Ig involved administration to RhD positive women. The NZBS protocol for the issue of anti-D immunoglobulin requires that patient records in eProgesa be checked for confirmation that the blood group is RhD negative and that there is no history of RhD sensitisation, i.e., the presence of actively produced anti-D. An investigation was undertaken to determine the number of vials of RhD Ig that were issued to RhD positive patients and to patients where the RhD status was unknown within NZBS.

Between July 2009 and June 2014, NZBS sites issued 21,513 vials of RhD Ig, equating to 49.2% of the total national issues of RhD Ig. In five cases RhD Ig was issued to women known to be RhD positive. The RhD status of the patient was unknown in 5,519 cases (25.7%). The percentage of issues to patients of unknown RhD status ranged from 5.4% to 38.3% across the six NZBS sites.

Of the 5,519 instances where RhD Ig was issued to a patient of unknown RhD status, the RhD status was subsequently determined in 1,719. In 8 of these cases the patient was subsequently found to be RhD positive. The overall rate of issues of RhD Ig to RhD positive women (13) was 6 /10,000. The low rate of RhD positivity amongst the 'status unknown' women subsequently tested suggests that the RhD status was not unknown to the requesting clinician in the majority of cases. RhD status is likely to have been performed in community laboratories and these results are in most cases unavailable to NZBS at the time of request for RhD Ig.

22 Near Miss Events

DEFINITION

A near miss event is an error or deviation from standard procedure or policy that is discovered before the transfusion and that, if not discovered, would have led to an inappropriate transfusion and has potential for an adverse reaction in the recipient.

Near miss events are usually reported to a local incident management system (within a DHB) so that appropriate investigations are undertaken and the necessary education and preventive actions are implemented. During 2014 there were 30 events identified from the NZBS incident management system. These events are summarised in Table 22.1.

TABLE 22.1 NEAR MISS EVENTS 2014 BY ERROR TYPE AND SITE

Error		Site of Error			
		Blood Bank	Processing	Clinical	Total
Wrong product/component issued (including wrong dose or wrong patient)					
RBC	5	8	1	2	11
Platelets	3				
Anti-D immunoglobulin	2				
Other blood products	1				
Irradiation errors			12		12
Labelling errors		1			1
Data entry		2			2
Expiry of blood components		2		1	3
Other				1	1
Total		**13**	**13**	**4**	**30**

CASE N

Patient A was admitted to the Emergency Department with a head injury. Her friend thought it would be "funny" to give the medical staff her own details instead of the correct details for the patient. A pre-transfusion specimen was taken and processed in the blood bank under the wrong details. The Emergency Department contacted the blood bank the following morning to inform them of the event.

CASE O

Hospital A received a pre-transfusion sample from a patient who had been ABO RhD grouped at Hospital B. The blood obtained in Hospital A was grouped as B RhD positive, while the group obtained at Hospital B was group A RhD positive. Hospital B blood bank was contacted and it was subsequently found that while both the first and confirmation groups were typed as B RhD positive they both had been entered manually into eProgesa as group A RhD positive. As it was a new patient, no historical information was available to compare the result with. A new pre-transfusion sample was requested by Hospital A to ensure the correct grouping, however the patient was discharged before a new specimen could be taken. The blood bank at Hospital B amended their results.

CASE P

Ward staff requested in error both 1000 IU Prothrombinex™-VF (prothrombin complex concentrate) and 1000 IU Thrombotrol®-VF (antithrombin III concentrate) for a patient at the same time. The error originated from a nursing educator confusing the two products and believing that Thrombotrol®-VF was a new trade name for prothrombin complex concentrate. Incorrect advice was given to a new nursing graduate. No error in prescribing was noted. In-service education on both plasma products to be provided to the staff.

CASE Q

A red cell unit was received by a blood bank as an irradiated unit. The Rad-Sure irradiation indicator stated 'NOT irradiated'. The Rad-Sure label had been signed and dated and the unit has been transformed in eProgesa as an irradiated product and the expiry date amended to 14 days post-irradiation.

23. NZBS Wrong Blood in Tube (WBIT) Events

A "wrong blood in tube", sometimes referred as "wrong name on tube", error is when the pre-transfusion sample was collected from the wrong patient or the sample was labelled with the details of another patient. These types of errors are normally identified when ABO and RhD testing shows a different blood group from the historic results for the patient in ePrognosa. A current WBIT is where the sample received is proven to be incorrectly labelled. A historic WBIT is where the historic grouping result was likely based on a sampling or labelling error. Silent errors can occur when the wrong patient is bled but where the two patients have the same ABO and RhD groups. The corrected WBIT rate is calculated using the following equation:

$$\text{Corrected WBIT rate} = \frac{\text{Number of historical groups}}{\text{Number of WBIT} \times 1.6}$$

The correction factor 1.6 is based on New Zealand blood group frequencies and corrects reported rates to take into account silent WBIT events.

Rather than relying on voluntary Haemovigilance reporting of near miss events, the NZBS incident management system collects accurate WBIT data from the six NZBS Blood Banks. In 2013 historic ABO RhD blood groups were available in ePrognosa for 65.3% (range 63.4% to 67.5%) of all pre-transfusion samples submitted to NZBS Blood Banks. There were 14 WBIT errors identified. In five cases the historic result was assumed to be incorrect. Table 23.1 shows the corrected WBIT rate for the 9 current WBIT events reported by the NZBS Blood Banks in 2014. The overall corrected WBIT rate was 1.6 per 10,000 samples (1:6,439).

TABLE 23.1 NZBS WBIT EVENTS 2014 BY BLOOD BANK SITE

	WBIT Events	Historic Groups	WBIT Frequency[1]	Rate / 10,000 Specimens (95% CI)[1]
Wellington	5	15,173	1:1,897	5.3 (2.5 to 10.6)
Christchurch	1	13,966	1:8,729	1.1 (-0.1 to 5.2)
Auckland	2	31,911	1:9,972	1.0 (0.2 to 3.0)
Waikato	1	19,652	1:12,283	0.8 (-0.1 to 3.7)
Dunedin	0	6,473		0
Palmerston North	0	5,551		0
NZBS Total	**9**	**92,726**	**1:6,439**	**1.6 (0.9 to 2.6)**

[1] *Corrected to account for silent errors.*

Table 23.2 shows the cumulative number of WBIT errors for the six NZBS Blood Banks over an eight year period from 2007 to 2014. The overall corrected WBIT rate was 2.5 per 10,000 samples (1:4,000). An international study (Dzik et al. Vox Sanguinis 2003: 85; 40-47) involving 10 countries reported an approximate median WBIT rate of 5 per 10,000 samples (1:2,000).

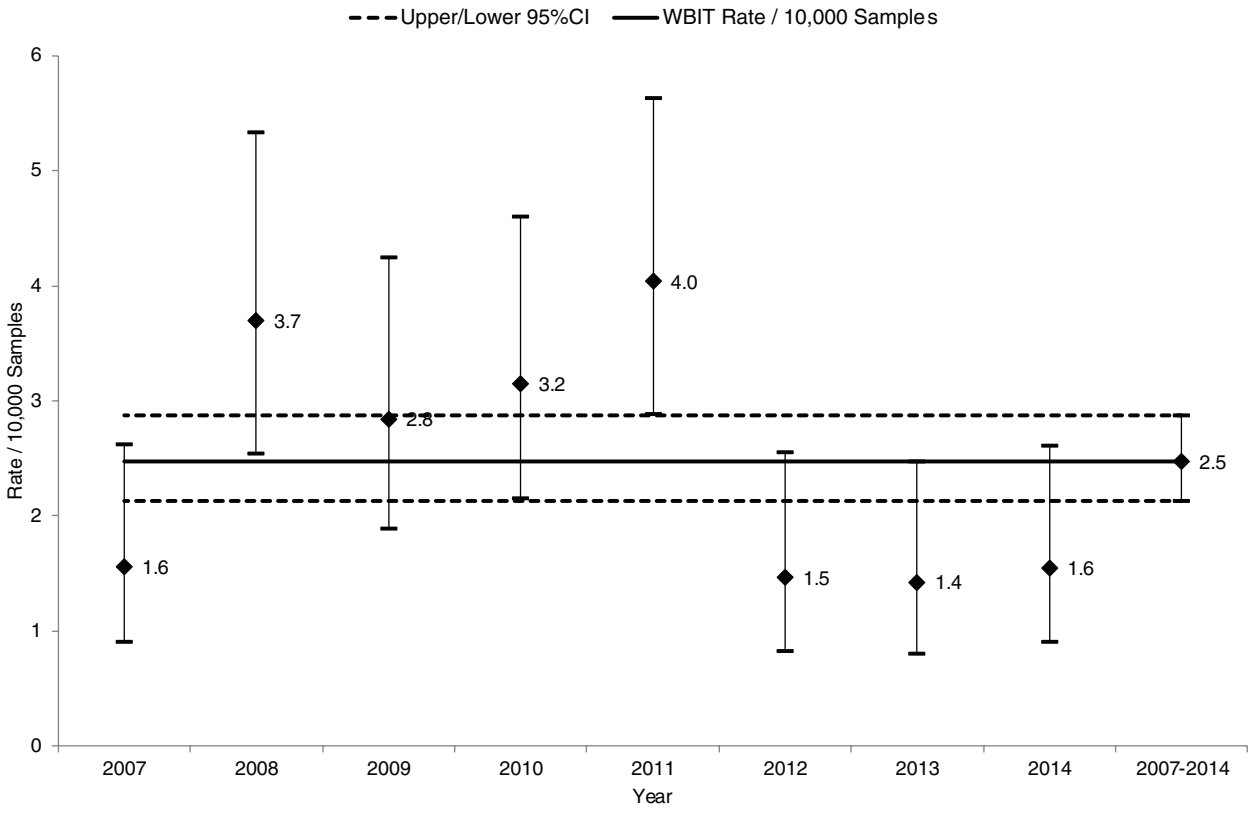
TABLE 23.2 NZBS WBIT EVENTS 2007 – 2014 BY BLOOD BANK SITE

	WBIT Events	Historic Groups	WBIT Frequency[1]	Rate / 10,000 Samples (95% CI)[1]
Wellington	36	102,714	1:1783	5.6 (4.3 to 7.3)
Palmerston North	7	45,296	1:4044	2.5 (1.3 to 4.5)
Auckland	34	240,012	1:4412	2.3 (1.7 to 3.0)
Waikato	15	140,620	1:5859	1.1 (1.1 to 2.6)
Dunedin	5	49,306	1:6163	1.6 (0.8 to 3.3)
Christchurch	11	119,886	1:6812	1.5 (0.9 to 2.4)
NZBS Total	**108**	**697,832**	**1:4038**	**2.5 (2.1 to 2.9)**

[1] *Corrected to account for silent errors.*

The annual NZBS WBIT event rate per 10,000 (95% CI) samples from 2007 to 2014 is shown in Figure 23.1.

FIGURE 23.1 ANNUAL NZBS WBIT EVENT RATE 2007 – 2014



24 Bacterial Monitoring of Platelet Concentrates

Bacterial contamination in platelets can result in sepsis with the associated morbidity occasionally leading to death and as such continues to be a serious risk of transfusion. Bacteria will either enter the component at the time of venepuncture or more rarely arises due to an occult infection in the donor but can also enter due to a breach of the closed system during processing. The warm storage temperature of 22 ± 2°C combined with the platelet component itself is an ideal medium for some, though not all, bacteria to flourish. The likelihood of detecting bacteria in platelet components and the consequent risk of clinical sepsis in the recipient increases with the cumulative age of the platelet.

International Haemovigilance programmes report the rate of septic reactions to bacterially contaminated platelets as 0.001 – 0.002% (1 in 100,000 – 1 in 50,000) and the risk of death from a contaminated platelet as 0.0002 – 0.0004% (1 in 500,000 – 1 in 250,000). The Serious Hazards of Transfusion (SHOT) UK Haemovigilance 2009 report identified approximately 1 septic reaction per 75,000 platelets issued and 1 death per 273,000 platelets issued. Similar data has been reported by both the USA and French Haemovigilance where septic reactions are 1 in 83,000 and 1 in 50,000 respectively. The rate of fatal reactions reported by the USA is approximately 1 in 500,000 while France reports 1 in 300,000. These risks will however have reduced significantly as a consequence of the introduction of specific measures designed to both reduce the likelihood of contamination occurring and to detect the presence of contamination prior to the component being transfused.

During the period 2008 – 2014 two reports were received by the NZBS haemovigilance office that meets the criteria utilised by the SHOT scheme. In the same period approximately 150,000 platelet components were issued to hospitals. Both of the reports involved platelet components that had not been screened for evidence of bacterial contamination prior to issue. The reactions were classified as 'not severe'. A further two reports of possible bacteria contamination were received involving platelet components that were screened by NZBS for evidence of bacterial contamination on day 2 of their shelf life. In both cases a non-transfusion source for the contamination was identified and the imputability of the event was classified as 'possible'. Both reports were classified as 'non-severe'.

Blood service organisations, including the New Zealand Blood Service (NZBS), have introduced initiatives aimed at reducing the incidence of bacterial contamination in blood components including improved skin disinfection at the venepuncture site and diversion of the first 30 – 50mL of the donation in order to avoid skin commensals contaminating the donation. These measures are widely accepted to reduce the risk of contamination by 60 – 70%.

Increasing concern relating to bacterial transmission of platelet concentrates has led a number of Blood Services to introduce systems to detect the presence of bacterial contamination of platelet components. Canada, the Netherlands and Hong Kong were the first countries to introduce a formal requirement for the use of pre-release bacterial detection systems for platelet concentrates. In recent years many other countries have followed. The AABB introduced a formal requirement for screening of platelet components in 2004 and have required testing to utilise either FDA approved systems or systems shown to have equivalent sensitivity since 2011. The Australian Red Cross Blood Service (ARCBS) implemented a pre-release culture system across its sites in April 2008. This involves culture on day one post production with no quarantine of cultured platelets.

A number of systems are currently available to support bacterial detection in platelet concentrates. These can either be used to monitor the level of contamination, as required by the Council of Europe Guide, or to support release of platelets on a 'negative at release' basis. NZBS commenced a pilot study to assess the frequency of bacterial contamination during October 2003. The scheme has been progressively rolled out such that by the end of 2007 all sites within NZBS that manufacture platelets were participating. The proportion of components tested increased significantly during 2014 such that approximately 95% of all apheresis collections and platelet pools were cultured. Apheresis collections are normally split into two components (doses) soon after production. Currently only one of the two components is tested. The detailed results of day 2 testing undertaken by individual sites during 2014 is shown in Table 24.1.

Bacterial Monitoring of Platelet Concentrates continued

TABLE 24.1 PROPORTION OF PLATELET COMPONENTS BACTERIALLY CULTURED IN 2014 BY PROCESSING SITE

Site	Apheresis Platelets			Pooled Platelets		
	Collections	Components Tested	% Tested	Produced	Components Tested	% Tested
Auckland	1,288	1,190	92.4%	4,431	4,152	93.7%
Wellington	680	653	96.0%	1,950	1,902	97.5%
Waikato	552	545	98.7%	1,847	1,817	98.4%
Christchurch	551	431	78.2%	2,059	2,037	98.9%
Manawatu	258	242	93.8%			
Otago	209	205	98.1%			
Total	**3,538**	**3,266**	**92.3%**	**10,287**	**9,908**	**96.3%**

The NZBS protocol for bacterial monitoring involves testing of platelets at day 2 of storage. A 6mL sample of the concentrate is used to inoculate an aerobic BacT / Alert culture bottle. The bottles are cultured until a positive signal is obtained or until the platelet concentrate has expired. The platelets are available for release immediately following sampling and will be withdrawn from inventory in the event that a positive culture signal is obtained. Results of testing undertaken during 2014 are shown in Table 24.2.

TABLE 24.2 RESULTS OF DAY 2 TESTING OF PLATELET COMPONENTS DURING 2014

	Total Components Sampled	Number Reactive	% Reactive	Frequency of Reactives
National All reactives	13,174	20	0.15%	1:659
National Confirmed reactives	13,174	9	0.07%	1:1464

24 Bacterial Monitoring of Platelet Concentrates continued

The data indicates that NZBS systems compare well with published data. The contamination rate of platelets identified using the BacT / ALERT culture system is reported to be between 0.02 – 0.3% (1 in 5,000 – 3 in 1,000).

Published data indicates that bacterial culture of samples collected at day one of storage reduces but does not eliminate the risk of subsequent bacterial growth in platelet concentrates. Data from Ireland and the American Red Cross published during 2007 indicates that this testing might only detect 50% of contaminated platelet concentrates. This view is supported by the results of day 8 testing of expired platelet components undertaken by NZBS. Data for 2014 is shown in Table 24.3. A review of data for the 8 year period (2007 – 2014) identified that 27 of 23,134 day 8 components cultured were reactive (0.12%) with 9 being confirmed (0.04%).

TABLE 24.3 RESULTS OF DAY 8 TESTING OF OUT-OF-DATE PLATELET COMPONENTS DURING 2014

	Total Components Sampled	Number Reactive	% Reactive	Frequency of Reactives
National All reactives	2,564	12	0.47%	1:2564
National Confirmed reactives	2,564	0	0	<1:2564

In line with international practice, NZBS is currently developing systems to support culturing 100% of platelet components. This will be achieved by extending the platelet shelf-life to 7 days and therefore will not lead to any increased risk of expiry. Testing will be extended to include the use of both aerobic and anaerobic culture bottles with an increased sample volume. This will improve system sensitivity and reduce any additional risk associated with the longer shelf life. The approach will mirror that currently in place in the United Kingdom. Medsafe approval for the changes was obtained in January 2015 and plans are currently being progressed to support implementation by the end of 2015.

Donor Infectious Disease Screening and Transfusion-Transmitted Infections (TTI)

25

In New Zealand all blood donations are screened for hepatitis B surface antigen (HBsAg), HBV DNA, anti-HCV, HCV RNA, anti-HIV-1/2, HIV RNA and syphilis antibody. All new donors are also tested for anti-HTLV-I/II. Additional testing is performed on selected donations, e.g., CMV IgG for fetal and neonatal transfusions, Trypanasoma cruzi (Chagas) and malarial antibody tests in donors who may pose a risk due to residence and/or travel to affected areas.

During 2014 there were 162,337 donations collected from 79,260 donors. Of these donors 85% were repeat donors and 15% previously untested new donors.

Table 25.1 shows the number of donors with confirmed positive serology in 2014. There were 10 donors confirmed positive for HBV and 5 confirmed positive for HCV. One confirmed HIV positive new donor was identified during the year.

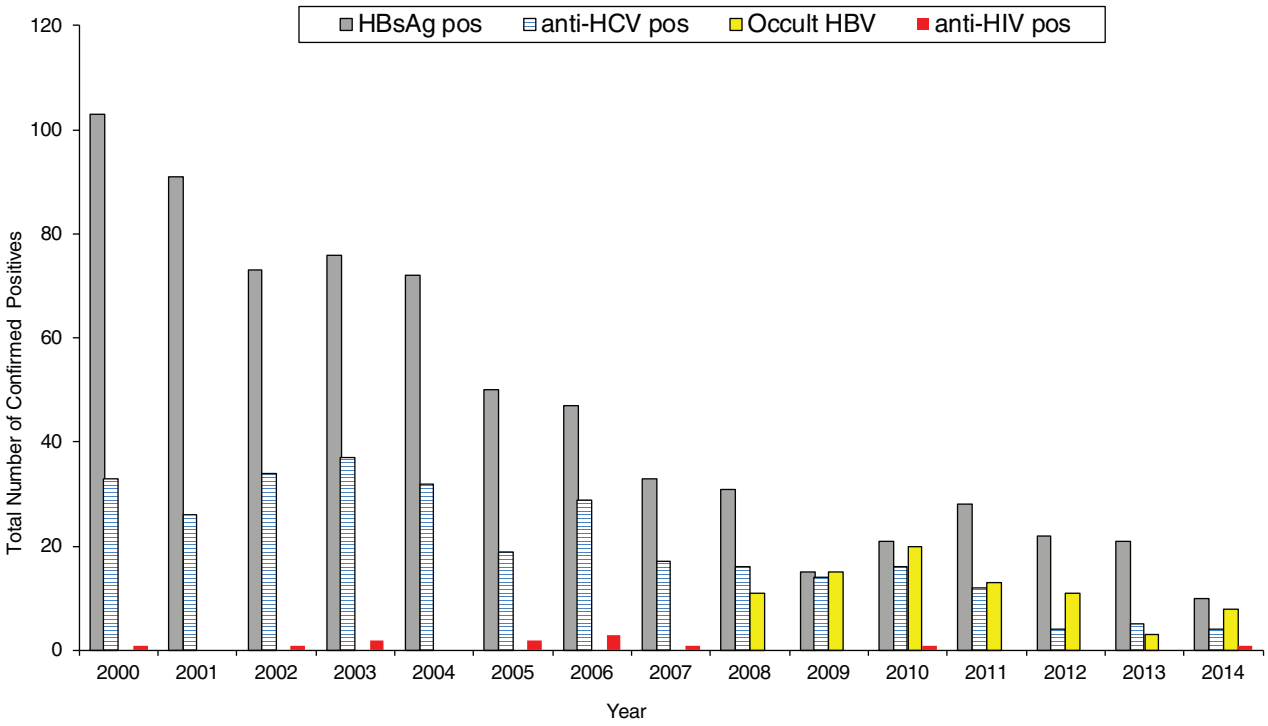
TABLE 25.1 DONORS WITH CONFIRMED POSITIVE INFECTIOUS DISEASE SEROLOGY 2014

		HBV	HCV	HIV	Syphilis	HBV Occult	HTLV I/II
Number	New Donors (n = 12,063)	10	4	1	4	3	0
	Repeat Donor (n = 67,197)	0	1	0	3	6	0
	Total Donors (n = 79,260)	10	5	1	7	9	0
Rate Per 100,000 Donations	New Donors	82.9	33.2	8.3	33.2	24.9	
	Repeat Donors	0.0	1.5	0.0	4.5	8.9	
	All Donations	12.6	6.3	1.3	8.8	11.4	
Frequency of Positive Donors	New Donor	1:1,206	1:3,016	1:12,063	1:3,016	1:4,021	
	Repeat Donor		1:67,197		1:22,399	1:11,200	
	Overall Donor Frequency	1:7,926	1:15,852	1:79,260	1:11,323	1:8,807	

25 Donor Infectious Disease Screening and Transfusion-Transmitted Infections (TTI) continued

Figure 25.1 shows the number of confirmed positive results each year from 2000 to 2014. This shows a consistent reduction in detection rates for each of the main markers. Occult hepatitis B infection is defined as 'the presence of HBV DNA in donor plasma without detectable HBsAg outside the window period'. Detection of these donors only became possible following the implementation of HBV DNA testing in 2007.

FIGURE 25.1 ANNUAL NUMBER OF DONORS WITH CONFIRMED POSITIVE INFECTIOUS DISEASE SEROLOGY 2000 – 2014



Residual Risk of Viral Infection from Transfusion of Fresh Blood Components

26

Despite no reported cases of HIV or hepatitis C transfusion-transmitted infection in New Zealand since testing was introduced in 1986 and 1992 respectively, these two viruses remain of particular concern to recipients. In line with international best practice, the approach of NZBS to this has been to refine donor selection and to test each donation for evidence of past or current infection.

Rates of infected donations are now so low that modelling is required to derive the risk to recipients. A number of models using infectious screening test results from donations have been developed to calculate the risk. All methodologies assume that donations made during the window period of infection represent the dominant likely source of risk. This is a reasonable assumption for HIV and hepatitis C but is less accurate for hepatitis B where, from experience, infection from occult carriers is the greater source of risk.

The best described and most robust model uses the incidence of new infections between donations, together with the window period of the virus, to derive a risk that a donation is in the window period. This works well for repeat donors but does not work for first time donors as there is no inter-donation interval for first time donors.

Several approaches have been described to calculate the risk for first time donors. However the results vary depending on the model and its assumptions. We have used an Australian model that derives the risk based on the window period of the infection and the time taken for the infection to be diagnosed. Although this model is not as robust in its assumptions as the repeat donor model, the impact is offset by first time donors accounting only for approximately 6% of donations during the period studied.

The data from first time and repeat donors is analysed using the two models in a Monte Carlo simulation to take account of the degree of imprecision around the window periods, proportion of donors with identifiable infections and, for first-time donors, the duration of undiagnosed infections. This simulation generated the results shown in Table 26.1.

TABLE 26.1 RESIDUAL RISK ESTIMATES FOR HUMAN IMMUNODEFICIENCY VIRUS, HEPATITIS B AND HEPATITIS C TRANSFUSION-TRANSMITTED INFECTION IN NEW ZEALAND

Infection	Mean Risk	95% Prediction Interval
HIV	1 in 9.2 million	1 in 2.5 – 32.8 million
Hepatitis C	1 in 6.9 million	1 in 3.6 – 12.5 million
Hepatitis B	1 in 0.8 million	1 in 0.4 – 1.4 million

Although the modelled risk for hepatitis B is greater than for hepatitis C and HIV, the true risk to patients is harder to establish. This is because the model for calculating hepatitis B risk does not take the prevalence of donor occult hepatitis B infection or recipient HBV immunity into account. Occult hepatitis B is a state where the liver is infected by hepatitis B but the virus is only multiplying intermittently and at low levels. As a result, the screening tests for hepatitis B are negative, but very low levels of viral DNA, enough to cause infection, may still be present. As the New Zealand population has a relatively high proportion of hepatitis B core antibody positive donors, reflecting past infection, the subset of donors with occult hepatitis B is correspondingly higher than many Western countries. This would increase the risk. The model also does not take into account the proportion of recipients who will be immune to hepatitis B, either from vaccination or past infection. Neither occult infection nor vaccination effect estimation of TTI risk for HIV or hepatitis C. Despite these uncertainties, the risks of transfusion-transmitted hepatitis B in NZ, and those of HIV and hepatitis C, remain very small.

27 Adverse Events Associated with Blood Donation

The year on year number of annual blood donations by donation type is shown in Table 27.1. The decline in plateletpheresis donations since 2012 is due to a change at a number of NZBS sites from a 60:40 to 40:60 ratio of apheresis to platelet pools for the production of platelet components.

TABLE 27.1 ANNUAL NUMBER OF BLOOD DONATIONS 2005 – 2014 BY DONATION TYPE

Year	Number							
	Whole Blood		Plasmapheresis		Plateletpheresis		Total	
	Donors	Donations	Donors	Donations	Donors	Donations	Donors	Donations
2005	95,382	156,684	1,227	6,479	979	5,098	97,588	168,261
2006	91,929	151,934	2,647	12,880	957	5,148	95,533	169,962
2007	88,584	150,308	4,064	23,514	957	5,493	93,605	179,315
2008	90,364	152,760	4,190	26,985	1,009	5,998	95,563	185,743
2009	89,159	151,689	3,012	18,106	1,143	6,578	93,314	176,373
2010	89,623	153,044	3,407	18,243	1,136	6,499	94,166	177,786
2011	86,986	147,093	4,723	28,886	1,119	6,491	92,828	182,470
2012	83,040	139,845	5,037	30,179	1,138	6,527	89,215	176,551
2013	75,069	125,684	5,078	29,585	830	4,942	80,977	160,211
2014	72,754	120,668	5,910	38,099	595	3,570	79,259	162,337

Adverse Events Associated with Blood Donation continued

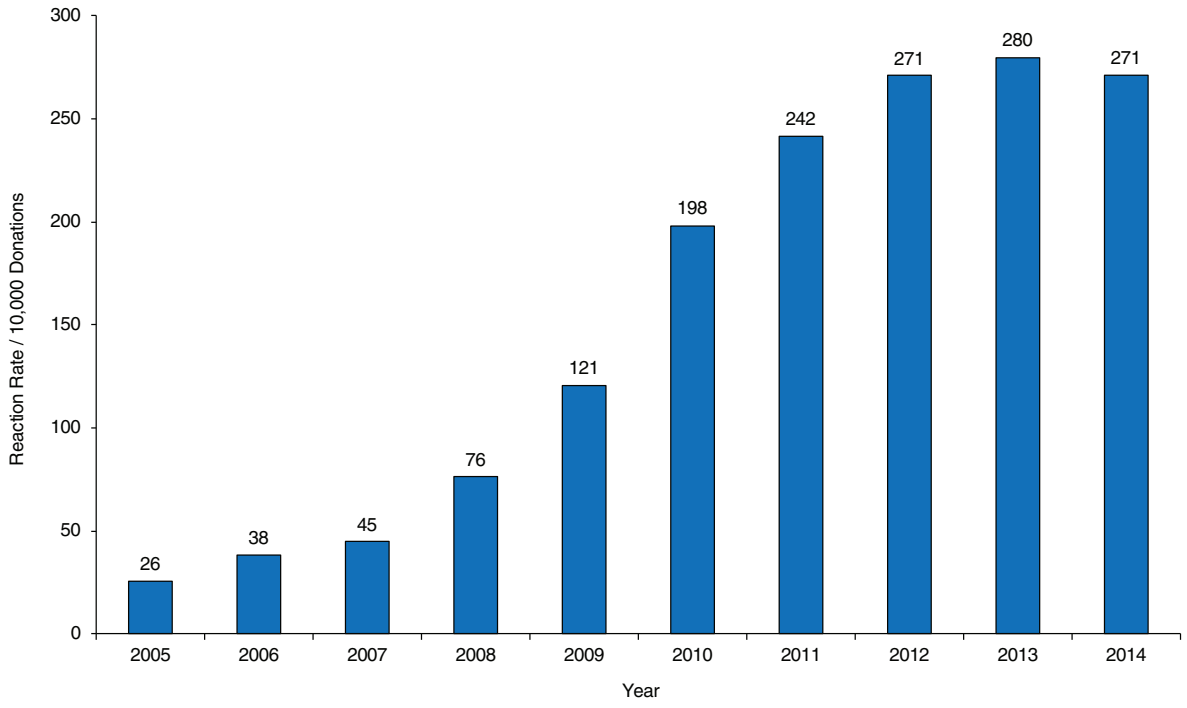
27

Adverse events associated with blood donation can occur during or after collection of the donation. Delayed complications are defined as a complication which has occurred after the donor has left the donation site. Delayed complications are notified either by a telephone call, personal visit, email or letter.

NZBS utilises definitions for these adverse events contained in the Standard for Surveillance of Complications Related to Blood Donation (2008) developed by the International Society of Blood Transfusion Working Party on Haemovigilance (Appendix III). A standardised national form is used by all collection sites to record the information for each donor adverse event (Appendix IV).

The annual reported donation-related adverse event rate per 10,000 donations has remained similar for the last three years (Figure 27.1). Prior to this the increases seen likely reflected efforts within NZBS to improve consistency of reporting across the sites.

FIGURE 27.1 ANNUAL DONATION-RELATED ADVERSE EVENT RATE PER 10,000 DONATIONS 2005 – 2014



During 2014 there were 162,337 donations (120,668 whole blood, 38,099 plasmapheresis and 3,570 plateletpheresis donations) collected. Adverse events were reported in relation to 4,407 of the donations and involving 4,076 donors. The overall frequency of reported donation-related adverse events was 1:37. Adverse events are more frequently reported with apheresis procedures, particularly plateletpheresis, than whole blood donations (Table 27.2).

TABLE 27.2 DONATION-RELATED ADVERSE EVENTS 2014 BY COLLECTION METHOD

Procedure	Donors	Donations with Events	Total Donations	Frequency	Rate / 10,000 Donations (95%CI)
Whole blood donation	3,009	3,103	120,668	1:39	257.2 (240.7 to 258.3)
Plasmapheresis	794	895	38,099	1:43	234.9 (194.5 to 223.2)
Plateletpheresis	273	409	3,570	1:9	1145.7 (681.9 to 856.6)
All apheresis procedures	1,067	1,304	41,669	1:32	312.9 (241.3 to 271.7)
Total procedures	**4,076**	**4,407**	**162,337**	**1:37**	**271.5 (243.6 to 258.8)**

27 Adverse Events Associated with Blood Donation continued

A number of donors experienced more than one adverse event with a single donation so in total there were 4,888 reported events with 3,218 involving whole blood donations and 1,670 involving apheresis procedures. Immediate vasovagal reactions and bruising/haematoma were the most common events associated with donation. For whole blood donation the most common event (54.8%) was an immediate vasovagal reaction. For apheresis procedures the most common event (64.2%) was bruising/haematoma. Donation-related adverse events by reaction type and collection method are shown in Table 27.3 and Table 27.4.

TABLE 27.3 DONATION-RELATED ADVERSE EVENTS 2014 BY REACTION TYPE

Adverse Event	All Blood Donations (Total Collections 162,337)			
	Number Events[1]	Percentage	Frequency	Rate / 10,000 Donations (95% CI)
Immediate Vasovagal	2,092	50.9%	1:78	129 (123 to 134)
Haematoma	1,462	35.6%	1:111	90 (86 to 95)
Painful Arm	207	5.0%	1:784	13 (11 to 15)
Delayed Vasovagal	133	3.2%	1:1,221	8 (7 to 10)
Nerve Irritation	109	2.7%	1:1,489	7 (6 to 8)
Other	52	1.3%	1:3,122	3 (2 to 4)
Delayed Bleeding	25	0.6%	1:6,493	2 (1 to 2)
Allergy	11	0.3%	1:14,758	<1 (0 to 1)
Nerve Injury	8	0.2%	1:20,292	<1 (0 to 1)
Arterial Puncture	4	0.1%	1:40,584	<1 (0 to 1)
Thrombophlebitis	2	0.05%	1:81,169	<1 (0 to 1)
Tendon Damage	1	0.02%	1:162,337	<1 (0 to 1)
Total	**4,106**		**1:40**	**253 (245 to 261)**

[1] *Apheresis-specific complications excluded, i.e., citrate reactions and red cell return failures.*

TABLE 27.4 DONATION-RELATED ADVERSE EVENTS 2014 BY REACTION TYPE AND COLLECTION METHOD

Adverse Event	Type of Blood Donation							
	Whole Blood (Total Collections = 125,684)				Apheresis (Total Collections = 34,527)			
	Events	% All Events		Rate / 10,000 Donations (95% CI)	Events	% All Events	Freq.	Rate / 10,000 Donations (95% CI)
Immediate Vasovagal	1,902	54.8%	1:63	158 (151 to 165)	190	21.4%	1:219	46 (40 to 53)
Haematoma	892	25.7%	1:135	74 (69 to 79)	570	64.2%	1:73	137 (126 to 148)
Painful Arm	151	4.4%	1:799	13 (11 to 15)	56	6.3%	1:744	13 (10 to 17)
Delayed Vasovagal	123	3.5%	1:981	10 (9 to 12)	10	1.1%	1:4167	2 (1 to 4)
Nerve Irritation	87	2.5%	1:1,387	7 (6 to 9)	22	2.5%	1:1894	5 (3 to 8)
Other	25	0.7%	1:4,827	2 (1 to 3)	27	3.0%	1:1543	6 (4 to 9)
Delayed Bleeding	20	0.6%	1:6,033	2 (1 to 3)	5	0.6%	1:8,334	1 (0 to 3)
Nerve Injury	6	0.2%	1:20,111	0,5 (0 to 1)	2	0.2%	1:20,835	0.5 (0 to 2)
Allergy	6	0.2%	1:20,111	0.5 (0 to 1)	5	0.6%	1:8,334	1 (0 to 3)
Arterial Puncture	4	0.1%	1:30,167	0.3 (0 to 1)	0			
Thrombo-phlebitis	2	0.1%	1:60334	0.2 (0 to 1)	0			
Tendon Damage	0				1	0.1%	1:41,669	0.2 (0 to 2)
Total	**3,218**	**0.0%**	**1:37**	**267 (258 to 276)**	**888**		**1:47**	**213 (200 to 227)**

	Apheresis-only Complications			
	Events	% Reaction	Freq.	Rate / 10,000 Donations (95% CI)
RBC not returned	472	60.4%	1:88	113 (104 to 124)
Citrate toxicity	310	39.6%	1:134	74 (67 to 83)
Total Apheresis-specific Events	**782**		**1:53**	**188 (175 to 201)**

27 Adverse Events Associated with Blood Donation continued

Tables 27.5, 27.6 and 27.7 detail the type, severity score and rate of adverse events per 10,000 donations. The majority of adverse events were classified as mild. For 2014, of the total 4,407 reported events, 937 were classified as moderate and two involving whole blood donations and one following an apheresis procedure, were classified as severe. No deaths were reported as a result of blood donation. Severe complications are defined as events resulting in any of the following:

- Hospitalisation: if it was attributable to the complication.
- Intervention: if required to preclude permanent damage or impairment of a body function or to prevent death (i.e., life-threatening event).
- Symptoms: if attributable to the complication, causing significant disability or incapacity and persisting for more than a year after donation (i.e., long-term morbidity).
- Death: if attributable to the complication and of either possible, probable or definite imputability.

TABLE 27.5 DONATION-RELATED ADVERSE EVENTS 2014 BY REACTION TYPE, SEVERITY AND COLLECTION METHOD

Adverse Event			Rate per 10,000 Donations					
			Whole Blood (n=125,684)		Plasmapheresis (n=29,585)		Plateletpheresis (n=4,942)	
			Events	Rate	Events	Rate	Events	Rate
Complications mainly characterised by blood outside blood vessels	Haematoma	Mild	822	68.1	447	117.3	99	277.3
		Moderate	70	5.8	17	4.5	7	19.6
	Arterial Puncture	Mild	4	0.3				
	Delayed Bleeding	Mild	18	1.5	5	1.3		
		Moderate	2	0.2				
Pain	Nerve Irritation	Mild	82	6.8	19	5.0		
		Moderate	5	0.4	3	0.8		
	Nerve Injury	Mild	4	0.3	1	0.3	1	2.8
		Moderate	2	0.2				
	Tendon Damage	Mild			1	0.3		
	Painful Arm	Mild	132	10.9	48	12.6	6	16.8
		Moderate	19	1.6	1	0.3	1	2.8
Other complications with local symptoms	Thrombo-phlebitis	Mild	1	0.1				
		Moderate	1	0.1				
	Allergy (Local)	Mild	6	0.5	3	0.8	1	2.8
		Moderate					1	2.8
Immediate vasovagal reaction	Without Injury	Mild	1,190	98.6	107	28.1	30	84.0
		Moderate	692	57.3	39	10.2	13	36.4
		Severe	1	0.1	1	0.3		
	With Injury	Mild	10	0.8				
		Moderate	9	0.7				
Delayed vasovagal reaction	Without Injury	Mild	72	6.0	4	1.0	1	2.8
		Moderate	45	3.7	1	0.3	1	2.8
		Severe	1	0.1				
	With Injury	Mild	1	0.1				
		Moderate	4	0.3	3	0.8		
Other			25	2.1	19	5.0	8	22.4
Complications related to apheresis	Citrate Reaction				71	18.6	239	669.5
	RBC Not Returned				380	99.7	92	257.7

There is a significant difference (p=<0.001) in the frequency of moderate reactions reported by whole blood donors (1:1,142) compared to that reported in apheresis donors (1:474).

TABLE 27.6 MODERATE AND SEVERE DONATION-RELATED ADVERSE EVENTS 2014 BY COLLECTION METHOD

Procedure	Total Donations	Severity	Number Events	Frequency	Rate / 10,000 Donations (95%CI)
Whole Blood Donation	120,668	Moderate	849	1:142	70.4 (65.8 to 75.2)
		Severe	2	1:60,334	0.2 (0.0 to 0.6)
Apheresis Donation	41,669	Moderate	88	1:474	21.1 (17.1 to 26.0)
		Severe	1	1:41,669	0.2 (-0.1 to 1.5)
All Donations	162,337	Moderate	937	1:173	57.7 (54.1 to 61.5)
		Severe	3	1:54,112	0.2 (0.0 to 0.6)

TABLE 27.7 RATE AND FREQUENCY OF MODERATE AND SEVERE WHOLE BLOOD DONATION-RELATED ADVERSE EVENTS 2014 BY GENDER FOR NEW AND REPEAT DONORS

Gender	New Donors		Repeat Donors		All Donors	
	Rate /10,000 Donations	Frequency	Rate /10,000 Donations	Frequency	Rate /10,000 Donations	Frequency
Female	364	1:27	57	1:176	89	1:113
Male	240	1:42	31	1:328	51	1:194
Total	305	1:33	44	1:227	71	1:141

The frequency of donation-related adverse events in whole blood donors is inversely related to age and highest in donors under the age of 20 years. In this youngest group of donors aged 16 to 19 years the adverse event rate is 1:16 donations and the odds ratio is 2.57 (Table 27.8).

TABLE 27.8 WHOLE BLOOD DONATION-RELATED ADVERSE EVENTS 2014 BY DONOR AGE GROUP

Age Group	Number Adverse Events	Total Donors in Age Group	Frequency	Rate / 1,000 Donations (95%CI)	Odds Ratio (95%CI)
16 - 19 Years	752	11,790	1:16	63.8 (59.5 to 68.3)	2.57 (2.37 to 2.79)
20 - 24 Years	689	14,379	1:21	47.9 (44.5 to 51.5)	1.90 (1.75 to 2.07)
25 - 29 Years	405	11,091	1:27	36.5 (33.2 to 40.2)	1.43 (1.29 to 1.59)
30 - 34 Years	235	8,630	1:37	27.2 (24.0 to 30.9)	1.06 (0.92 to 1.21)
35 - 39 Years	153	9,023	1:59	17.0 (14.5 to 19.8)	0.65 (0.55 to 0.77)
40 - 44 Years	200	10,793	1:54	18.5 (16.1 to 21.3)	0.71 (0.62 to 0.82)
45 - 49 Years	152	11,190	1:74	13.6 (11.6 to 15.9)	0.52 (0.44 to 0.61)
50 - 54 Years	169	12,962	1:77	13.0 (11.2 to 15.1)	0.50 (0.43 to 0.58)
55 - 59 Years	171	12,335	1:72	13.9 (11.9 to 16.1)	0.53 (0.45 to 0.62)
≥60 Years	173	17,846	1:103	9.7 (8.4 to 11.2)	0.37 (0.32 to 0.43)
All	**3,099**	**120,039**	**1:39**	**25.8 (24.9 to 26.7)**	

27 Adverse Events Associated with Blood Donation continued

Vasovagal reactions are the most common whole blood donation-related adverse event. Table 27.9 shows that for all age groups the rate of these events in new donors is higher than in repeat donors. There is a steady reduction in the likelihood of a vasovagal reaction with increasing age.

TABLE 27.9 WHOLE BLOOD VASOVAGAL EVENTS 2014 BY DONOR AGE GROUP FOR NEW DONORS AND REPEAT DONORS

Age Group	Gender	New Donors (n = 12,259)		Repeat Donors (n = 107,780)	
		Frequency	Rate / 1,000 Donations (95%CI)	Frequency	Rate / 1,000 Donations (95%CI)
16 - 19	Female	1:11	92.6 (82.8 to 103.4)	1:33	30.6 (25.5 to 36.8)
	Male	1:20	49.4 (41.9 to 58.3)	1:42	23.9 (18.5 to 30.9)
20 - 24	Female	1:10	103.3 (86.1 to 123.5)	1:37	27.3 (23.9 to 31.3)
	Male	1:12	83.2 (67.2 to 102.5)	1:58	17.2 (13.9 to 21.3)
25 - 29	Female	1:9	108.4 (86.9 to 134.5)	1:48	20.7 (17.2 to 24.9)
	Male	1:14	70.1 (53.1 to 91.8)	1:78	12.9 (9.9 to 16.7)
30 - 34	Female	1:13	78.0 (56.1 to 107.3)	1:56	17.8 (14.0 to 22.5)
	Male	1:20	48.9 (31.5 to 74.7)	1:90	11.1 (8.2 to 14.9)
35 - 39	Female	1:15	65.9 (44.3 to 96.6)	1:127	7.8 (5.6 to 11.0)
	Male	1:39	26.0 (12.3 to 51.3)	1:138	7.2 (5.0 to 10.4)
40 - 44	Female	1:17	60.4 (38.0 to 94.0)	1:139	7.2 (5.2 to 9.9)
	Male	1:35	28.2 (12.6 to 58.3)	1:155	6.4 (4.5 to 9.1)
45 - 49	Female	1:34	29.7 (13.2 to 61.1)	1:123	8.1 (6.0 to 10.9)
	Male	1:50	20.0 (6.0 to 52.1)	1:372	2.7 (1.6 to 4.5)
50 - 54	Female	1:14	70.4 (42.3 to 113.7)	1:170	5.9 (4.3 to 8.1)
	Male	1:22	45.5 (18.9 to 97.7)	1:396	2.5 (1.5 to 4.1)
55 - 59	Female	1:12	87.0 (46.3 to 154.3)	1:119	8.4 (6.4 to 11.1)
	Male	1:24	42.6 (13.3 to 107.8)	1:420	2.4 (1.4 to 4.0)
≥60	Female	1:18	55.6 (17.7 to 138.4)	1:197	5.1 (3.7 to 6.9)
	Male	1:63	15.9 (-5.3 to 92.7)	1:1575	0.6 (0.3 to 1.4)
Total	Female	1:11	88.4 (81.7 to 95.6)	1:75	13.3 (12.4 to 14.3)
	Male	1:19	53.6 (48.1 to 59.7)	1:146	6.8 (6.2 to 7.6)
	Total	**1:14**	**71.9 (67.5 to 76.7)**	**1:98**	**10.2 (9.6 to 10.8)**

In line with international practice NZBS has introduced measures to reduce the frequency of adverse reactions in younger donors. Current guidance contained in the Council of Europe Guide to the Preparation, Use and Quality Assurance of Blood Components identifies that a standard whole blood donation can be undertaken from a donor weighing at least 50kg. In addition, in younger donors, an estimate of total blood volume is made based on donor weight and height. Donors with an estimated blood volume of less than 3,500 mL are deferred from donating.

Donation-Related Adverse Events Associated With Citrate Toxicity During Plateletpheresis

A survey in 2012 of the six NZBS sites collecting platelets by apheresis showed that the rate of citrate-related adverse events was 83 per 1,000 procedures (range 3 to 161) and that there was variation in practice of offering donors calcium supplements to prevent hypocalcaemia associated with this procedure. The results of the survey lead to the implementation in 2014 of a national protocol for calcium supplementation for plateletpheresis donors.

All plateletpheresis donors now receive at the time of venesection 3 chewable Nestlé Quick-Eze antacid tablets each containing 800mg calcium carbonate followed by a further 3 tablets with the onset of symptoms of citrate toxicity, and repeated if necessary every 20-30 minutes to a maximum dose of 9 tablets. Comparing the national rate of citrate reactions reported in 2014 to that in 2013, a decrease of 33% has occurred (p=<0.001) (Table 27.10).

TABLE 27.10 DONATION-RELATED ADVERSE EVENTS ASSOCIATED WITH CITRATE TOXICITY DURING PLATELETPHERESIS 2013 – 2014

	Year			
	2013	2014	% Change	P Value
Number Citrate Adverse Events	493	238		
Number Plateletpheresis Procedures	4,942	3,570		
Rate / 1,000 Procedures	100	67	-33%	<0.001

28 Request Form and Specimen Labelling Errors

The collection of a blood specimen for pre-transfusion testing from the correct patient is vital for safe transfusion. Errors made in the collection of the pre-transfusion specimen can lead to the transfusion of ABO incompatible red cells which can cause significant morbidity and death.

International guidelines require that labels on pre-transfusion specimens must be handwritten at the patient's bedside. A declaration must be signed by the collector at the time of collection of the specimen certifying that:

- The identity of the patient was made by direct enquiry and/or inspection of their wristband
- Immediately upon the blood being drawn the specimen was labelled

Specimens received with a pre-printed addressograph label are not acceptable for pre-transfusion testing purposes and are discarded.

Over the past nine years the six NZBS Blood Banks (Auckland, Waikato, Palmerston North, Wellington, Christchurch and Dunedin) have been recording errors and corrective actions associated with pre-transfusion specimens. Data is entered into a Microsoft Access™ database at each site and then analysed. Reports are reviewed by Hospital Transfusion Committees and by the NZBS Clinical Advisory Group.

The minimum requirements for pre-transfusion request forms and specimen labelling (for NZBS Blood Banks) are outlined in Table 28.1.

TABLE 28.1 NZBS PRE-TRANSFUSION REQUEST FORM AND SPECIMEN LABELLING REQUIREMENTS

Request Form Hand-written or pre-printed label	Specimen Must be hand-written
Full name	Family name and one or more given names (not abbreviated)
National Health Index (NHI) number and/or date of birth	NHI number and/or date of birth
Gender	Signature or initials of collector
Patient's location	
Details of request (group and screen, blood products etc.)	
Name or signature or other identifier of person completing the form	
Signed declaration by specimen collector that • The patient was positively identified prior to collection • Specimen labelled before leaving the patient	
Date and time of specimen collection written on specimen or form	

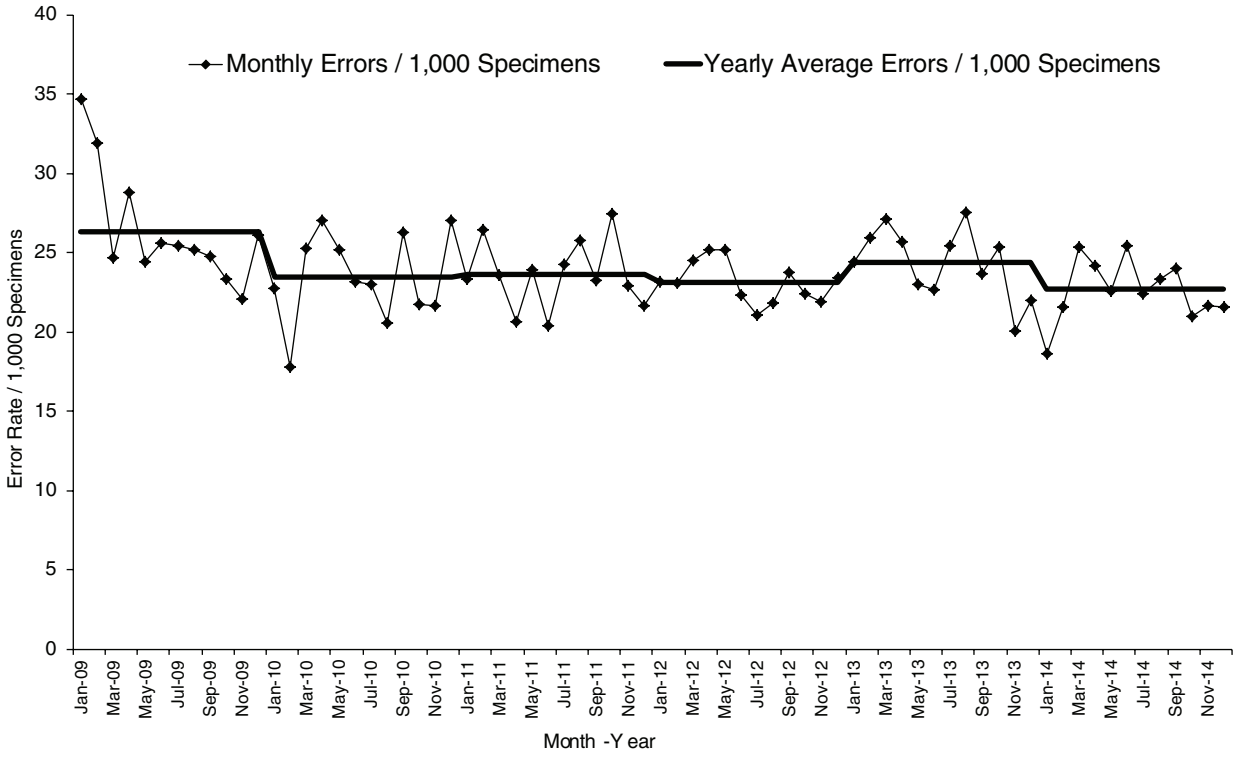
During 2014 a total of 141,991 pre-transfusion specimens were received by the six NZBS Blood Banks. Errors were identified in 3,219 specimens/forms. The overall error rate for the six NZBS Blood Banks for 2014 was 22.7 per 1,000 specimens received which is equivalent to an error rate of 1:44 specimens. The error rate in 2014 showed a 7% decrease from that reported in 2013 (24.4 per 1,000 specimens or 1:41). Table 28.2 details the error rate per 1,000 specimens for the six NZBS Blood Banks in 2014.

TABLE 28.2 PRE-TRANSFUSION REQUEST FORM AND SPECIMEN LABELLING ERRORS 2014 BY NZBS BLOOD BANK SITE

Blood Bank	Errors	Total Specimens	Error Rate	Rate / 1,000 Specimens (95% CI)
Palmerston North	309	8,567	1:28	36.1 (32.3 to 40.2)
Christchurch	590	22,015	1:37	26.8 (24..7 to 29.0)
Dunedin	253	10,112	1:40	25.0 (22.1 to 28.3)
Waikato	686	29,132	1:42	23.5 (21.9 to 25.4)
Wellington	550	22,989	1:42	23.9 (22.0 to 26.0)
Auckland	831	49,176	1:59	16.9 (15.8 to 18.1)
NZBS Total	**3,219**	**141,991**	**1:44**	**22.7 (21.9 to 23.5)**

The monthly and yearly mean error rate per 1,000 pre-transfusion specimens received by the NZBS Blood Banks from 2009 to 2014 is detailed in Figure 28.1.

FIGURE 28.1 PRE-TRANSFUSION REQUEST FORM AND SPECIMEN LABELLING ERROR RATE PER 1,000 SPECIMENS 2009 – 2014



28 Request Form and Specimen Labelling Errors continued

The types of errors and the corrective actions taken are summarised in Table 28.3. Some request forms and specimens received had more than one type of error present. The total number of errors was 3,267. The most frequent type of error (20%) was "Declaration not signed (specimen signed)" followed by "Specimen not signed (declaration signed)". The most common error resulting in a request for recollection (15.8%) was "Missing / incomplete/ incorrect patient details (major error)".

When corrections are allowable they must be carried out by the collector within the Blood Bank, unless the collector is directly involved in critical patient care. If the collector is not available a new pre-transfusion specimen must be collected. The collector must sign a declaration stating that "I have re-checked and verified the identity of the patient from whom this specimen originated and I accept full responsibility for the accurate completion of this form / specimen".

TABLE 28.3 PRE-TRANSFUSION REQUEST FORM AND SPECIMEN LABELLING ERRORS 2014 BY ERROR TYPE

Error	Number	% Total	Frequency	Rate / 1,000 Specimens	Action Required
Declaration not signed (specimen is signed)	652	20.0%	1:218	4.6	Correction by collector or Recollect
Sample not signed (declaration signed)	516	15.8%	1:275	3.6	Correction by collector or Recollect
Missing patient details (major error)	515	15.8%	1:276	3.6	Recollect
Pre-printed patient ID label on specimen	291	8.9%	1:488	2.0	Recollect
Moderate error on specimen	259	7.9%	1:548	1.8	Correction by collector or Recollect
Technical[1]	243	7.4%	1:584	1.7	Recollect
Adhesive remaining, indicating label removed	237	7.3%	1:599	1.7	Recollect
Signature on specimen and declaration differ	164	5.0%	1:866	1.2	Recollect
Moderate error on form	140	4.3%	1:1014	1.0	Correction by collector or Recollect
Unlabelled specimen	86	2.6%	1:1,651	0.6	Recollect
Presence of partial pre-printed label	70	2.1%	1:2,028	0.5	Recollect
Original details overwritten	43	1.3%	1:3,302	0.3	Recollect
Declaration and specimen not signed	42	1.3%	1:3,381	0.3	Recollect
Other clerical error	9	0.3%	1:15,777	0.1	Correction by collector or Recollect
Total	**3,267**				

[1] *Technical errors include incorrect blood collection tube type, insufficient specimen, haemolysed and leaking/broken specimens.*

Request Form and Specimen Labelling Errors continued

The overall rate of request for recollection of pre-transfusion specimens by NZBS Blood Banks for 2014 was 14.6 per 1,000 specimens received. Table 28.4 summarises the recollection rates for each NZBS Blood Bank in 2014. Overall, 64% of errors resulted in a request for recollection of the pre-transfusion specimen.

TABLE 28.4 PRE-TRANSFUSION SAMPLE RECOLLECTION REQUESTS 2014 BY NZBS BLOOD BANK SITE

	Recollection Requests	Total Number of Specimens	Frequency	% Errors Requiring Recollection	Rate / 1,000 Specimens (95% CI)
Palmerston North	174	8,567	1:49	56%	20.3 (17.5 to 23.5)
Dunedin	173	10,112	1:58	68%	17.1 (14.8 to 19.8)
Christchurch	373	22,015	1:59	63%	16.9 (15.3 to 18.7)
Wellington	384	22,989	1:60	70%	16.7 (15.1 to 18.4)
Waikato	474	29,132	1:61	69%	16.3 (14.9 to 17.8)
Auckland	489	49,176	1:101	59%	9.9 (9.1 to 10.9)
NZBS Total	**2,067**	**141,991**	**1:69**	**64%**	**14.6 (13.9 to 15.2)**

Appendix I. Transfusion-Related Adverse Event Notification Form

NZBLOOD Te Ratonga Toto O Aotearoa

Transfusion Related Adverse Event Notification Form

A. Patient Details

NHI:	**Hospital:**
DOB: **Sex:** Male / Female	**Ward/clinical area:**

B. Transfusion & Clinical Details

Date of transfusion	/ /	Time reaction noticed	am / pm
Time transfusion started	am/pm	Volume transfused	mL

Event occurred during/ following transfusion with: (please circle)	Red Cells	Platelets	Fresh Frozen Plasma	Cryoprecipitate	Cryodepleted Plasma	
	Other: *A Fractionated Product Reaction form (111F003) may be required.*					
Donation number(s) of unit(s) transfused	Red Cells: Platelets: Fresh Frozen Plasma: Cryoprecipitate: Cryodepleted Plasma:					
Patient's diagnosis, reason for transfusion & other medical/surgical history						
Medications & treatment						

C. Signs and Symptoms

Baseline observations pretransfusion:	Temp:	Pulse:	BP:	RR:	O_2 sat^n:
Observations at time of reaction:	Temp:	Pulse:	BP:	RR:	O_2 sat^n:

Please circle relevant symptoms & provide details:

Febrile: Chills / Rigors / Flushing Temperature rise: ˚C

Urticaria: Isolated / Extensive

Non-urticarial rash:

Respiratory: Dyspnoea / Wheeze / Stridor / Pulmonary oedema / Cough / Hypoxaemia

Circulatory: Pulmonary oedema / Arrhythmia / Hypotension / Hypertension / Tachycardia / Δ JVP

GI tract: Nausea / Vomiting / Diarrhoea

Pain: Chest / Loin / Abdominal / Infusion site / Other

Restlessness/Anxiety: **Red urine:** Yes / No / Unknown

Chest xray changes: **Patient under anaesthesia:** Yes / No

No symptoms

Other comments, signs, symptoms & laboratory results: (bilirubin, haptoglobin, BNP etc)

HV

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National Haemovigilance Programme 111F04208

Page 1 of 4

Appendix I. Transfusion-Related Adverse Event Notification Form continued

D. Severity score

☐ **Grade 1:**	The recipient may have required treatment but lack of such would not have resulted in permanent damage or impairment of a body function.
☐ **Grade 2 (severe):**	The recipient required hospitalization or prolongation of hospitalization directly attributable to the event; and/or the adverse event resulted in persistent or significant disability or incapacity; or the adverse event necessitated medical or surgical intervention to preclude permanent damage or impairment of a body function.
☐ **Grade 3 (life-threatening):**	The recipient required major intervention following the transfusion (e.g. vasopressors, intubation, transfer to intensive care) to prevent death.
☐ **Grade 4 (death):**	The recipient died following an adverse transfusion reaction. *Grade 4 should only be used if death is possibly, probably or definitely related to transfusion. If the patient died of another cause, the severity should be graded as 1, 2 or 3.*

E. Pretransfusion haematology

If red cells transfused state pretransfusion haemoglobin: _____ Date: Time:

If platelets transfused state pretransfusion platelet count: _____ Date: Time:

If fresh frozen plasma transfused state pretransfusion INR: _____ Date: Time:

If cryoprecipitate transfused state pretransfusion fibrinogen: _____ Date: Time:

F. Nature of adverse event (definitions on back page)

- ☐ Allergic reaction
- ☐ Anaphylaxis
- ☐ Febrile non-haemolytic transfusion reaction
- ☐ Component or equipment related event
- ☐ Haemolytic transfusion reaction: acute / delayed
- ☐ Incorrect blood component/product transfused
- ☐ Near miss event
- ☐ Post-transfusion purpura (PTP)
- ☐ Transfusion associated circulatory overload (TACO)
- ☐ Transfusion associated graft vs host disease (TA-GVHD)
- ☐ Transfusion related acute lung injury (TRALI)
- ☐ Transfusion-transmitted infection (TTI)
- ☐ Other *(please specify)*

Notify a Transfusion Medicine Specialist (TMS) of all severe (Grade 2 – 4) reactions

TMS informed: Yes / No

TMS name: .....

Date: .....

Time: .....

Blood Bank or Transfusion Nurse Specialist can notify TMS if necessary

G. Imputability Score

NA	**Not assessable**	When there is insufficient data for imputability assessment	☐
1	**Excluded**	When there is conclusive evidence beyond reasonable doubt for attributing the event to alternative causes	☐
2	**Unlikely**	When the evidence is clearly in favour of attributing the event to causes other than the transfusion	☐
3	**Possible**	When the evidence is clearly indeterminate for attributing the event either to the transfusion or alternative causes	☐
4	**Likely, probable**	When the evidence is clearly in favour of attributing the event to the transfusion	☐
5	**Certain**	When there is conclusive evidence beyond reasonable doubt for attributing the event to the transfusion	☐

Reported by:

Contact Number:

Date:

Please note that patient identifiers will be removed for reporting to the National Haemovigilance Programme.

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Page 2 of 4

Appendix I. Transfusion-Related Adverse Event Notification Form continued

H. For Blood Bank/Transfusion Nurse Specialist Use Only

Transfusion History

☐ Yes < 3 months ☐ Yes > 3 months ☐ No ☐ Unknown

Pages 1 & 2 completed Yes / No

Transfusion reaction investigation

Red cell serology: Anomalies: Yes / No / Not tested

Microbiology: Yes / No / Not tested

Unit / Patient / Both

Result:

Other:

☐ **Check TMS has been notified if applicable (page 2)**

Notification form sent by: (if different from person completing pages 1 and 2)

Name:.....

Telephone: .....

Date:.....

Please retain a copy of pages 1 – 3 of this form for your records, send the original to the National Haemovigilance Office:

National Haemovigilance Office
New Zealand Blood Service
Private Bag 7904
Wellington 6242
Phone 04 380 2243
Fax 04 389 5608
Website www.nzblood.co.nz
Email haemovigilance@nzblood.co.nz

I. For National Haemovigilance Office Only

Form received on.....

Acknowledgement sent.....

Further information requested Yes / No

HV | | | | | | | |
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Appendix I. Transfusion-Related Adverse Event Notification Form continued

Reporting categories for transfusion-related adverse events	
Allergic reaction	Mucocutaneous signs and symptoms during or within 4 hours of transfusion: morbilliform rash with pruritus, urticaria, localised angioedema, oedema of lips, tongue and uvula, periorbital pruritus, erythema and oedema, conjunctival oedema. **Anaphylactic reaction** is when, in addition to mucocutaneous symptoms, there is airway compromise or cardiovascular involvement. Laryngeal symptoms include tightness in throat, dysphagia, dysphonia, hoarseness, stridor. Pulmonary symptoms include dyspnoea, cough, wheeze/bronchospasm, hypoxaemia. Cardiovascular symptoms include hypotension, hypotonia, syncope.
Febrile non-haemolytic transfusion reaction (FNHTR)	Fever (≥38˚C and a change of ≥1˚C from pre-transfusion value) and/or chills/rigors occurring during or within 4 hours of transfusion without other cause such as haemolytic transfusion reaction, bacterial contamination or underlying condition.
Component-related event	An adverse event related to anticoagulant or use, misuse or defect of the bag or container occurring at some point from collection from the donor through to transfusion. Also includes use of an incorrect or inappropriate IV fluid with the component.
Equipment-related event	An adverse event resulting from use, misuse or malfunction of equipment involved in the transfusion e.g. filters, infusion pumps, blood warmers, pressure devices.
Haemolytic transfusion reaction	**Acute:** onset within 24 hours of transfusion. Clinical and laboratory features of haemolysis are present. May be due to red cell antibodies or non-immunological factors e.g. malfunction of a pump, blood warmer, use of hypotonic solutions etc. **Delayed:** Usually manifests between 24 hours and 28 days after a transfusion and signs of haemolysis are present. It may manifest as an inadequate rise of post-transfusion haemoglobin level or unexplained fall in haemoglobin. Blood group serology normally gives abnormal results confirming immunological origin.
Hypotensive transfusion reaction	Decrease in systolic and/or diastolic blood pressure of > 30 mmHg occurring during or within one hour of completing transfusion. All other categories of adverse reactions presenting with hypotension must have been excluded together with underlying condition that could explain hypotension.
Haemosiderosis	Ferritin level of ≥ 1000mcg/L, with or without organ dysfunction, in the setting of repeated RBC transfusions.
Hyperkalaemia	Any abnormally high potassium level (≥5mmol/L or ≥1.5 mmol/L net increase) within an hour of transfusion.
Incorrect blood component transfused (IBCT)	Patient was transfused with a blood product that did not meet the appropriate requirements or which was intended for another patient.
Near miss event	An error or deviation from standard procedures or policies that is discovered before the start of the transfusion and that could have led to a wrongful transfusion or a reaction in the recipient.
Post-transfusion Purpura (PTP)	Thrombocytopenia arising 5-12 days following transfusion of cellular blood components with findings of antibodies in the patient directed against the Human Platelet Antigen (HPA) system.
Transfusion associated circulatory overload (TACO)	Any 4 of the following: acute respiratory distress, tachycardia, increased blood pressure, acute or worsening pulmonary oedema on frontal chest radiograph, evidence of positive fluid balance. Occurring within 6 hours of completion of transfusion. An elevated BNP is supportive of TACO.
Transfusion associated dyspnoea (TAD)	Respiratory distress within 24 hours of transfusion that do not meet the criteria of TRALI, TACO, or allergic reaction. Not explained by the patient's underlying condition.
Transfusion associated graft versus host disease (TA-GVHD)	Clinical syndrome characterized by fever, rash, liver dysfunction, diarrhoea, pancytopenia and findings of characteristic histological appearances on biopsy occurring 1-6 weeks following transfusion with no other apparent cause. The diagnosis of TA-GVHD is further supported by the presence of chimerism.
Transfusion related acute lung injury (TRALI)	New acute lung injury (ALI): acute onset, hypoxaemia (PaO_2/FiO_2 < 300 mmHg, or oxygen saturation < 90% on room air, or other clinical evidence), bilateral infiltrates on frontal chest radiograph, no evidence of left atrial hypertension i.e. circulatory overload, no temporal relationship to an alternative risk factor for ALI. During or within 6 hours of completion of transfusion.
Transfusion transmitted infection (TTI)	Following investigation the recipient has evidence of infection post-transfusion, and there was no evidence of infection prior to transfusion and no evidence of an alternative source of infection.
Unclassifiable complication of transfusion (UCT)	Occurrence of an adverse effect or reaction temporally related to transfusion, which cannot be classified according to an already defined event with no risk factor other than transfusion.

Appendix II. Notification of Adverse Reactions to Fractionated Blood Products

NZBLOOD Te Ratonga Toto O Aotearoa

NATIONAL
111F00307

NOTIFICATION OF SUSPECTED ADVERSE REACTION TO A FRACTIONATED BLOOD PRODUCT

RECIPIENT				
Family Name First Names		National Health Index No.	Gender	NZBS Use
Address		Date of Birth dd/mmm/yyyy	Weight	Height
Relevant history: pre-existing conditions, diagnoses, pre-existing medical conditions, smoking, alcohol use, surgical procedure(s) with dates, Pregnancy with LMP, etc				Pregnant ☐Yes ☐ No ☐ Not applicable

BLOOD PRODUCTS ADMINISTERED * Asterisk implicated Blood Product

Blood Product(s)	Manufacturer	Batch Number	Expiry Date	Dose / Volume	Date administered (start / stop)	Indication(s) for Use
1.						
2.						
3.						

Previous administration of this / these product(s) if any. Indicate date of commencement and dates or frequency of administration

ALL OTHER MEDICINES IN USE (including Premedication/Anaesthetic agents, 'Over The Counter' and 'Alternative' Medicines) *Asterisk agents that may be implicated in reaction. *Add further medicines on separate page if necessary*

Medicine	Daily Dose (with units)	Batch number	Route	Date Started	Date Stopped	Indications for Use / Comments

DESCRIPTION OF ADVERSE REACTION OR EVENT

Transfusion started / Product administered: Date _____ Time _____ Route: ☐ IV ☐ IM ☐ Subcut ☐ Other
If the patient was receiving a course of treatment with daily / frequent doses, what were the intended **dates and doses(s)** of treatment: _____

Onset of Reaction: *date* _____ time _____. **End of reaction** *date* _____ *time* _____ *or* ☐ not yet settled.

For IV or Subcut Immunoglobulin: infusion rate at time of reaction _____, **dose given** on day_____.

For freeze dried products: concentration of solution infused: _____, solvent used for reconstitution _____.

Describe adverse reaction (signs, symptoms, diagnosis, course, relevant test results) *continue on separate page if necessary*

NZBLOOD
Te Ratonga Toto O Aotearoa

NATIONAL
111F00307

NOTIFICATION OF SUSPECTED ADVERSE REACTION TO A FRACTIONATED BLOOD PRODUCT

Treatment of adverse reaction or event

Adverse Reaction Information

Seriousness

Is the event serious (treatment needed to preserve life)? ☐ Yes ☐ No

If yes, please tick at least one of the following boxes.

☐ Life-threatening ☐ Death _____ *date*
☐ Persistence of significant disability / incapacity
☐ Required intervention to prevent permanent impairment / damage
☐ Congenital anomaly / birth defect
☐ Required hospitalisation or hospitalisation was prolonged
☐ Suspected transfusion of an infectious agent

Case Outcome as at _____ dd/mmm/yyyy

☐ Recovered _____ dd/mmm/yyyy, Time _____
☐ Recovered with sequelae _____ (specify)
☐ Permanently disabled
☐ Death _____dd/mmm/yyyy, autopsy: date _____ *or* ☐ not done
☐ Not yet recovered ☐ Unknown

Did reaction abate after stopping blood product?

First batch: ☐ Yes ☐ No ☐ Not applicable
Second batch: ☐ Yes ☐ No ☐ Not applicable

Did reaction reappear after re-introduction?

First batch: ☐ Yes ☐ No ☐ Not applicable
Second batch: ☐ Yes ☐ No ☐ Not applicable

Previous therapy with suspected blood product?

1._____ ☐ Yes ☐ No ☐ Not applicable

2. ._____ ☐ Yes ☐ No ☐ Not applicable

Has suspected product been tolerated in the past?

1. ._____ ☐ Yes ☐ No ☐ Not applicable
2. ._____ ☐ Yes ☐ No ☐ Not applicable

If yes, dates: dd/mmm/yyyy

Causality assessment: ☐ Highly probable ☐ Possible ☐ Unlikely ☐ Unassessable

Other Conditions Present (tick all that apply): ☐ Renal Disease ☐ Hepatic Disease ☐ Cardiac Disease ☐ Allergy
☐ Respiratory Disease ☐ Other medical conditions (list):

Report type (tick all that apply)

☐ Product used for a MedSafe-registered indication ☐ S29 Medicine ☐ Medication error ☐ Overdose / Underdose
☐ Unexpected therapeutic benefit ☐ Lack of effect ☐ Pregnancy ☐ Lactation occurring ☐ Off-label use ☐ Misuse
☐ Occupational exposure ☐ Incorrect product transfused ☐ Idiosyncratic effect ☐ Quality defect in product

REPORTER DETAILS

This information will be used for follow up of the result by NZ Blood Service and will be retained only as long as needed for this review.

Person Reporting the event	**Details of Treating Specialist/GP/Midwife if different from notifier**
Name & Role/Occupation:	**Name:**
If the reporter is the patient, has consent been given to contact the Treater to follow up the adverse reaction? ☐ Yes ☐ No **Organisation / Address:**	**Organisation / Address:** **Phone:** **Fax:**
Phone: **Fax:**	**Email:**
Email:	**Registrar** (if relevant): **Pager contact:**

INSTRUCTIONS

1. **If the reaction or event is serious, telephone the Transfusion Medicine Specialist via a Blood Bank listed below.**
2. All adverse reactions to blood products must be notified to NZ Blood Service and should be reported on this form.
3. Please fill in all sections relevant to you, your patient and the clinician responsible for treating the patient.
4. Use pre-printed identification labels for patient information, if available. Use only standard abbreviations
5. Record all medicines in use. Continue report on a separate page, if necessary, so that full information is provided.
6. Return the completed form to the Blood Bank as soon as possible. The form will then be forwarded to the NZBS National Reporting Centre. Relevant information will be forwarded to the manufacturer of the product. A non-identifying summary report may be forwarded to Medsafe and CARM.

Blood Bank	Telephone	Fax	Blood Bank	Telephone	Fax	Blood Bank	Telephone	Fax
Auckland	09 307 2834	09 307 2823	Palmerston N'th	06 350 2854	06 350 8557	Christchurch	03 364 0314	03 364 0159
Waikato	07 839 8919	07 858 0988	Wellington	04 9186961	04 385 5982	Dunedin	03 470 9369	03 470 9513

Appendix III. Reporting Adverse Events Associated with Blood Donation

NATIONAL
107M00509

REPORTING OF ADVERSE EVENTS RELATED TO BLOOD DONATION

REASON FOR ISSUE: New definitions and grading based on IHN.

1. PURPOSE

To ensure that adverse events related to blood donations and therapeutic procedures are appropriately identified, recorded and reviewed so that donor health issues are managed appropriately. To provide a database of donor related adverse events to assist in improving the management of such events.

2. SCOPE

This procedure should be followed for all incidents in which a donor experiences any adverse event or suffers any harm as a direct consequence of the donation process – this includes fainting, nerve irritation.
Any harm caused to the donor by factors other than the donation process is classified as a workplace injury and managed through another process.

3. KEY RESPONSIBILITIES

- All staff to identify and document any donor adverse event.
- Nursing staff to provide initial care and follow up.
- Medical Staff to review the event, and follow up when and where appropriate.
- Delegated individuals to record the relevant information in the donor adverse event database, and provide reports for review.
- Senior operations staff members may review data to identify trends.

4. ITEMS REQUIRED

4.1. Related documents

107F005	Donor Adverse Event Report
107M016	Management of Complications of Phlebotomy for Standard Whole Blood and Apheresis Collections from Voluntary Donors
170P005	H&S Manual Section E: Incident/Injury Reporting & Management
170F007	Accident Report Form *(To be used only when NZBS Intranet or Q-Pulse not available)*

5. DEFINITIONS

5.1. Definitions and description of categories of adverse event.

Donation site is the area within which staff can observe donor and be responsible for care of donors with complications. This includes the reception area, registration, collection, refreshment area and also the designated toilet area for donors.

An immediate complication is a complication which occurs before donor has left the donation site.

A delayed complication is a complication which occurs after donor has left the donation site. The relation of a delayed complication to the actual blood donation should be critically assessed

A. Complications mainly with local symptoms.

These complications are directly caused by the insertion of the needle. Some of these are mainly characterised by visible swelling from bleeding into tissues, whereas others are mainly characterised by pain.

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REPORTING OF ADVERSE EVENTS RELATED TO BLOOD DONATION

A1. Complications mainly characterized by the occurrence of blood outside vessels.

Haematoma (Bruise)
Definition: A haematoma is an accumulation of blood in the tissues outside the vessels.
Mechanism: The symptoms are caused by blood flowing out of damaged vessels and accumulating in the soft tissues. For apheresis procedures, haematomas may also be caused by infiltration of the soft tissues by red cells during the return phase of the procedure. Large haematomas, particularly those in deeper layers of the forearm, put pressure on surrounding tissues and may contribute to other complications such as nerve irritation and injury and more rarely compartment syndrome. Bruises can be very extensive but without any measurable swelling, whereas when the name haematoma is used there would generally be swelling. However, as there is no physiological difference between bruises and haematomas except for the thickness, extensive skin discolouration can still be registered as a haematoma.
Haematoma is the second most common acute complication associated with blood donation.
Signs and Symptoms: Bruising, discolouration, swelling and local pain.

Bleeding may arise from:

- Incomplete insertion of the bevel of the needle into a vein or movement that dislodges the needle partly or completely from the vein: a haematoma typically forms over the vein and is usually visible and obvious except with deeply located veins.
- The needle penetrates the back of the vein: the haematoma forms under the vein and may not be visibly obvious.

Pressure will develop locally, depending on size of the swelling and softness of the surrounding tissue. Pressure on nerves will result in neurological symptoms like pain radiating down in forearm and hand, and of peripheral tingling. If blood accumulates in the frontal deep layers of the forearm between muscles and tendons swelling is hard to recognize, but the pressure increases very easily. Therefore, complications like injury of a nerve and even a compartment syndrome occurs more often related to a haematoma with this localisation.

Note: *If haematoma is large and/or exhibits other neurological/vascular signs, e.g. numbness of fingers in venesected arm or weak pulse, this warrants urgent medical attention.*

Arterial puncture
Definition: Arterial puncture is a puncture of the brachial artery or of one of its branches by the needle used for bleeding of donor.
Signs and Symptoms: A lighter red colour than usual of the collected blood can be seen and perhaps some movements of the needle caused by arterial pulsation; the bag fills very quickly. In uncomplicated cases there may be no haematoma. There may be weak pain localised to the elbow region.
Complications: The risk of a large haematoma is increased and thereby risks such as Compartment Syndrome in the forearm, brachial artery pseudo aneurysm and arterio-venous fistula.

Re-bleeding
Definition: Leakage of blood from the venepuncture site after the initial bleeding has stopped.
Mechanism: Re-bleeding may be related to pressure not being applied to the correct location or for an adequate duration, or premature removal.
After the donor has left the donation site, re-bleeding may be related to heavy lifting or strain to the donor's arm. Donors on certain medications, such as autologous donors on anticoagulants, may be at higher risk to re-bleed.

A2. Complications mainly characterised by pain.

Nerve Injury/Irritation
Definition: Direct injury or indirect irritation of a nerve.
Mechanism: A nerve may be hit directly by the needle at insertion or withdrawal, or there may be pressure on a nerve due to a haematoma or inflammation of the soft tissues. Include all cases confirmed by a medical diagnosis, as well as cases reported on the basis of documented 'nerve' type symptoms.
Signs and Symptoms: Radiating, often 'electrical' sharp pain moving away from the venepuncture site, and/or paraesthesia's such as tingling, burning sensations in the hand, wrist or shoulder area

but away from the venepuncture site. Symptoms may arise immediately when the needle is inserted or withdrawn. In cases associated with a haematoma, pain will not be apparent at the time and may start when the haematoma has reached a sufficient size, some time after the insertion of the needle. Symptoms may be worse in certain positions or with certain arm movements. Rarely weakness of the arm may develop.
Later, after the haematoma has been absorbed, some scar tissue can be left around the nerve and give rise to pain and paraesthesiae which can last for weeks or months. In order to avoid this complication, it is important to discontinue the donation immediately if the donor complains of paraesthesiae to minimize the volume of haematoma.
Symptoms resolving within a year will be classed as non-severe and those lasting more than a year will be classed as severe.

Other Painful arm

Definition: Pain in the arm is the primary symptom and not related to the characteristics of nerve injury or irritation or haematoma.
Mechanism: Pain is usually related to tissue injury, possibly due to haematoma in the deeper tissues or related to a tendon injury.
Signs and Symptoms: Pain in the arm used for the donation and arising during or within hours following donation, but without further details to permit classification in one of the already more specific categories mentioned above. Maybe described as an ache or heaviness in the arm, similar to that after vaccination. This does not include pain at venepuncture site that appears at time of insertion of needle and disappears after donation is completed.

A3. Localised Infection/inflammation

Definition: Inflammation along the course of a vein, which may progress to localised infection several days after phlebotomy. There may be clotting in the vein.
Mechanism: Tissue damage and introduction of surface bacteria into the deeper tissues with venepuncture. The superficial vein itself (thrombophlebitis) or surrounding subcutaneous tissue (cellulitis) may be predominantly affected.
Signs and Symptoms: Warmth, tenderness, local pain, redness and swelling at the site of phlebotomy. The site and the vein may feel tender, firm and warm to touch. Fever may be present. These may be divided into 2 categories;

Thrombophlebitis: The redness, swelling and tenderness extend along the course of the vein. Thrombophlebitis in a superficial vein gives rise to a subcutaneous red, hard and tender cord. Thrombophlebitis in a deep vein gives more severe symptoms and may be associated with fever.

Cellulitis: The redness, swelling and tenderness affect the soft tissues and are not localised to the course of the vein.

A4. Other major blood vessel injury.

These rare, serious conditions must always be medically diagnosed.

Deep vein Thrombosis (DVT)
Definition: Thrombosis of a deep vein in the donor's phlebotomy arm.
Mechanism: Superficial venous thrombosis may progress into the deeper veins of the donor's arm. DVT may also rarely occur without previous signs and symptoms of superficial thrombosis. An additional risk factor (use of oral pills) may be present in these donors.
Signs and Symptoms: Swelling and pain in the upper arm. May be accompanied by symptoms of superficial inflammation and thrombosis (as above).

Arteriovenous fistula
Definition: Acquired connection between the vein and artery due to venepuncture lacerations.
Mechanism: A channel forms between the lacerated vein and artery immediately post-venepuncture, or in the healing process. May be related to arterial puncture.
Signs and Symptoms: Pulsating mass with a palpable thrill and associated bruit. The affected area may be warm, and the distal part of the arm may be cool if significant shunting of blood is present. The distal veins may be dilated and may pulsate.

Compartment Syndrome:

REPORTING OF ADVERSE EVENTS RELATED TO BLOOD DONATION

Definition: Increased compartment pressure leading to muscle and soft tissue necrosis.
Mechanism: Blood may accumulate in the frontal deep areas of forearm, closing small blood vessels and resulting in muscle and tissue necrosis. May be related to arterial puncture.
Signs and Symptoms: Painful arm, particularly on movement, swelling, Paresthesias and partial paralysis.

Brachial artery pseudoaneurysm
Definition: Collection of blood outside an artery, contained by adventitia or surrounding tissues alone.
Mechanism: After a traumatic arterial puncture, blood may leak out of the artery and accumulate in the surrounding space. In time this collection of blood gets surrounded by adventitia and forms a "pseudoaneurysm".
Signs and Symptoms: Pulsating mass in the arm. May be accompanied pain and paraesthesia. May be preceded by a large haematoma following the arterial puncture.

B. Complications mainly with generalised symptoms: Vasovagal reaction

Definition: A vasovagal reaction is a general feeling of discomfort and weakness with anxiety, dizziness and nausea, which may progress to loss of consciousness (faint). It is the most common acute complication related to blood donation.
Mechanism: Both physiological and psychological factors are important. The reaction is generated by the autonomic nervous system and further stimulated by psychological factors and the volume of blood removed, relative to the donor's total blood volume.
Signs and Symptoms: Usually several of the following; discomfort, weakness, anxiety, light-headedness/dizziness, nausea, sweating, vomiting, pallor, hyperventilation, rapid or a slow pulse. Hypotension and loss of consciousness (LOC) may occur and can be accompanied by loss of bladder or bowel control or convulsive movements.
Reactions can occur before phlebotomy (rare), during phlebotomy or immediately after phlebotomy, when the donor stands up, or in the refreshment area, or after the donor has left the donor site, (delayed vasovagal reaction). Most reactions occur within 12 hours of phlebotomy. Reactions accompanied by LOC carry a risk of injury, particularly if they occur once the donor has left the donor site, (delayed vasovagal reaction).

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REPORTING OF ADVERSE EVENTS RELATED TO BLOOD DONATION

Vasovagal reactions are divided into two main groups:

Without loss of consciousness (LOC) – the donor does not faint.
With loss of consciousness (LOC) – the donor faints for a period.

Donors who faint (with LOC) are further subdivided into two categories depending on the length of faint and if they had other complications of convulsive movements, urinary or faecal incontinence. Thus

LOC<60 seconds – without other signs and symptoms
LOC>60seconds – or with complications of convulsive movements, urinary or faecal incontinence.

The second subdivision depends if the donor sustained any injury as a result of the vasovagal reaction.

Thus;

With Injury – Injury caused by falls or accidents in donors with a vasovagal reaction
Without Injury

And lastly subdivision is based on the location of reaction;

Immediate – Symptoms occurred before donor has left the donation site
Delayed – Symptoms occurred after the donor has left the donation site

C. Complications related to apheresis.

Citrate reaction.
Definition: Neuromuscular hyperactivity related to reduced ionized calcium levels.
Mechanism: Infusion of citrate anticoagulant during apheresis causes a fall in ionised calcium levels, leading to neuromuscular hyperactivity. If untreated, symptoms may progress to tetany and severe cardiac arrhythmias, including cardiac arrest. Operator error with mix up of saline and citrate bags may occur with some apheresis equipment, and lead to rapid citrate infusion.
Signs and Symptoms: Numbness or tingling of lips, feelings of vibrations, numbness or tingling in the fingers, muscle twitching, rapid or slow pulse, shortness of breath.
Symptoms may progress to carpopedal spasms and vomiting, and in severe reactions, to generalised muscle contractions (tetany), shock, irregular pulse and cardiac arrest.

Haemolysis.
Definition: Donor red cells may be damaged, releasing haemoglobin.
Mechanism: There may be malfunctioning valves, kinks or obstruction of the tubing, incorrect installation of equipment, or other equipment failures affecting the extracorporeal circuit. Incompatible replacement fluids such as dextrose may be used in error.
Signs and Symptoms: Pink or red plasma, blood in lines or filter may appear dark. The donor may notice pink or red urine after collection

Air embolism
Definition: Air bubble introduced into the donor's circulation.
Mechanism: Air may enter into the lines due to incomplete priming of lines, as a result of a machine malfunction or defective collection kits or through incorrect manipulation by staff. Air in the donor's pulmonary circulation may occlude the pulmonary arteries in the lung and cause cardiopulmonary symptoms. Air may pass to the arterial circulation through an atrial septal defect, and reduce blood flow to the brain.
Signs and symptoms: Bubbling sound or feeling at the venipuncture site. Cough, dyspnea, apprehension, sweating, chest pain, confusion, tachycardia, hypotension, nausea and vomiting.

D. Allergic Reactions.

Allergy (Local)
Definition: Red or irritated skin at the venepuncture site.

REPORTING OF ADVERSE EVENTS RELATED TO BLOOD DONATION

Mechanism: Reaction caused by allergens or irritants in solutions used for disinfection of the arm (such as chlorhexidine) or in manufacture of the collection set. Irritation may also occur due to application of the adhesive bandage (bandage adhesive dermatitis). An allergic reaction to latex that may be in supplies such as gloves may also occur.
Signs and Symptoms: Itching and redness at the venepuncture site, the bandage or adhesive site or the entire skin disinfection area. In a true allergic reaction there may be raised rash or hives in the in these areas that may expand to cover a larger area of the arm. The reaction may occur soon after donation or in hours to days post donation.

Generalised allergic reaction (anaphylactic reaction)
Definition: An anaphylactic type reaction usually starting soon after the procedure is begun and may progress rapidly to cardiac arrest.
Mechanism: Extremely rare reactions, attributed to donor sensitivity to ethylene oxide gas used to sterilise some collection bags.
Signs and Symptoms: Apprehension, anxiousness, flushing, swelling of eyes, lips or tongue, cyanosis, cough, wheezing, dyspnoea, chest tightness, cramps, nausea, vomiting, diarrhoea, tachycardia, hypotension and altered mentation.

E. Other serious complications related to blood donation

Major cardiovascular event (MCE)
Acute cardiac symptoms (other than myocardial infarct or cardiac arrest
Myocardial infarction
Cardiac arrest
Transient Ischemic arrest
Cerebrovascular accident
Death

F. Other complications

Other systemic reactions or complications that do not fit into any of the above, such as chest pain that was investigated as angina, but actually diagnosed as musculoskeletal or transmission of infection to a donor through erroneous re-use of equipment.

Grading of severity.

Life threatening complications and long-term disability are thankfully extremely rare after blood donation. The criteria for classification of a reaction as serious (severe) are:

- Hospitalisation: If it was attributable to the complication. The criterion of hospital admission is applicable if the donor is kept in hospital overnight. Cases where a donor is seen, examined, and in some cases given treatment (e.g. suturing, IV fluids, treatment of a fracture) but discharged home are not automatically classified as severe.
- Intervention: To preclude permanent damage or impairment of a body function or to prevent death (life threatening).
- Symptoms: Causing significant disability or incapacity following a complication of blood donation and persisted for more than a year after the donation (Long term morbidity).
- Death: If it follows a complication of blood donation and the death was possibly, probably or definitely related to the donation.

6. PROCEDURE

6.1. Identify the complication. This may be at a session or reported later.

6.2. Provide appropriate nursing care to donor immediately.

6.3. If the donor suffers harm as a direct consequence of the donation process, this is managed as a clinical event. As such record appropriate details of the adverse event/complication on the Donor Adverse Event Report form, 107F005.
Note: If the donor suffers harm due to factors other than the recognized complications of blood donation this is to be managed as a workplace injury - refer to 170P005 and

complete an Accident and Investigation Report Form, using intranet or Q-Pulse reporting format, if the intranet or Q-Pulse is unavailable use 170F007.

6.3.1 In the first instance, appropriate action and follow up of donor should be done by the staff involved or the team leader. **ALL parts of the document need to be completed.**
Note:

- For "Type of Donation" indicate what type of donation was carried out (whole blood, plasma, platelets, autologous whole blood, stem cell collection etc). Also use the check boxes to indicate if the donor is a new donor or not. This form does not need to be filled in for therapeutic plasma exchange patients.
- For complications in A and B, tick **only one** of the grades of severity as is seen appropriate.
- Provide details of all care and advice given to donor in the section "Adverse Event Description and Action Taken".
- Indicate whether a follow up was carried out or not. If a follow up was done, provide details in the space provided. All follow ups should be completed within 10 working days.
- ALWAYS enter any comments or codes in donor's eProgesa record and indicate this in the space provided in page two. If no comments or codes have been entered write down 'NIL'.
- Ensure donor receives a copy of the appropriate information sheet (Haematoma or Bruising and Faints).
- Fill in the appropriate outcome for the donor using the four tick box options.
- **Complete form by filling in name and signing the document.**

6.4. If the adverse event is reported at a session, pass the completed form to the Clinical Nurse Leader/Session Coordinator or to the Medical Officer at the end of the session or immediately after follow up has been completed. If the adverse event is reported after the session, or no MO is present at the session, send the form to the appropriate Medical Officer/TMS immediately.

6.5. The Medical Officer reviews the adverse event and action taken. If required, further action and follow up is carried out by the Medical Officer. The form is then sent to the local delegated individual.

6.6. The delegated person logs the form, assigns a number, updates the Donor Adverse Event database and files the form.

7. TRAINING REQUIREMENTS

☐	Complete Document Sign-Off Sheet (108F060). • Read specified sections: Sections:
☒	Complete Document Sign-Off Sheet (108F060). • Read and understand whole document
☐	Complete Document Sign-Off Sheet (108F060). • Formal training required
☐	Complete Training Module *(enter name of module)*
☐	No training required. Specify reason:

Appendix IV. Donor Adverse Event Report Form

NZBLOOD Te Ratonga Toto O Aotearoa

NATIONAL
107F00510

DONOR ADVERSE EVENT REPORT

REASON FOR ISSUE: New definitions/categories.

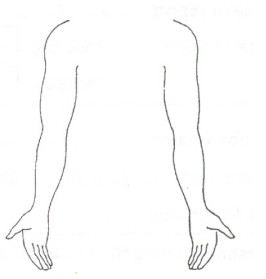
OFFICE USE ONLY: Database Record No:	

EVENT				
Date of Report:		**Type of Report:**	**Venue**	**Type of Donation**
Time of Report:		☐ At Session ☐ Phone call	☐ Static Site ☐ Mobile	☐ WB ☐ Plasma
Date of Event:		☐ Personal Visit ☐ Email ☐ Letter	Location:	☐ Platelets ☐ PBSCH / Granulocyte New donor **Y** ☐ **N** ☐

DONOR DETAILS					
Donor's Name:				**Other person reporting the event** (i.e. not donor or NZBS staff):	
Donor Number:					
Date of Birth:		**Gender:**	**M** ☐ **F** ☐	**Name:**	
Telephone No:	**(Home)**			**Relationship to Donor:**	
	(Work)				

ADVERSE EVENT DETAILS

Complication		**Grade**	
		Non-severe	**Severe**
A. COMPLICATIONS MAINLY WITH LOCAL SYMPTOMS			
A1. Complications mainly characterised by the occurrence of blood outside blood vessels	Haematoma	☐	☐
	Arterial Puncture	☐	☐
	Re-bleeding	☐	☐
A2. Complications mainly characterised by pain	Nerve Irritation/ Injury	☐	☐
	Other Painful Arm	☐	☐
A3. Localised Inflammation/Infection	Thrombophlebitis	☐	☐
	Cellulitis	☐	☐
A4. Other major vessel injury			



B. COMPLICATIONS MAINLY WITH GENERALISED SYMPTOMS					
		Without LOC	**With LOC (loss of consciousness)**		**Severe**
			Without other signs/symptoms	With other signs/symptoms and/or >60 secs	
Immediate Vasovagal Reaction	Without Injury	☐	☐	☐	☐
	With Injury	☐	☐	☐	☐
Delayed Vasovagal Reaction	Without Injury	☐	☐	☐	☐
	With Injury	☐	☐	☐	☐

C. COMPLICATIONS RELATED TO APHERESIS		
Citrate Reaction		**RED CELLS RETURNED:**
Haemolysis		**Y** ☐ **N** ☐
Air Embolism		

D. ALLERGIC REACTIONS	
1. Local ☐	2. Generalised allergic reaction ☐

E. OTHER SERIOUS COMPLICATIONS RELATED TO BLOOD DONATION

F. OTHER COMPLICATIONS

DESCRIPTION of ADVERSE EVENT and /or HARM and ACTION TAKEN
Give details:

NZBLOOD
Te Ratonga Toto O Aotearoa

NATIONAL
107F00510

DONOR ADVERSE EVENT REPORT

Information Sheet e.g. Faints, Haematoma/Bruising given to donor (tick one) **YES ☐ / NO ☐ / NA ☐**				
Observations:		**Time**	**BP**	**Pulse**
	First:			
	Final:			
Names of Staff/Witnesses Involved:				
Deferral Code/Comments:		**Entered: YES ☐ / NO ☐**		
Outcome for Donor:		☐ No Action	☐ Return from apheresis to whole blood donation	
		☐ Deferred until / /	☐ Permanent Deferral	
Follow up required		**YES ☐ / NO ☐** (If yes complete follow up then forward form to MO)		
Name of Staff (filling in form):		**Name:**	**Sign:**	**Date:**
FOLLOW UP DETAILS				
Name of Staff (conducting F/U):		**Name:**	**Sign:**	**Date:**

OFFICE USE ONLY			
Review – TMS/MO	*Name:*	*Signature:*	*Date:*
Database Entry carried out by:	*Name:*	*Signature:*	*Date:*


SAVE LIVES
GIVE BLOOD
New Zealand Government