NZBLOOD
Te Ratonga Toto O Aotearoa

National Haemovigilance Programme

Annual Report 2008

Written July 2009 by the New Zealand Blood Service Haemovigilance Steering Group:

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Haemovigilance has been declared a protected quality assurance activity under section 54 of the Health Practitioners Competence 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 exceptions:

- 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.

Contents

Foreword

This is the fourth annual Haemovigilance report for New Zealand. The continued support of clinical and laboratory staff from across the sector is a major contributor to the ongoing success of the scheme. NZBS is very appreciative of the time and effort that many individuals have given to support this achievement. I would also like to take this opportunity to thank the Haemovigilance team in Wellington, Dr Dorothy Dinesh and John Dagger, who are primarily responsible for managing the scheme and production of the report.

Vigilance schemes can provide a considerable amount of information on how effective clinical systems are in delivering their outputs. True value however arises when this information can be utilised to improve the outputs of the system. Haemovigilance schemes in both New Zealand and overseas have shown that the infectious risks, in particular the risk of viral transmission, associated with transfusion are now remarkably low. The major risks associated with transfusion today relate to immunological problems and human error. In particular Haemovigilance has highlighted the risk associated with Transfusion Related Acute Lung Injury (TRALI). In early 2008 NZBS implemented a system of 'male only Fresh Frozen Plasma' to reduce the frequency and severity of this complication. Prior to this NZBS received 9-10 reports of TRALI each year. In 2008 this reduced to 4 reports. None of these related to transfusion of FFP. Two reports related to apheresis platelets. Currently 60% of apheresis platelet donors are female. Restricting platelet donation to male donors will therefore be impractical. NZBS is about to embark on a study to determine how the risk associated with apheresis platelets might be reduced. The study will assess the relative benefits of immunological screening of donors for HLA and neutrophil antibodies versus selecting female donors based on a history of pregnancy. It is anticipated that the study will enable implementation of a revised donor selection strategy for platelet apheresis early in 2010.

Haemovigilance data indicates that the rate of adverse reactions to platelet components is significantly higher than for other component types. NZBS is progressing development of platelets suspended in additive solutions. International experience suggests that this will reduce the frequency of immunological and allergic reactions to platelet components.

Data is increasingly been collected on 'near miss' events. These involve errors that are identified before the product is transfused to patient. In New Zealand a significant proportion of such events relate to errors occurring in the laboratory. This is not seen in other Haemovigilance schemes. The reason for the difference in reporting rates between New Zealand and other countries is not clear. It might however reflect the high level of co-ordination between NZBS and hospital blood banks and also the use of a single blood management system (Progesa) in all major hospitals. Whatever the explanation the current data indicates that there are opportunities to improve laboratory systems to reduce the frequency of these type of events. This will be an increasing focus for NZBS in next few years.

I hope that you will find the report informative and look forward to your ongoing support of the programme.

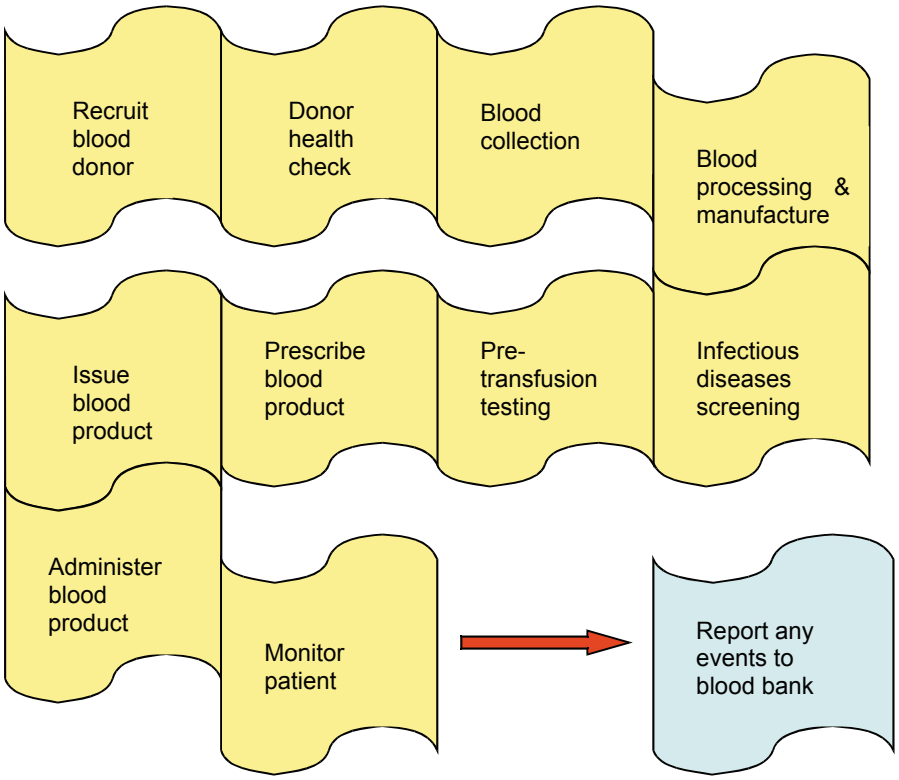
Dr Peter Flanagan
NZBS National Medical Director

Introduction

The National Haemovigilance Programme was established in May 2005 and collects data on events or reactions in blood donors and blood transfusion recipients.

Haemovigilance includes incidents that occur at any stage of the vein-to-vein transfusion process (Figure 1.1). These events include donor complications, specimen labelling errors, blood bank errors, bedside checking errors and transfusion reactions.

Figure 1.1 > The Transfusion Process

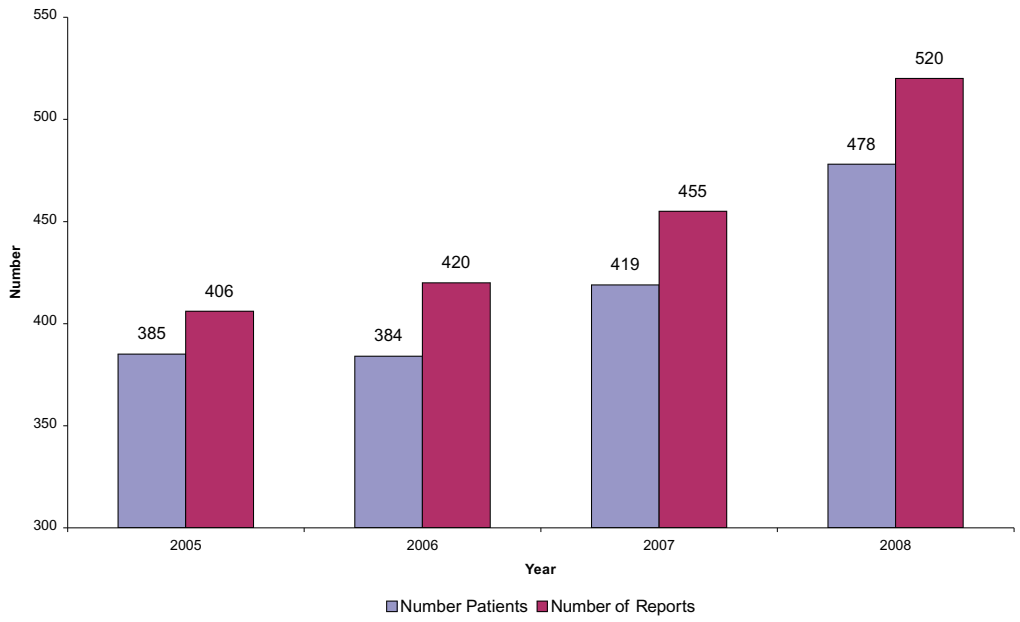


This 4th annual report indicates a continued trend of increasing numbers of reported events per year (Figure 1.2) and provides reassurance that the scheme is functioning well given that reporting is voluntary in New Zealand.

The process for reporting transfusion related adverse events remains the same and is outlined in Appendix I. Most blood banks receive the Notification and Investigation of Transfusion Reaction Form (Appendix II) accompanied by a blood sample if investigation is indicated. A blood bank scientist or Transfusion Nurse Specialist completes the Transfusion Related Adverse Event Notification Form (Appendix III) and sends this to the Haemovigilance Office. The reports are reviewed by a team of Transfusion Medicine Specialists and a Technical Advisor. Further information, if necessary, is requested from the submitter. The reports are categorised, imputability scores are reviewed by a team of Transfusion Medicine Specialists and a Scientist, and revised if necessary. A severity grading scale was introduced during 2008 and will be included in the 2009 annual report.

Introduction continued

Figure 1.2 > Reports Received by Haemovigilance Programme 2005-2008



(2005 total adjusted for 12 months)

The reports are entered into a secure database. No clinician or patient names are entered into the haemovigilance database. The reports are stored in a secure location and are destroyed on publication of the annual report. It is important that these measures are undertaken in order to encourage reporting of events, and to promote a no-blame culture. The Haemovigilance Programme provides a mechanism for identifying hazards associated with the transfusion process and therefore plays a vital role in transfusion safety.

The purpose of this report is to provide information that will help health professionals to better understand the current risks associated with transfusion. The main risks need to be communicated to potential recipients of blood products as part of the informed consent process. The Haemovigilance Programme also provides a means for identifying emerging trends relating to blood transfusion.

In order to enable comparison with international data, categories for reporting events have been revised by the International Haemovigilance Network (previously known as the European Haemovigilance Network). These are outlined in Appendix IV.

2 Trends in Blood Product Use in New Zealand

Blood components are produced from individual donations by voluntary blood donors and include resuspended red cells, platelet concentrates, fresh frozen plasma and cryoprecipitate. Plasma derivatives are manufactured from large pools of New Zealand plasma by CSL Bioplasma in Melbourne, Australia.

Plasma is derived from whole blood donations or plasmapheresis, an automated procedure where plasma is collected from a donor using an apheresis (cell separator) machine. Platelet concentrates are produced by pooling buffy coats from four whole blood donations or collected by apheresis (plateletpheresis). This procedure takes approximately 90 minutes and usually yields two adult doses. Cryoprecipitate is produced from apheresis plasma from donors with suitable fibrinogen levels.

Pre-storage leucodepletion of all blood components was implemented in July 2001 in New Zealand. White blood cells are removed by a filtration process. This reduces the frequency of febrile transfusion reactions. Other benefits of leucodepletion include reduction in the risk of transmission of cytomegalovirus, less HLA alloimmunization and possible reduction in the risk of transmission of variant Creutzfeldt-Jakob disease.

In New Zealand the vein-to-vein process is managed through Progesa (the NZBS Blood Management System). This enables us to extract data and provide detailed information on blood product usage. Table 2.1 shows the total number of red cells, platelets, plasma and cryoprecipitate transfused per year since 2006.

Red cell usage increased by 2% from 2007 whereas platelet usage has risen more steeply (14%). Fresh frozen plasma usage has continued to decline (-5%). Similar trends have been observed in the United Kingdom (SHOT annual report 2007).

Table 2.1 > Total Annual Transfused Blood Components 2006 - 2008

Component	Units Transfused in 2008	Units Transfused in 2007	Units Transfused in 2006
Red cells	121,231	118,751	117,688
Platelets - apheresis	7,942	6,762	6,758
Platelets - pooled	5,157	4,749	4,657
Fresh frozen plasma	18,962	19,956	20,619
Cryoprecipitate	2,372	1,991	1,847
Cryodepleted plasma	524	927	690
Total	**156,188**	**153,136**	**152,259**

Data on transfusion recipients can also be extracted from Progesa. Overall 39,656 individuals received a blood product in 2008. This represents approximately 1% of the population of New Zealand.

2 Trends in Blood Product Use in New Zealand continued

In 2008 27,756 patients received red cells, 3,456 patients received platelets and 3,456 patients received fresh frozen plasma. The number of fresh frozen plasma recipients has decreased since 2007 (4,686). The gender, age and number of units transfused is shown in Table 2.2. The data is very similar to that of 2007 except for the maximum number of red cells per recipient and the maximum number of platelets transfused per recipient, which have both increased.

Table 2.2 > Blood Component Recipients 2008

		Red cells	Platelets	FFP
Gender of recipients	Female	15,882	1,320	1,380
	Male	11,817	2,131	2,070
	Unknown	57	5	6
	Total	**27,756**	**3,456**	**3,456**
Age of recipients (years)	Mean	61	45	60
	Median	68	51	65
	Maximum	106	99	103
	Minimum	0	0	0
Total units transfused per recipient for 2008	Mean	4	4	4
	Median	3	2	3
	Maximum	153	145	239
	Minimum	1	1	1

3 Transfusion Related Adverse Events Reported in 2008

A total of 520 events were reported to the National Haemovigilance Programme in 2008. Reports were received from 19 of the 21 District Health Boards (DHBs) and involved 478 patients. Table 3.1 shows the number of reported events per patient.

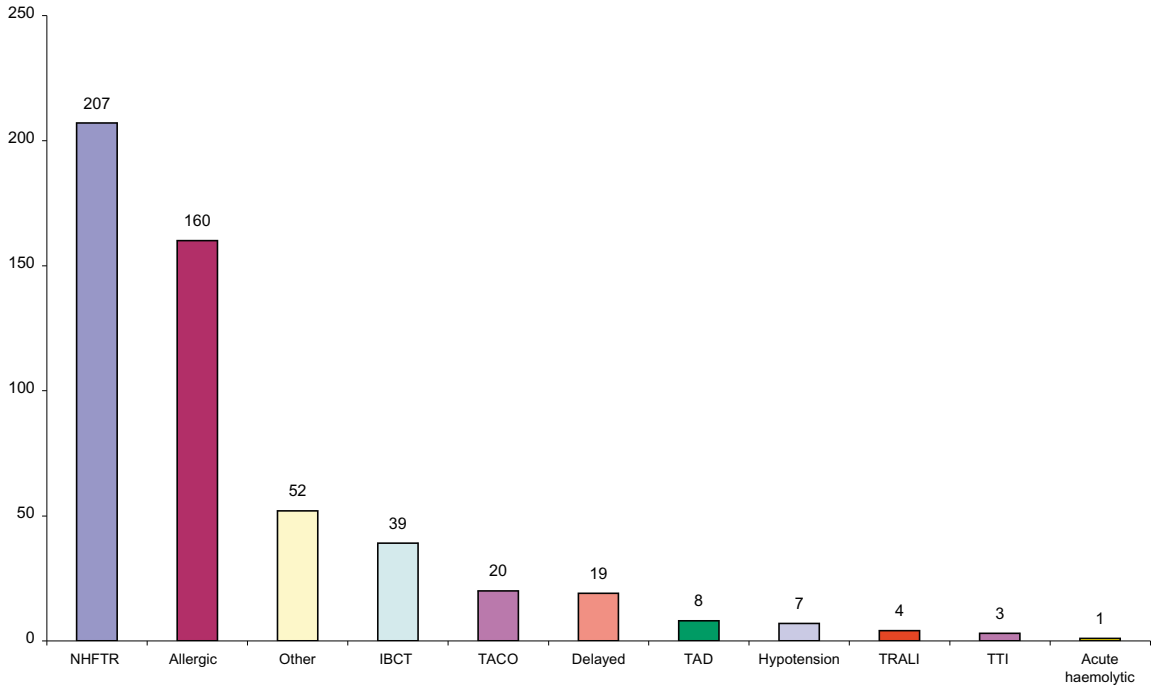
Table 3.1 > Number of Reported Events per Patient 2008

Number of Reports	1	2	3	5
Number of Patients	444	28	5	1*

**patient had multiple reactions during therapeutic plasma exchange*

Figure 3.1 shows the breakdown of reported events by type of event. Non-haemolytic febrile transfusion reactions (NHFTRs) and allergic reactions were the most frequently reported events. The breakdown of events ranked similarly to data from previous years.

Figure 3.1 > Events Reported by Type 2008



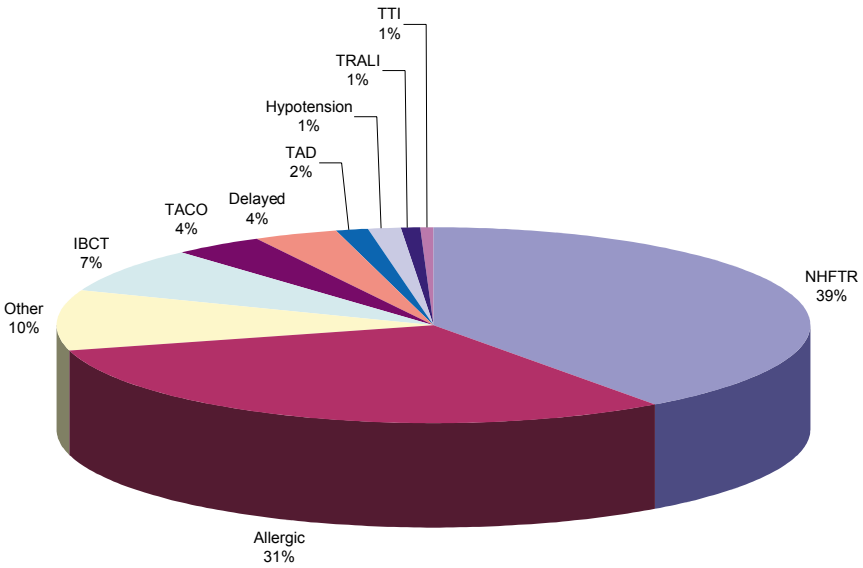
Key:

NHFTR	*Non-haemolytic febrile transfusion reactions*
Allergic	*Allergic reactions*
IBCT	*Incorrect blood component transfused*
TACO	*Transfusion-associated circulatory overload*
Delayed	*Delayed haemolytic transfusion reactions*
TAD	*Transfusion-associated dyspnoea*
TRALI	*Transfusion-related acute lung injury*
TTI	*Transfusion-transmitted infections (suspected)*
Acute Haemolytic	*Acute haemolytic and other severe acute reactions*

3 Transfusion Related Adverse Events Reported in 2008 continued

The breakdown of reported events as a percentage of the total reports for 2008 is shown in Figure 3.2. In 2007 there were no reports of suspected transfusion-transmitted infection and reports of transfusion associated dyspnoea (TAD) or hypotension were included in the category "other".

Figure 3.2 > Type of Event as Percentage of Total 2008 (n = 520)



Imputability Scores

The imputability assessment reflects the likelihood of an event being attributable to transfusion. It can be completed by medical or nursing staff and is reviewed by the Haemovigilance Steering Group and may be modified. Imputability data may be less accurate where very little clinical information is provided. Table 3.2 summarizes the imputability scores for 2008 events.

Overall 53% of events were recorded as being probably or certainly related to transfusion and 14% of events were unlikely/excluded or had unknown imputability.

Transfusion Related Adverse Events Reported in 2008 continued

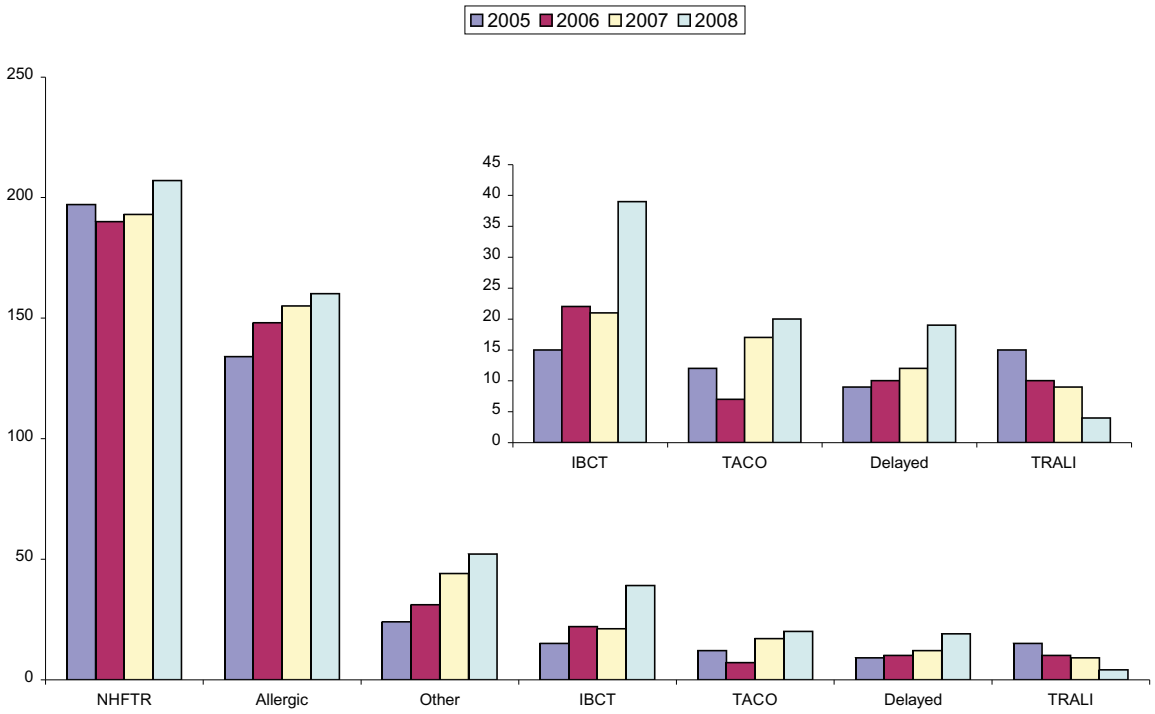
Table 3.2 > Imputability Scores for Reported Events in 2008

	Unknown	Excluded/ Unlikely	Possible	Likely/ Probable	Certain	Total
NHFTR		37	97	66	7	207
Allergic	3	4	38	105	10	160
Other	2	23	19	7	1	52
IBCT					39	39
TACO			7	13		20
Delayed TR					19	19
TAD		1		7		8
Hypotension		2	5			7
TRALI		1	1	2		4
TTI			3			3
Acute					1	1
Total	**5**	**68**	**170**	**200**	**77**	**520**
Percentage	1%	13%	33%	38%	15%	

4 Trends in Reported Events

The National Haemovigilance Programme began collecting data in May 2005. Figure 4.1 shows the total number of reports per year since the scheme commenced. The 2005 data are corrected for a twelve month period. There has been a steady increase in most event types apart from TRALI, which has declined. The number of reported IBCT and delayed reactions have increased more sharply although the IBCT increase can be explained by an FFP audit by one site, which identified inappropriate dosing for warfarin reversal.

Figure 4.1 > Total Annual Reports 2005 – 2008



*2005 totals corrected for 12 month period

Reported Events by Region

There are 21 District Health Boards (DHBs) in New Zealand that are responsible for providing health care services in specific geographical regions. Some DHBs have several hospitals within their region.

Table 4.1 shows the origin of reported events for 2008 by DHB and the rate of events per 10,000 blood components transfused, in descending order of frequency. Two DHBs did not report events in 2008 however one had a relatively low transfusion rate.

Most DHBs appear to be reporting consistently as shown in Figure 4.2. Waikato DHB has a higher rate of reports which can be explained by an audit of fresh frozen plasma (FFP) use that revealed considerable underdosing when solely used to reverse warfarin effect. These were reported as IBCT. Australasian guidelines for warfarin reversal recommend the use of Prothrombinex complex concentrate (25 – 50 IU/kg) and one unit of FFP as the preferred method for reversing warfarin effect, where clinically indicated.

4 Trends in Reported Events continued

Capital Coast DHB and Counties Manukau DHB reporting rates fall well below the average rate of 1 in 300 units transfused. The reason for this anomaly is not clear however it is important to note that both are in the top 5 transfusers and their reporting rates appear to be declining (Figure 4.3).

Table 4.1 > Origin of Haemovigilance Notifications 2008

District Health Board	Reported Adverse Events 2008 (n=520)	Components Transfused *	Events/10,000 Components Transfused
Waikato	119	16,700	71
Lakes	12	2,275	53
Hutt	16	3,274	49
MidCentral	32	6,479	49
Hawke's Bay	17	3,895	44
Northland	14	3,415	41
Otago	27	7,223	37
Waitemata	38	10,553	36
Bay of Plenty	23	6,599	35
Canterbury	54	15,884	34
Auckland	94	32,693	29
Taranaki	10	3,519	28
Capital and Coast	34	16,491	21
Tairawhiti	3	1,495	20
South Canterbury	4	2,062	19
Wairarapa	2	1,373	15
Whanganui	2	1,438	14
Counties Manukau	16	13,930	11
Nelson Marlborough	3	3,987	8
West Coast	0	441	0
Southland	0	2,463	0

**Red cells, Platelets, FFP, Cryodepleted plasma, Cryoprecipitate*

4 Trends in Reported Events continued

Figure 4.2 > Total Reports per DHB for 2008 vs Total Units Transfused

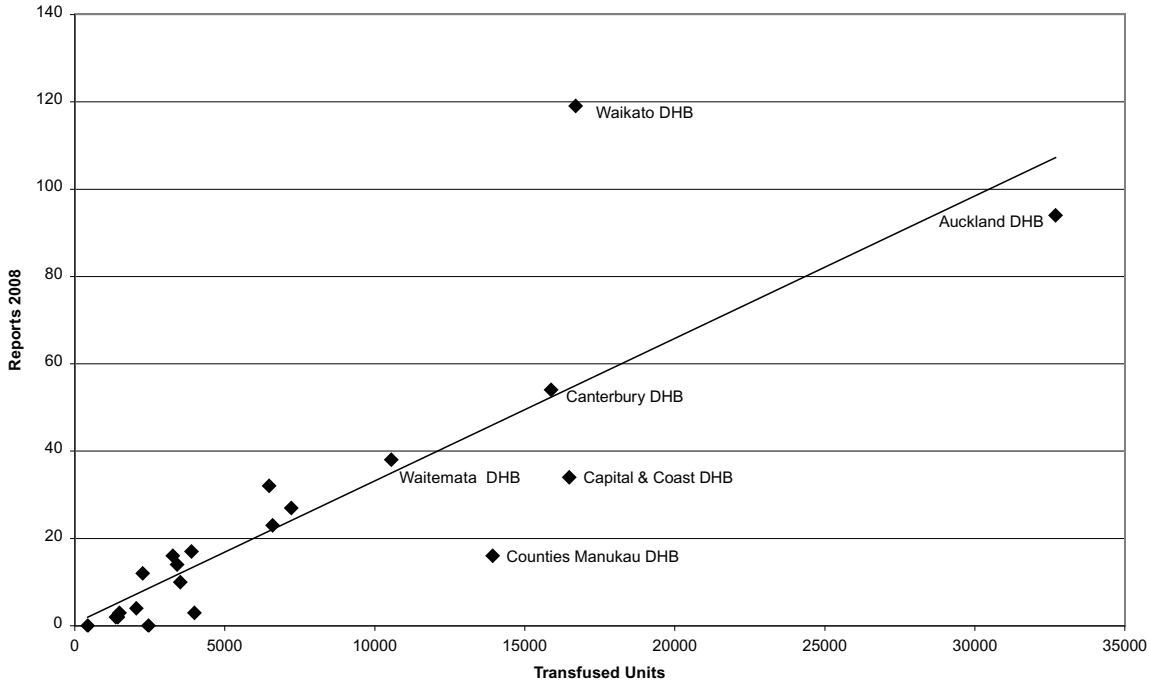
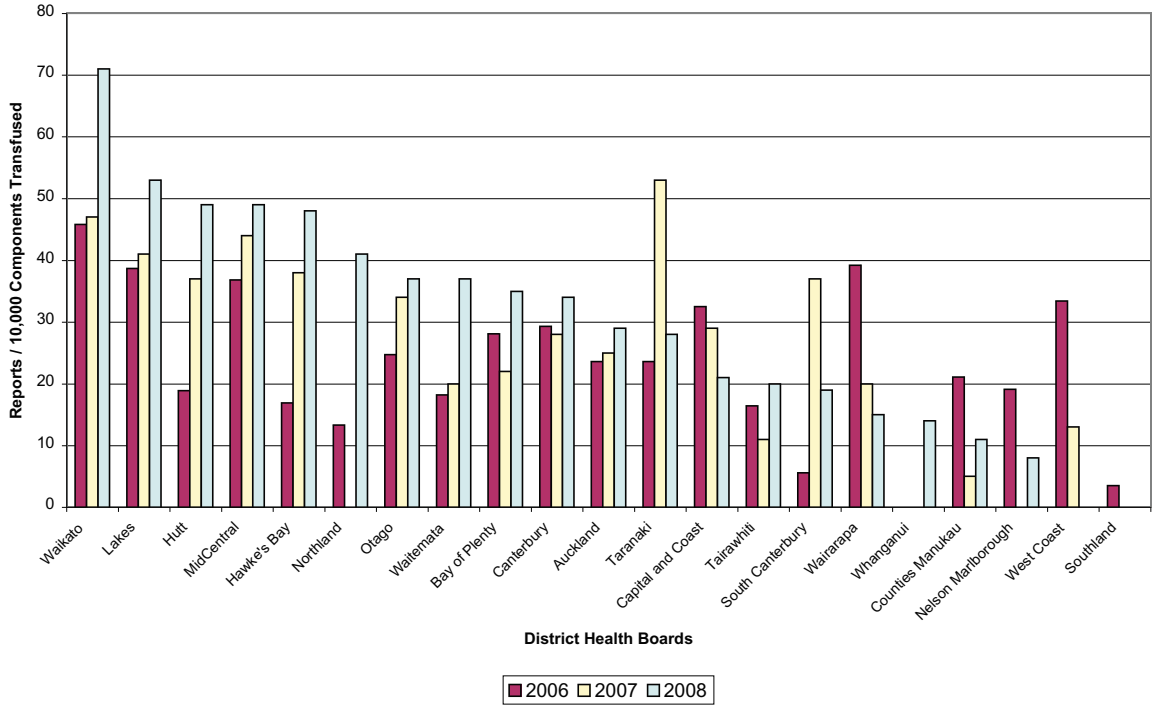


Figure 4.3 > Reported Events per 10,000 Transfusions 2006 – 2008



5 Blood Component Type and Reported Events

Transfusion related adverse events are consistently more frequently associated with platelet and plasma transfusions compared to red cell transfusions. This is demonstrated in Table 5.1. The overall rate of a report of an adverse event related to transfusion of a blood component is approximately 1 in 300 units transfused.

Table 5.1 > Reported Events by Type of Blood Component

Component	Number Transfused	Number Events *	Frequency	Per 10,000 units Transfused
Red Cells	121,231	369	1:329	30
Platelets - apheresis	7,942	54	1:147	68
Platelets - pooled	5,157	28	1:184	54
Fresh frozen plasma	18,962	80	1:237	42
Cryoprecipitate	2,372	10	1:237	42
Cryodepleted plasma	524	6	1:87	115

** Includes events where multiple component types transfused*

Most reports were associated with the transfusion of one type of blood component (red cells 67%, platelets 12%, plasma 12%); 7% of reported events were associated with the transfusion of more than one type of blood component (Table 5.2).

Table 5.2 > Nature of Event by Blood Component Type 2008

	Red Cells	Fresh Frozen Plasma	Platelets Apheresis	Platelets Pooled	Cryoprecipitate	Cryodepleted Plasma	Other	Multiple Components*
Acute haemolytic	1							
Allergic	61	37	33	7	2	2		18
Delayed reaction	18							1
IBCT	12	9		3	1	4	6	4
NHFTR	182	3	8	6				8
Other type of reaction	45	3	1				2[a]	1
TAD	8							
Hypotension	5	1						1
TACO	14	2		1				3
TRALI	2		1	1				
TTI	1		1					1
All (n=520)	**349**	**55**	**44**	**18**	**3**	**6**	**8**	**37**

**Events include transfusion of both blood components and plasma derivatives*

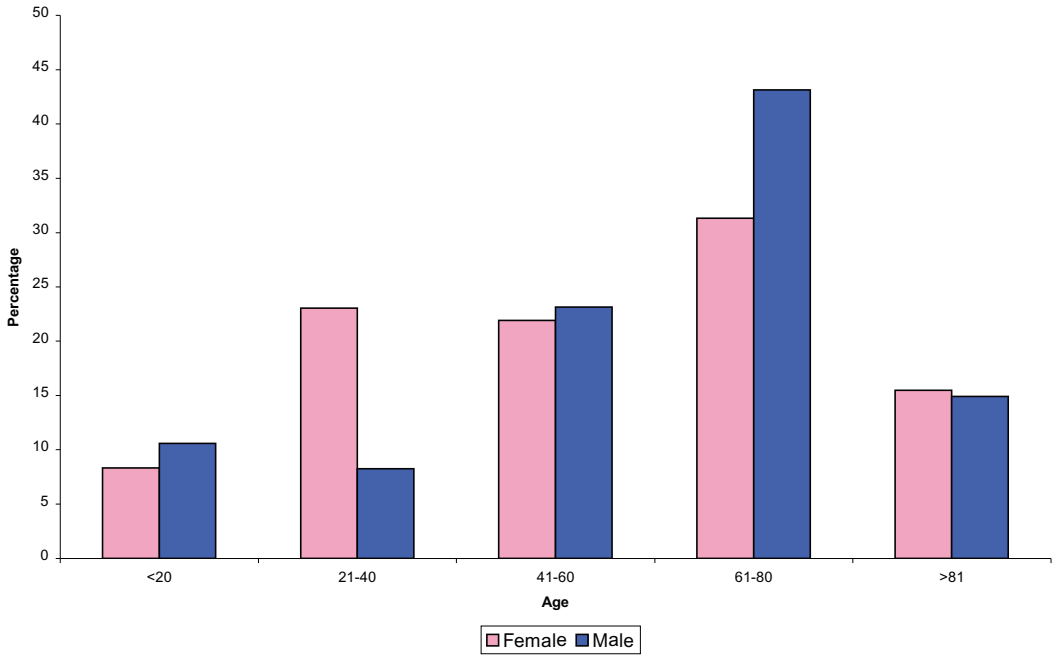
[a]One event involved plasma and Albumex, the other was a near miss involving immunoglobulins

6 Recipient Related Data for Reported Adverse Events

In 2008, 265 of the 520 reported events involved female recipients and 255 involved male recipients.

The age and sex distribution of recipients with reported adverse events in 2008 is similar to that of 2007 and is shown in Figure 6.1.

Figure 6.1 > Age and Sex of Recipients of Reported Adverse Events 2008



Adverse events were again more frequently reported in recipients of plasma and platelets concentrates, as shown in Table 6.1.

Table 6.1 > Adverse Events by Blood Component per Recipient 2008

Component	Recipients	Number Events	Frequency	Per 1,000 Recipients
Red cells	27,756	369	1:75	13
Platelets	3,456	82	1:42	24
Fresh frozen plasma	3,456	80	1:43	23

6 Recipient Related Data for Reported Adverse Events continued

Table 6.2 shows the type of adverse event per blood component recipient in 2008. Recipients are most likely to have a febrile non-haemolytic reaction reported. Overall 1 in 69 blood component recipients had an adverse event reported in 2008.

Table 6.2 > Adverse Events Reported in Recipients of Blood Components

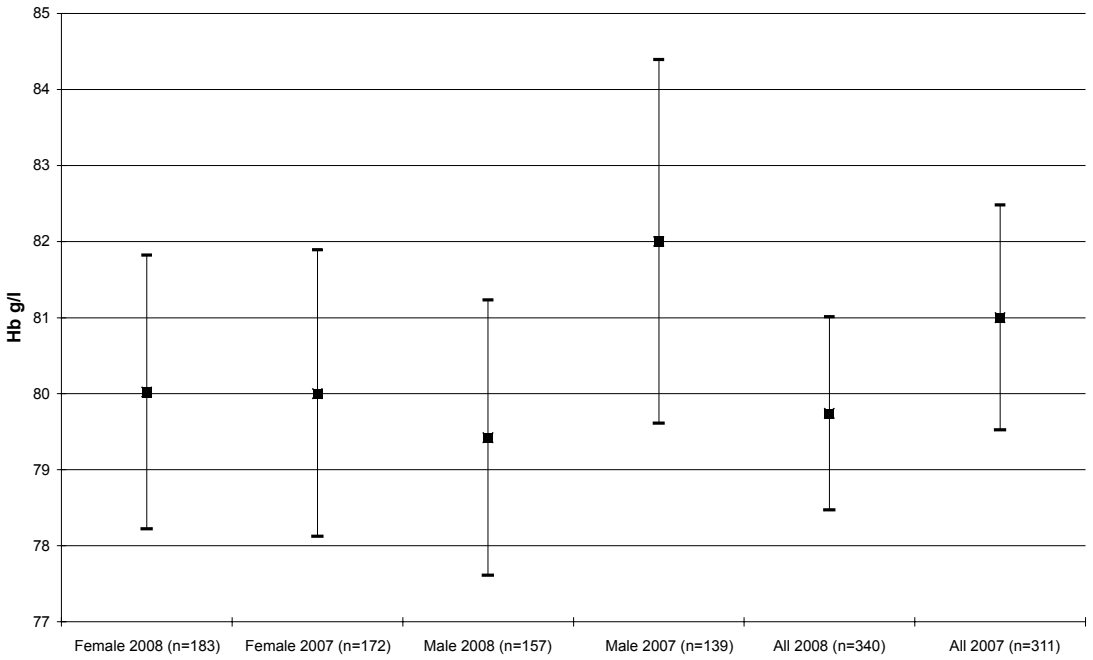
Event	Number	Frequency
NHFTR	207	1:167
Allergic	160	1:217
Other	52	1:667
IBCT *	19	1:1,825
TACO	20	1:1,733
Delayed	19	1:1,825
TAD	8	1:4,334
Hypotension	7	1:4,953
TRALI	4	1:8,667
TTI	3	1:11,556
Acute haemolytic	1	1:34,668
All	**500**	**1:69**

**Excludes IBCTs relating to fractionated plasma products*

Pre-transfusion Haemoglobin Levels

The haemoglobin level provides a crude indicator of the appropriateness of red cell transfusion. This value is requested in reported events involving red cell transfusion. The overall mean pre-transfusion haemoglobin value has decreased slightly in comparison to the 2007 haemovigilance data (Figure 6.2) but again suggests that most reported events associated with red cell transfusions involved appropriate transfusions.

Figure 6.2 > Mean Pre-transfusion Haemoglobin Values

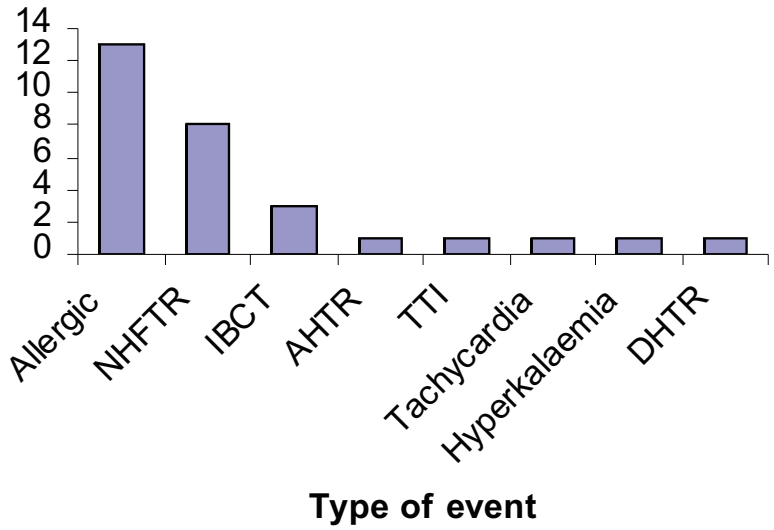


6 Recipient Related Data for Reported Adverse Events continued

Transfusion Related Adverse Events in Paediatric Recipients

Twenty nine (6%) reports involved recipients under the age of 15 years in 2008. There were 13 reports involving female recipients and 16 involving male recipients. Eight recipients were less than one year of age. Allergic reactions were the most frequent type of reaction reported in paediatric recipients (Figure 6.3).

Figure 6.3 > Types of Reported Events in Paediatric Recipients



7 Non-haemolytic Febrile Transfusion Reactions (NHFTRs)

DEFINITION

One or both of:

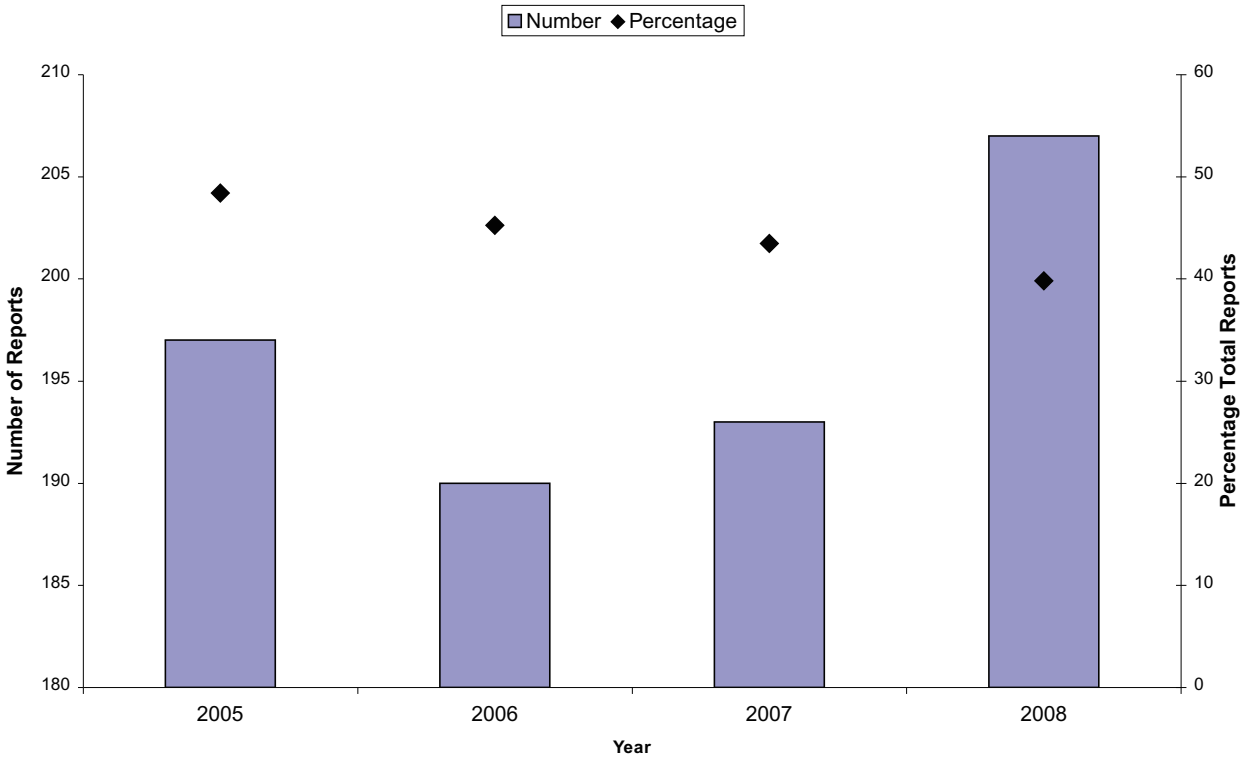
- Fever (≥ 38°C and a change of ≥ 1°C from pre-transfusion temperature)
- Chills/rigors

Occurring during or within 4 hours of transfusion without other cause such as haemolytic transfusion reaction, bacterial contamination or underlying condition.

Febrile reactions are the most frequently reported type of transfusion reaction overall (39%) with 207 reports in 2008. These are predominantly associated with red cell transfusion (Table 5.2). These reactions are thought to be mediated by cytokines in stored blood components or HLA antibodies in the recipient. Similar symptoms can be caused by underlying conditions such as sepsis or malignancy. Units associated with febrile reactions should be returned to the laboratory and sent for microbiological testing.

Figure 7.1 demonstrates a steady increase in the number of reported febrile reactions since the Haemovigilance Programme was established in 2005.

Figure 7.1 > Annual Febrile Reactions 2005 – 2008



2005: 8 months corrected for 12 month period

Non-haemolytic Febrile Transfusion Reactions (NHFTRs) continued

There were similar numbers of males and females with reported febrile transfusion reactions, with a mean age of 61 years (Table 7.1).

Table 7.1 > Age and Sex of Patients with Reported Febrile Reactions

	Number	Mean	Median	Max	Min
Female	107	58	62	96	0
Male	100	64	70	95	1
All	**207**	**61**	**66**	**96**	**0**

18% of the reports had an imputability rating indicating these events were unlikely to be related to the transfusion. These cases had another identifiable cause for the increase in temperature. 47% were rated as possibly related to the transfusion and 35% were probably or certainly related. The imputability scores are summarized in Table 7.2.

Table 7.2 > Imputability Scores for NHFTRs 2008

	Imputability Scale	Number of Events	Percentage
0	Excluded/Unlikely	37	18%
1	Possible	97	47%
2	Likely, probable	66	32%
3	Certain	7	3%
Total		**207**	**100%**

Other Symptoms Associated with NHFTRs

Approximately one quarter of the NHFTRs also reported other symptoms or signs. 39 cases had accompanying hypertension (increase of at least 30 mmHg systolic blood pressure during transfusion). 7 cases also reported allergic symptoms (rash, wheeze, anaphylaxis) and 3 had dyspnoea. One patient had vomiting and another patient developed atrial fibrillation.

8 Allergic Reactions

DEFINITION:

Mucocutaneous signs and symptoms during or within 4 hours of transfusion:

- Morbilliform rash with pruritus
- Urticaria (hives)
- Localised angioedema
- Oedema of lips, tongue, uvula
- Periorbital pruritus, erythema, oedema
- Conjunctival oedema

Anaphylactic reaction is where, 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 features include hypotension, hypotonia, syncope.

Allergic transfusion reactions are thought to be mediated by a pre-formed IgE antibody in the recipient directed against a protein present in the plasma of the transfused blood component. Passive transfer of IgE antibodies can result in an anaphylactic reaction if the recipient receives the allergen, so donors with a history of severe anaphylaxis are not eligible to donate blood. Although rare, pre-existing antibodies to IgA immunoglobulins in individuals with IgA deficiency are associated with anaphylactic transfusion reactions.

Antihistamines are used to treat allergic transfusion reactions. Anaphylactic transfusion reactions are managed in the same manner as anaphylactic reactions from other causes. Patients with recurrent severe anaphylactic transfusion reactions should be discussed with a Transfusion Medicine Specialist as washed red cells or platelets may be indicated.

Allergic transfusion reactions comprised 31% of overall reports in 2008 and was the most frequent reaction type in paediatric blood component recipients. 18 (11%) of the reported allergic reactions were severe (anaphylaxis).

From 2009 all events will include a severity grade in the report. This will be particularly useful for distinguishing allergic reactions that are more severe than urticaria alone (which is a frequent occurrence) but that did not meet the previous criteria for anaphylaxis (drop in blood pressure of at least 30 mmHg).

Allergic reactions occurred with similar frequency in male and female blood component recipients (87 reports involved male recipients and 73 reports involved female recipients). In contrast there was a predominance of female recipients amongst allergic reactions reported in 2007.

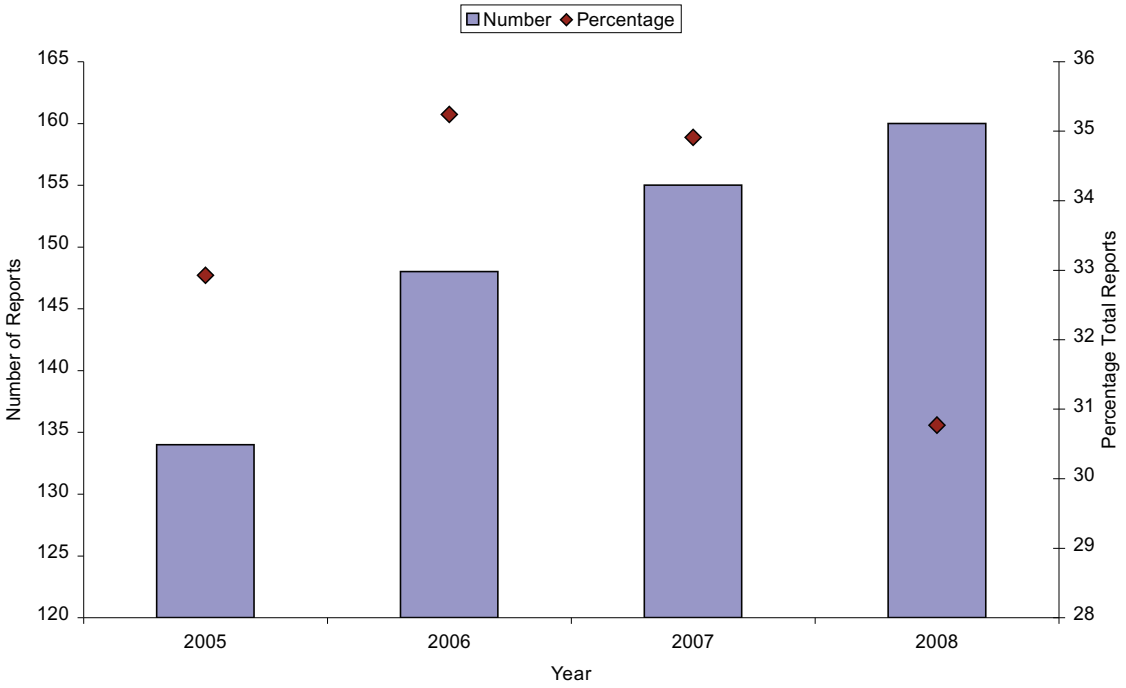
Figure 8.1 demonstrates a steady increase in the number of reported allergic reactions since the Haemovigilance Programme was established in 2005.

38% of reported allergic reactions were associated with red cell transfusion, 26% with plasma, 25% with platelets and 11% with multiple blood components (Table 5.2).

8 Allergic Reactions continued

The imputability scores outlined in Table 8.1 indicate that 72% were probably or certainly related to transfusion. Peri-operative reactions may be attributable to a variety of agents e.g. colloids, antibiotics, anaesthetic drugs; and a lower imputability score is often assigned. Occasionally the nature of a reaction may not be evident e.g. in anaesthetised patients with haemodynamic instability. A transient rise in the serum tryptase level may be useful to confirm that the reactions are allergic in nature, in this subset of patients.

Figure 8.1 > Annual Allergic Transfusion Reactions 2005 – 2008



2005: 8 months corrected for 12 month period

Allergic Reactions continued

Table 8.1 > Imputability Scores for Allergic Reactions 2008

	Number of Events	
Imputability Scale	Allergic	Anaphylactic/ Anaphylactoid
Not Reported / Unknown	2	1
Excluded / Unlikely	4	
Possible	29	9
Likely, probable	98	7
Certain	9	1
Total	**142**	**18**

Other Symptoms Associated with Allergic Transfusion Reactions

A number of patients experienced additional symptoms and signs which are outlined in Table 8.2. Patients with hypotension had a drop in their blood pressure of less than 30 mmHg (otherwise their reactions would have been categorised as anaphylactoid).

Table 8.2 > Additional Symptoms Associated with Allergic Reactions

Symptom/sign	Number
Hypertension	10
Hypotension	19
Chest pain	3
Fever	3

9 Transfusion Associated Circulatory Overload (TACO)

DEFINITION:

Any 4 of the following occurring within 6 hours of completion of the transfusion:

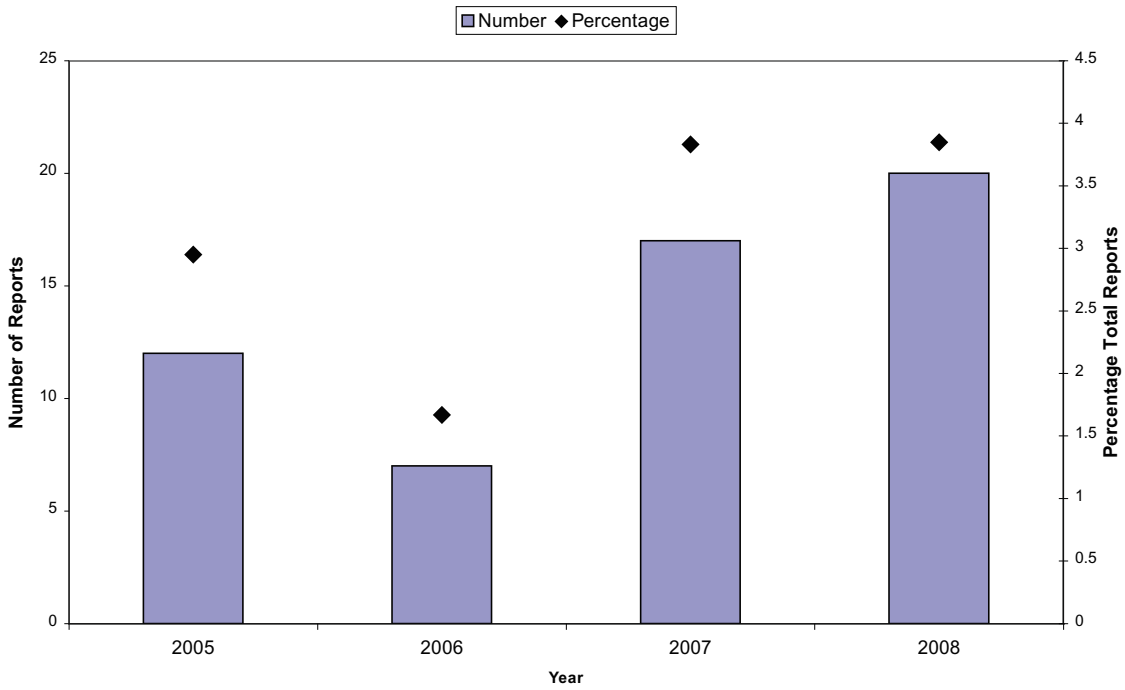
- Acute respiratory distress
- Tachycardia
- Increased blood pressure
- Acute or worsening pulmonary oedema on frontal chest radiograph
- Evidence of positive fluid balance

An elevated BNP (brain natriuretic peptide) is supportive of TACO.

Patients with underlying impaired cardiac function or chronic anaemia and receiving large volume or rapid infusion of blood are more susceptible to circulatory overload. Management is the same as for other causes of circulatory overload, i.e. restriction of fluid input, diuretics and oxygen/respiratory support.

There were 20 cases of TACO reported to the Haemovigilance Programme in 2008. Figure 9.1 shows a progressive increase in cases reported over the past 2 years. Dyspnoea, hypertension, tachycardia and falling oxygen saturation were the most frequent clinical features observed (Figure 9.2).

Figure 9.1 > TACO Reports 2005 – 2008



2005: 8 months corrected for 12 month period

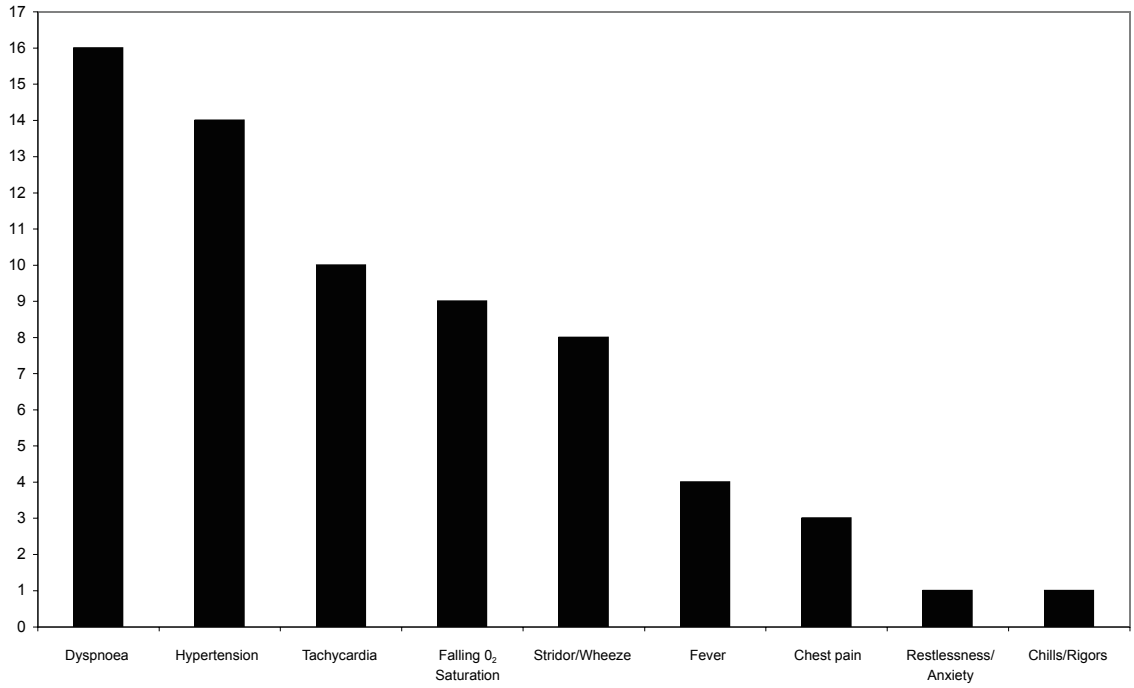
9 Transfusion Associated Circulatory Overload (TACO) continued

All reported cases of TACO involved adult patients, with mean age of 71 years and a higher frequency in females (Table 9.1).

Table 9.1 > Age and Sex of Patients with Reported TACO 2008

	Age				
	Number	Mean	Median	Max	Min
Female	14	73	74	94	18
Male	6	68	75	82	31
All	**20**	**71**	**74**	**94**	**18**

Figure 9.2 > Clinical Features of TACO 2008



Information for each patient's medical history provided to the Haemovigilance Programme varies between reports. Seven patients had a history of congestive cardiac failure, four patients had other cardiac conditions and one patient had acute renal failure.

Type of Blood Component Transfused and Time to Onset of Symptoms

Most of the reported cases of TACO (70%) were associated with the transfusion of red blood cells (Table 5.2). The volumes transfused cannot be reported as fluid balance charts are not consistently recorded or provided with the Haemovigilance notification. However the time interval between the start of the transfusion and onset of symptoms is captured and was available for 19 reports. The range of the time interval was 20 minutes to 7 ½ hours and the average time to onset of symptoms was 2.2 hours.

2 Transfusion Associated Circulatory Overload (TACO) continued

Imputability Scores

13 cases were rated as probably related to transfusion and 7 cases were rated as possibly related to transfusion.

Outcomes

Information regarding the outcome for patients with reported TACO was available for 11 cases. Two patients recovered within minutes, four patients recovered within 10 – 12 hours and three patients recovered within 24 hours.

Two patients died, one death was attributable to an intracranial haemorrhage and the other patient had multiple medical comorbidities (age 92 years) and died after 3 days.

Additional Symptoms and Events Associated with TACO

Four reports included concurrent fever/chills, three had allergic symptoms and several reports included accompanying chest pain.

10 Transfusion-Related Acute Lung Injury (TRALI)

DEFINITION:

New acute lung injury (ALI):

- Acute onset
- Hypoxaemia (PaO_2/FiO_2 < 300mmHg or oxygen saturation < 90% on room air, or other clinical evidence)
- Bilateral infiltrates on chest radiograph
- No evidence of left atrial hypertension/circulatory overload
- No temporal relationship to an alternative risk factor for ALI

During or within 6 hours of completion of transfusion.

Alternative risk factors for ALI:

- Direct lung injury: aspiration, pneumonia, toxic inhalation, lung contusion, near drowning
- Indirect lung injury: severe sepsis, shock, multiple trauma, burn injury, acute pancreatitis, cardiopulmonary bypass, drug overdose

Where an underlying risk factor for ALI is present, the diagnosis of TRALI is **possible** rather than **probable.** TRALI is non-cardiogenic pulmonary oedema that occurs within six hours of transfusion and is essentially a diagnosis of exclusion. TRALI was the leading cause of transfusion-related fatality reported to the UK haemovigilance scheme in 2007 (SHOT).

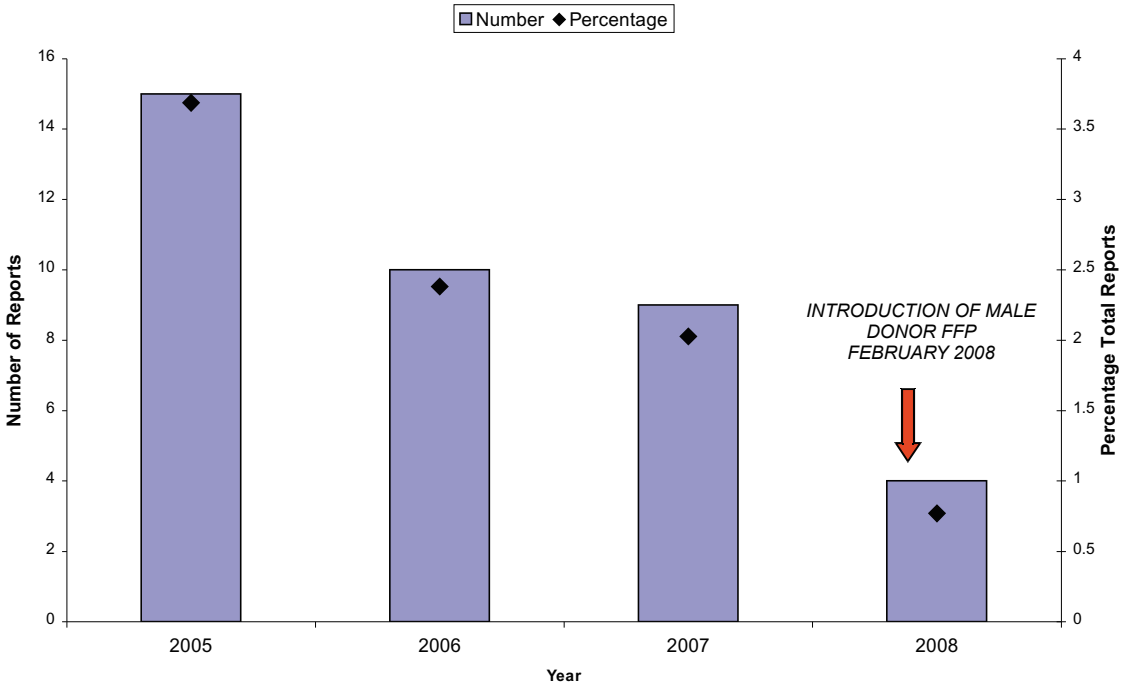
There were 4 cases of TRALI reported in 2008. Although the numbers are small, this appears to be a significant reduction (Figure 10.1).

The pathogenesis of TRALI in many cases can be explained by white cell antibodies in donor plasma reacting with recipient neutrophils, leading to damage of pulmonary vascular endothelium and capillary leak of protein and consequent pulmonary oedema. TRALI cases occur more frequently with transfusion of plasma containing blood components. White cell antibodies may be detectable in donors who are multiparous or have been previously transfused. The introduction of preferential male plasma policies in the UK in late 2003 led to a reduction in TRALI cases and deaths. In February 2008 the New Zealand Blood Service moved to production of FFP from male donors who had no history of blood transfusion. The reduction in TRALI cases reported in 2008 may be attributable to this measure. It is noteworthy that none of the reported TRALI cases in 2008 involved the transfusion of FFP, in contrast to 2007 where 5 of the 9 reports were associated with the transfusion of FFP.

Two of the four cases of TRALI involved transfusion of platelets from female donors found to have multispecific white cell antibodies. The third case involved red cell transfusion and the fourth case also involved the transfusion of red cells however the symptoms were felt to be unlikely to be due to TRALI. The New Zealand Blood Service has submitted an application to the multi-region ethics committee to study the frequency of HLA antibodies in female plateletpheresis donors. The application has been successful and testing is expected to commence during 2009.

Transfusion-Related Acute Lung Injury (TRALI) continued

Figure 10.1 > Reports of TRALI 2005 - 2008



2005: 8 months corrected for 12 month period

Case 1

A 77 year old female with acute myeloid leukaemia with a platelet count of 12 x 10^9/L was transfused one unit of pooled platelets. After 150mL (10 minutes) she became febrile (38°C) and developed dyspnoea (respiratory rate 44/minute), wheeze and acute desaturation (oxygen saturation reduced to 79%). Her heart rate and blood pressure increased and a generalised erythematous rash was noted. Her jugular venous pressure was not elevated and the fluid balance chart did not support circulatory overload. A chest xray showed new bilateral lung opacities in keeping with pulmonary oedema. She was treated with high flow oxygen, intravenous corticosteroid and nebulised salbutamol with improvement (reduction in supplemental oxygen required) after 7 hours.

Five donors were investigated: 4 were male and found to have negative HLA and neutrophil antibody tests, one female donor had class I & II HLA antibodies as well as neutrophil antibodies. The class II HLA antibodies (DR4, DR7, DR9) were specific against the patient's HLA type (DR4, DR7). The female donor was retired from blood donation.

There are features of this case that suggest an allergic reaction may have also occurred concurrently however it was recorded as probable TRALI.

Transfusion-Related Acute Lung Injury (TRALI) continued

Case 2

A 90 year old male with myelodysplastic syndrome was receiving 2 weekly red cell transfusion and weekly platelet transfusion. His pre-transfusion platelet count was 5 x 10^9/L. He was transfused one unit of apheresis platelets uneventfully and went home. After approximately 30 minutes he became breathless and was brought into the Emergency Department by ambulance. He was afebrile with heart rate 94/minute, respiratory rate 32/minute, blood pressure 106/52 mmHg and oxygen saturation 79% on air. Bilateral coarse crepitations were audible on auscultation and an arterial blood gas analysis confirmed hypoxaemia (pO2 50mmHg). A chest xray showed bilateral changes with the "appearance likely to represent heart failure". He was treated with intravenous fluids (his blood pressure fell to 64/42 in the ED) and high flow inspired oxygen. He improved and was discharged home the following day.

The implicated plateletpheresis donor is a 47 year old female. Investigations confirmed she had multispecific class I HLA antibodies, not directed or cross-reactive against the patient's HLA type. Anti-HNA3 was also identified in the donor serum. The donor was retired from donating fresh blood components. The imputability score was assigned as 2 (probably attributable to transfusion).

Case 3

An 87 year old female with a background history of chronic lymphocytic leukaemia and congestive heart failure had symptoms of anaemia and a haemoglobin level of 80g/L. She was referred by her General Practitioner for red cell transfusion. Following infusion of approximately 10mL of red cells she was unable to speak because of acute respiratory distress. Widespread inspiratory and expiratory rhonchi were audible and her oxygen saturation was reduced. The pulse and blood pressure remained elevated both prior to the start of the transfusion and during the reaction. The chest xray showed changes consistent with heart failure. Further information regarding fluid balance, diuretic treatment and outcome were not available.

The donor, a 38 year old female was found to have class I HLA antibodies with panel reactivity of 25%. The specificity of the HLA antibodies were not directed against the patient's HLA antigens. The HNA antibody screen was negative (donor). She was retired from donating blood.

This patient had a possible TRALI with red cell transfusion. Further clinical information could have clarified the nature of her reaction.

Transfusion-Related Acute Lung Injury (TRALI) continued

Case 4

A 75 year old male with a history of cerebrovascular disease, peripheral vascular disease and lung carcinoma was transfused two units of red cells. His pre-transfusion haemoglobin level was 80g/L. At the end of the transfusion he became unwell with cough, dyspnoea and grunting. He was afebrile with blood pressure 134/67 mmHg, respiratory rate 32/minute and oxygen saturation 88%. He was not for resuscitation and died several hours later. His death was attributed to pulmonary embolism, respiratory disease and heart failure. No transfusion reaction investigations were performed.

Additional TRALI Investigations

The New Zealand Blood Service National Tissue Typing laboratory investigated an additional 3 cases of TRALI in 2008. Two male patients had reactions reported to the Haemovigilance Programme that were subsequently categorised as TAD (transfusion associated dyspnoea) as there was insufficient information provided to categorise them as TRALI or TACO. Testing was incomplete as not all donors have provided samples however results to date are negative.

The third patient was a 46 year old female (Mrs W) who received multiple blood components. Table 10.1 summarizes the investigations for this case (not reported to the Haemovigilance Programme) and the outcome for the donors.

Table 10.1 > Summary of TRALI Investigations for Mrs W

Donor	Result	Outcome
1. female	No HLA or HNA antibodies found.	Reinstated
2. female	No HLA or HNA antibodies found.	Reinstated
3. female	Positive HLA class I antibodies PRA 7%. Not specific to patient HLA. Class II HLA & HNA antibody negative.	Retired
4. female	No sample received despite letter & phone call.	Awaiting tests
5. female	Positive HLA class I antibodies PRA 27%, positive HLA class II antibodies PRA 51%, not specific to recipient HLA. Negative for HNA antibody.	Retired
6. female	Positive HLA class I antibodies PRA 53%, positive HLA class II antibodies PRA 80%, specific to recipient HLA A24 and DR12. Negative for HNA antibody.	Retired
7. female	No HLA or HNA antibodies found.	Reinstated
8. female	Positive HLA class I antibodies PRA 93%, positive HLA class II antibodies PRA 40%, not specific to recipient HLA. Positive HNA antibody.	Retired

Transfusion Associated Dyspnoea (TAD)

DEFINITION:

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.

During 2008 there were 8 reports categorised as TAD. All cases were associated with red cell transfusion. One case involving a 93 year old female with gastrointestinal bleeding, renal failure, heart failure and bibasal pneumonia had deteriorating hypoxaemia, was deemed unlikely to be related to the transfusion. She died one day later. The remaining 7 reports had an imputability score of 1 (possibly attributable to transfusion) and are summarized in the table below.

Table 11.1 > Summary of TAD Reports 2008

Patient	Clinical Details	Reaction	Outcome
64 year old male	Myelofibrosis, neutropenic sepsis	Falling O_2 saturation, no chest xray	Recovered quickly
62 year old male	Lymphoma, renal failure, heart failure, neutropenic sepsis	Decreased O_2 saturation, no chest xray	Settled with oxygen
61 year old male	Gastrointestinal bleeding, past history: ischaemic heart disease, AML in remission, Hyper Eosinophilic Syndrome	Desaturation, cyanosis, fever 38.2˚C, unilateral opacity on chest xray (new), no signs of heart failure clinically	Recovered after 6 days. TRALI investigation done: 2 female donors; one donor negative for HLA & HNA antibodies, one donor untested
34 year old female	Nephrectomy, sepsis	Dyspnoea, no other information	No information
60 year old male	Haematuria, renal calculi, asthma, obesity, diabetes	Dyspnoea, wheeze, fever 38.1˚C, desaturation	Used own bronchodilator with good effect
39 year old female	Post partum haemorrhage	Dyspnoea, felt hot (temperature 37.4˚C)	No information
84 year old male	Acetabular fracture	Desaturation, fever 38.1˚C, chest xray showed bilateral changes (pulmonary oedema), elevated Troponin T	No response to diuretic, died after 6 days. TRALI investigation commenced: 2 donors (male & female) both age 17, no response to request for samples

12 Delayed Haemolytic Transfusion Reactions (DHTRs)

DEFINITION:

DHTRs usually occur between 24 hours and 28 days after transfusion and signs of haemolysis are present. It may manifest as an inadequate rise or an unexplained fall in the post-transfusion haemoglobin.
Blood group serology normally gives abnormal results confirming immunological origin. Often no symptoms or signs are noted during the transfusion. Evidence to support haemolysis include haemoglobinaemia, haemoglobinuria, decreased serum haptoglobin, unconjugated hyperbilirubinaemia, increased LDH and AST levels, positive direct antiglobulin tests (DAT), red cell antibody or evidence of incompatibility.

A delayed serologic transfusion reaction (DSTR) is red cell alloimmunization identified within 28 days of transfusion. This category is used when after a transfusion, there is demonstration of clinically significant red cell antibodies which were previously absent and no clinical or laboratory signs of haemolysis.

DHTRs and DSTRs are invariably detected by blood banks when red cells are requested for a patient who has been transfused within the past few weeks, is found to have a new red cell antibody in the latest cross-match sample. There were 19 reports in 2008, an increase from 2007 (Figure 12.1). These comprised 10 female and 9 male patients, with mean age of 64 years. Six reports were categorised as DHTRs and 13 as DSTRs. The specificity of the red cell antibodies is summarized in Table 12.1. Five patients had two new red cell antibodies. Anti-E was the most frequently implicated antibody in 2008. In 2007 Kidd antibodies were most frequently implicated in both New Zealand and the United Kingdom.

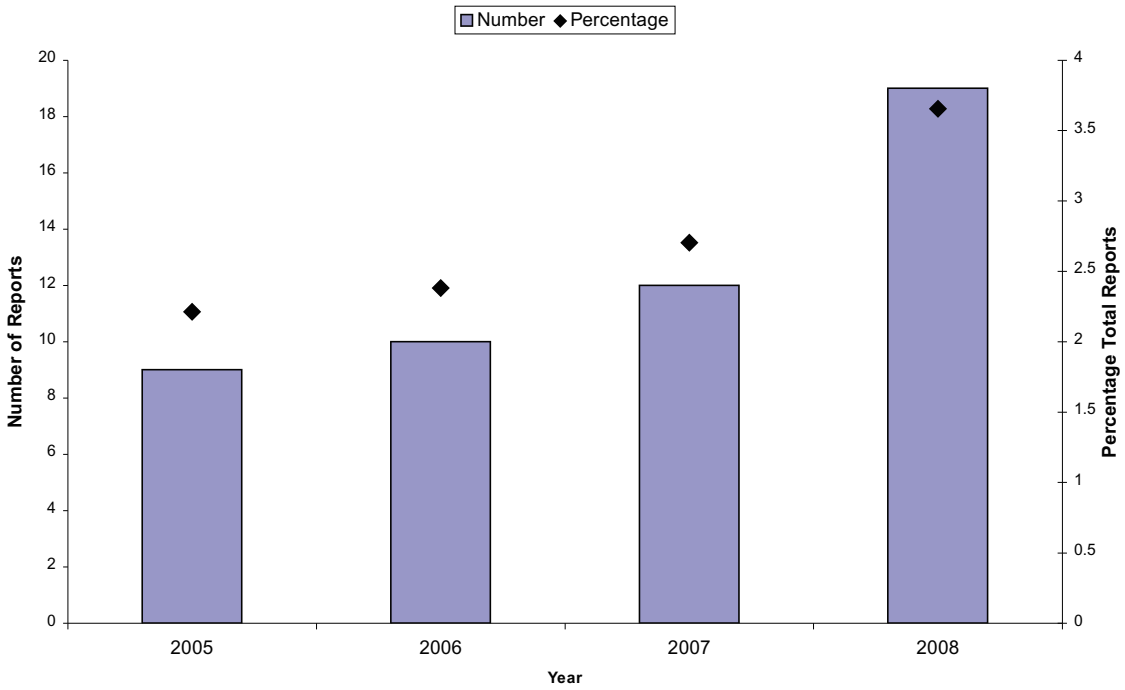
Only two patients had a positive red cell antibody screen prior to their initial transfusion: one patient had an antibody of unknown specificity, with subsequent identification of anti-Vel; the other patient had anti-C and anti-D identified in the pre-transfusion sample and anti-Jka in the post-transfusion plasma and eluate.

Case: Mrs B

Mrs B was admitted for revision of her hip joint. She had weak reactions in her pre-transfusion sample which were reported as an “AUS” (antibody of unknown specificity) after alloabsorptions failed to demonstrate any allo-antibodies. She was transfused 4 units of red cells intraoperatively. Seven days later her haemoglobin decreased to 57g/L, along with a reticulocytosis (4.2%), increased LDH (1010 U/L), increased bilirubin (35µmoL/L) and decreased haptoglobin (0.06g/L). The direct antiglobulin test was positive (IgG negative, C3d 2+). Anti-Vel was identified by the Reference Laboratory and Vel negative units were subsequently transfused. The Vel antigen has a very high prevalence and Vel negative donor units are rare.

12 Delayed Haemolytic Transfusion Reactions (DHTRs) continued

Figure 12.1 > Delayed Reactions 2005 – 2008



2005: 8 months corrected for 12 month period

Table 12.1 > Specificity of Red Cell Antibodies in Delayed Reactions 2008

Antibody	Number
E	4
C + e	1
c + E	1
Jka	3
Jkb	3
K	2
Fya	1
Vel	1
E + K	2
Jkb + E	1
Total	**19**

13 Acute Haemolytic Transfusion Reactions (AHTRs)

DEFINITION:

AHTRs occur within 24 hours of transfusion. Clinical features include fever, chills, rigors, flushing, chest pain, abdominal pain, flank pain, nausea, vomiting, diarrhoea, hypotension, tachycardia, pallor, jaundice and dark urine. Complications such as renal failure and disseminated intravascular coagulopathy may manifest as oligouria, anuria or diffuse bleeding.

Laboratory features include decreased serum haptoglobin, unconjugated hyperbilirubinaemia, increased LDH and AST, decreased haemoglobin, positive direct antiglobulin test and red cell antibody or evidence or incompatibility.

AHTRs may also be caused by red cell autoantibodies or non-immunological factors such as malfunction of a pump or blood warmer device, or use of hypotonic solution.

Administration of incompatible blood components can result in acute haemolytic transfusion reactions, which may be fatal. There were 10 ABO HTRs and 7 non-ABO HTRs reported to the US FDA as fatalities following transfusion for fiscal year 2008. HTRs were the most frequent cause of transfusion-related mortality.

In 2008 there was one AHTR reported to the National Haemovigilance Programme. The case is summarized below:

Miss A

Miss A is a 10 month old who underwent cardiac bypass surgery for repair of a large primum atrial septal defect (ASD) associated with mitral regurgitation. Her ABO type was confirmed as group A. She received 250mL of group O leucodepleted whole blood. After approximately 4 hours , when the drapes were removed, petechiae and rash were noted over her face and groin. Marked haemoglobinuria was observed. She was still under anaesthesia. Her plasma was moderately haemolysed. Routine transfusion reaction investigations did not reveal any anomalies. A cold agglutinin screen and a Donath-Landsteiner test were negative.

Rash and petechiae are not typical of haemolysis. Although the investigations were negative, it is possible that haemolysis occurred either from anti-A in the unit of group O whole blood (negative on haemolysin testing) or related to the bypass circuit. No further information was provided in the notification form. Imputability was not assessable according to the patient's nurse.

14 Hypotensive Transfusion Reactions

DEFINITION:

Decrease of ≥ 30mmHg in systolic and/or diastolic blood pressure occurring during or within one hour of completing transfusion. All other categories of adverse reactions presenting with hypotension must have been excluded together with the underlying condition that could explain hypotension. May be associated with other symptoms such as facial flushing, dyspnoea and abdominal cramps.

Hypotensive transfusion reactions may be more likely to occur in recipients taking ACE (angiotension converting enzyme) inhibitors. Hypotensive reactions are thought to be mediated by vasoactive kinins generated when plasma comes into contact with a negatively charged surface. In general these reactions resolve quickly once the transfusion is stopped.

There were 7 reports categorised as hypotensive transfusion reactions in 2008, however two were deemed to be unlikely to be related to the transfusion. The cases are summarized in Table 14.1. The reaction times are recorded from the start of the transfusion.

Table 14.1 > Hypotensive Transfusion Reactions 2008

Patient	Blood Component	Reaction	Imputability
82 year old female, resection of rectal carcinoma, massive intraoperative blood loss	Red cells, platelets, plasma, cryoprecipitate	Pulse 160/minute, systolic BP 50 mmHg (at baseline & after 10 minutes)	Unlikely
91 year old male with hip fracture	Red cells	Baseline pulse 66, BP 96/50; after 80 minutes pulse 75, BP 65/35; chest pain	Possible
58 year old male, haematuria, prostate cancer, obesity, congestive heart failure, hypertension	Red cells	Baseline pulse 88, BP 108/40, after 15 minutes pulse 95, BP 70/40; chest felt heavy	Possible
76 year old male, cardiac bypass surgery for coronary artery graft and valve replacement	Red cells	BP 110/60 → 70/30 (immediate), no change in pulse (84)	Unlikely
44 year old female, post-partum haemorrhage	Red cells	Baseline pulse 100, BP 120/65, after 105 minutes pulse 120, BP 65/30	Possible
57 year old male, coronary artery graft x4, diabetes, hypertension, chronic obstructive airways disease	Plasma	BP 104/65, after 10 minutes BP 70/40, pulse remained 68; under anaesthesia	Possible
80 year old female, pelvic mass, fever	Red cells	Baseline BP 121/61, after 60 minutes BP 100/52, pulse remained 82	Possible

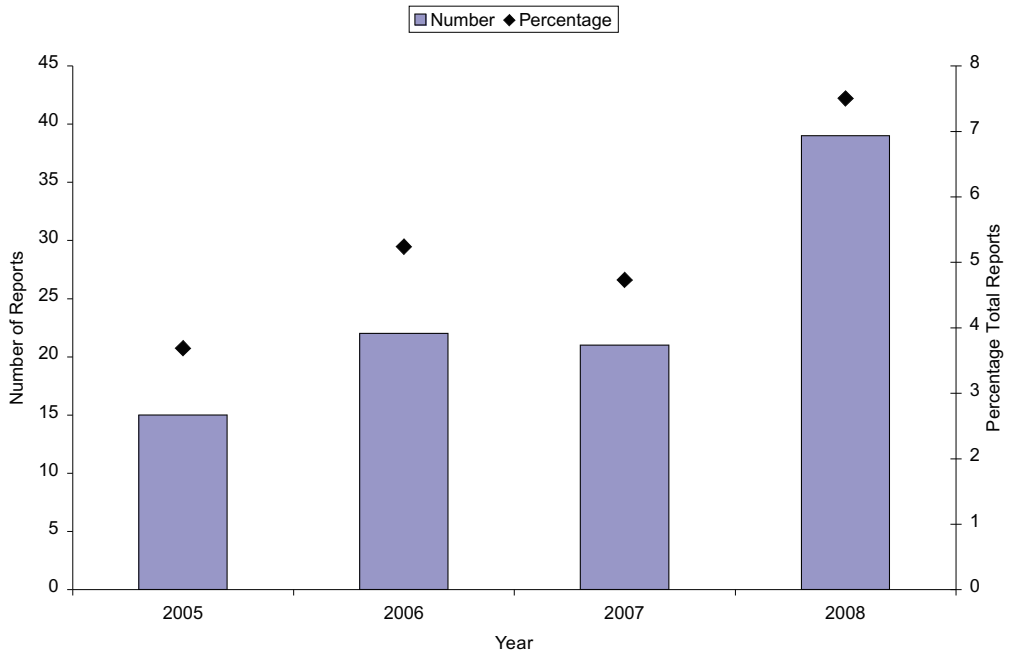
15 Incorrect Blood Component Transfused (IBCT) & Near Miss Events

DEFINITION OF IBCT:

The patient was transfused with a blood product that did not meet the appropriate requirements or which was intended for another patient.

There were 39 IBCT events reported to the National Haemovigilance Programme in 2008, an increase from 2007 (Figure 15.1). Ten events were excluded from the analysis, nine involved one site which audited FFP usage for warfarin reversal and reported underdosing when used without Prothrombinex.

Figure 15.1 > Incorrect Blood Component Transfused 2005 – 2008



2005: 8 months corrected for 12 month period

A total of 29 reports were included in the analysis of IBCT. Four reports involved the same recipient (group A plasma given to a group AB patient having therapeutic plasma exchange). Approximately half of the events originated in the laboratory, similar to the previous year. Table 15.1 summarizes the site of error.

Table 15.1 > Initial Site of Error of IBCT 2008

Site of Error	Number
Prescription of blood product	11
Laboratory	14
Administration of blood product	4

Incorrect Blood Component Transfused (IBCT) & Near Miss Events continued

Table 15.2 summarizes IBCT events for 2008. There was an increase in prescribing errors and inappropriate transfusions in comparison to 2007.

Table 15.2 > Summary of IBCT in 2008

Type of Event	Number	Description
Prescribing and dispensing errors	5	• Platelets requested & transfused instead of FFP (platelet count 500 x 10^9/L) • Hepatitis B Ig requested for mother instead of newborn, infant received higher dose than recommended • Cryoprecipitate thawed & transfused instead of FFP • Incorrect Factor VIII concentrate issued • Infant over transfused with red cells
Inappropriate transfusion	6	• Intragam P given for ITP when platelet count 102 x 10^9/L • Pretransfusion Hb 120g/L, transfused 4 units red cells, post transfusion Hb 175g/L • Hb 125g/L,2 red cell units transfused • Hb 147g/L,2 red cell units transfused • Hb 47 from drip arm, later confirmed as 123g/L, 1 red cell unit transfused. • Inappropriate transfusion of FFP (INR 1.1)
Rh D Immunoglobulin	6	• 2 cases of incorrect dose of Rh D Ig • Rh D Ig not given post-partum (2007) • Patient with Rh D negative infant given Rh D Ig • Rh D positive platelets issued to an Rh D negative female patient without authorisation or Rh D Ig prophylaxis • Inappropriate use of 10 vials of WinRho in a male patient
Incompatible red cell transfusion	3	• Rh D incompatible transfusion, grouping error: Rh D negative patient transfused Rh D positive red cells* • Historic anti-s, current antibody screen negative, s negative units could not be provided • Historic anti-E, currently not detectable, Rh E positive units transfused because of duplicate NHI number/ records at different hospital
Failure to follow protocol	3	• Failure to follow protocol. Patient required IAT crossmatch but only room temperature abbreviated crossmatch performed • 2 cases of failure to provide irradiated components despite protocols in place
Other	6	• 4 reports of allergic reactions in a patient having plasma exchange, patient group AB, group A plasma transfused and evidence of haemolysis due to anti-B • 2 cases where a blood product was issued to one patient & transfused to another patient (one involved neonatal red cells, the other involved Albumex 20 used to prime cardiac bypass circuit)

**patient died shortly after transfusion however cause of death attributed to the patient's underlying condition of autoimmune haemolytic anaemia*

Incorrect Blood Component Transfused (IBCT) & Near Miss Events continued

IBCT events related to Rh D immunoglobulin

In March 2008 a mini-dose (250IU preparation) of Rh D immunoglobulin was introduced for prophylaxis in Rh D negative women following potentially sensitising events during the first trimester of pregnancy (except for multiple pregnancies, where the standard 625IU dose is recommended). There were 2 reported cases where a 250IU dose was given to a post-partum Rh D negative mother who had given birth to an Rh D positive infant, instead of the 625IU dose. These events occurred in different hospitals.

One report was a historic error (2007) where Rh D Ig had not been administered to a postpartum Rh D negative woman and alloimmunization had occurred. Two samples from 2007 had a negative red cell antibody screen and a sample taken in 2008 was positive for anti-D. The midwife involved with the patient was contacted and admitted that she had forgotten to give Rh D Ig.

There was one report where Rh D Ig was administered to an infant of an Rh D negative mother, because the initial baby's blood group result was erroneously interpreted by a laboratory staff member as Rh D positive, however the baby's Rh type was later confirmed to be Rh D negative.

Limited supplies of Rh D negative platelet concentrates are available. One report described an 11 year old Rh D negative girl who had received Rh D positive platelets without authorisation from a Haematologist or Transfusion Medicine Specialist. She did not receive Rh D Ig prophylaxis. The final decision on whether Rh D Ig is administered in this setting, lies with the consultant responsible for the care of the patient.

The case where a patient received 10 vials of WinRho (commercial Rh D Ig product) is a matter of opinion. The notification described a mild febrile reaction during a red cell transfusion in an Rh D negative male who had received a haematopoietic cell transplant from an Rh D positive donor. Review of the transfusion record revealed that the patient had received a large dose of Rh D Ig. The donor haematopoietic cells had a calculated red cell volume of 60mL and dosing was based on the product insert which stated to use 90 - 120 IU/mL of incompatible red cells transfused to Rh D negative females. There is no evidence to support the use of Rh D Ig in this setting.

Over Transfusion of Red Cells

There were 5 reports of inappropriate red cell transfusion. Four events took place in the evening, the time of transfusion was not given for one report. All events occurred in different hospitals and involved junior medical staff.

Baby N weighed 6.3kg and was admitted for surgery for an abdominal mass. Her haemoglobin level was 81g/L and the on call doctor was contacted to chart red cells. One unit of red cells over 3-4 hours was prescribed. After 3 hours Baby N became tachycardic, tachypnoeac and hypertensive. She looked plethoric. She was treated with frusemide and fluid restriction. A repeat haemoglobin level confirmed polycythaemia (Hb 186g/L, Hct 0.54). The doctor realised that 44mL/kg red cells had been administered instead of 10mL/kg. Venesection was considered but not performed as the baby was scheduled to have surgery. Post-operative haemoglobin was 117g/L. Further transfusion was not required. The event was recorded as a prescribing error.

Two patients at different hospitals were transfused red cells for gastrointestinal bleeding. One patient received 4 units of red cells and had a post-transfusion haemoglobin level of 175g/L. It would have been appropriate to recheck the blood count after 2 units. The other patient was stable, the junior doctor did not check the blood count and prescribed 2 units. The patient's haemoglobin was 138g/L the following day.

15 Incorrect Blood Component Transfused (IBCT) & Near Miss Events continued

An elderly patient was seen by the on call house surgeon for bleeding from an ear tumour. Samples for full blood count and coagulation tests were taken. Two units of red cells were charted though the haemoglobin was 147g/L.

A 43 year old male in the Emergency Department with active bleeding had a haemoglobin level of 47g/L and INR 2.2. Crossmatch of 6 units of red cells and 2 units of FFP were requested. Red cell transfusion was commenced. The biochemistry laboratory telephoned to notify that the K+ was 0.9 mmol/L, estimated GFR 668 mL/min/1.73m^2 and total protein 16g/L, these results suggested that the samples were collected from the drip arm. A repeat blood test confirmed this when the repeat haemoglobin level came back at 123g/L. No further red cell transfusion was given. The 2 units of thawed FFP were consequently discarded.

Lessons Relating to Red Cell Transfusion:

- Errors occur more frequently in the evening.
- Dosing for paediatric transfusion should be based on the desired haemoglobin increment (formula) or usually 10 – 20 mL/kg.
- Check the pre-transfusion haemoglobin level and document the reason for transfusion in the patient's record. Monitor the haemoglobin regularly to guide further transfusion requirements.
- Education needs to focus on junior medical staff.
- Do not collect diagnostic samples from a drip arm and ensure that samples are labelled with the correct patient's details. Decisions to transfuse are often based on results of diagnostic tests and errors related to sampling may be propagated, leading to transfusion errors.

"Near Miss" Events

A near miss event is 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 reaction in the recipient.

Near miss events are usually reported to local incident management systems (reportable events). It is important to identify the root cause of such errors so that preventive actions and education can be implemented to avoid harm to transfusion recipients. In 2008 there were 3 near miss events reported to the Haemovigilance Programme. Two of the 3 errors originated in the laboratory and all 3 occurred in different hospitals. These events are summarized in Table 15.3.

15 Incorrect Blood Component Transfused (IBCT) & Near Miss Events continued

Table 15.3 > Near Miss Events Reported During 2008

Site	Event	Error
Ward	Patient A had already been transfused 2 units of red cells. A third unit was requested however a sticky label (addressograph) for patient B had been placed over the details for Patient A on the Blood requisition/Transfusion record form. The form already had the unit numbers for 2 units that had been transfused to Patient A. The error was identified by blood bank.	Blood requested for wrong patient. Patient's transfusion record incorrect.
Blood Bank	Rh D immunoglobulin was requested for prophylaxis in an Rh D negative patient following delivery. Blood Bank issued and labelled tetanus immunoglobulin in error. The ward identified the error and returned the product to the Blood Bank.	Wrong blood product issued by Blood Bank.
Blood Bank	During an evening shift an ABO blood group was incorrectly interpreted and resulted as A positive. There was no historic record on the patient. The 2nd ABO group was performed and correctly interpreted as B positive by the night shift staff, however A positive was entered into the database. A senior transfusion scientist detected the errors when authorising the results the following morning. The tests were repeated.	Incorrect interpretation of blood group results by one person and blood group transcription error for the same sample by another person.

Near miss events within the New Zealand Blood Service can be extracted from the incident reporting database. These are summarized in Table 15.4 and represent incidents from 4 blood processing centres and 6 hospital blood banks.

15 Incorrect Blood Component Transfused (IBCT) & Near Miss Events continued

Table 15.4 > Near Miss Events Within NZBS During 2008

Event	Incident
Wrong blood product issued or to wrong patient	Red cells issued to wrong patient (3 events)
	Prothrombinex issued to wrong patient
	Wrong product issued: • Intragam P instead of Albumex 4 • Biostate instead of Kogenate • Tetanus Ig instead of Rh D immunoglobulin • Albumex 20 issued instead of red cells • Albumex 4 issued instead of Albumex 20 • Red cells instead of platelets & platelets to wrong patient • G-CSF (Neupogen) instead of Intragam P sent to blood bank from blood centre • Platelets requested by doctor instead of FFP
Irradiation	Red cells irradiated after 14 days post-collection (3 events)
	Irradiated red cells not transformed/wrong expiry date (5 events)
	Label error • labelled as irradiated when not (4 events) • wrong unit number after transformation
	Two apheresis platelet units left in irradiator for 6 hours, found by evening staff.
Expiry	Red cells placed in after-hours refrigerator on evening of expiry (2 events)
Manufacturing	Error on label (2 events)
	Suspected that additive solution (SAGM) not added to red cells when Hct determined to be 0.804
Storage	Unit sent via pneumatic tube & stored in ward fridge not suitable for blood: • red cells sent to ward and returned after 5 hours • red cells sent to ward and returned after 16 days
	Red cell unit found by person fixing pneumatic tube, blood bank not notified that system being repaired
Wrong Blood In Tube	22 events: • 18 on current pre-transfusion sample • 4 involving historic sample
Equipment Failure	During planned power outage found that essential power was operating fans and digital monitors of a coolroom but not the compressors.
Data Entry / Transcription errors	Blood issued with incorrect date of birth on compatibility label (2 events), both detected immediately prior to transfusion.
	Red cells issued manually with donation number transcription error.
	Incorrect group entered in blood management system as A Rh D pos, automated group A Rh D negative. Repeat testing duplicate samples confirmed A Rh D negative.
	Antibody result entered as anti-Fya when it should have been anti-Fyb. New sample confirmed as anti-Fyb.

16 Transfusion-Transmitted Infections (TTIs)

DEFINITION:

Following investigation, the recipient has evidence of infection post-transfusion, and there was no evidence of infection prior to the transfusion and no evidence of an alternative source of infection.

The donor may have evidence of the same transmissible infection or the component transfused may be shown to contain the infectious agent.

With continual improvement in donor screening, blood collection and processing procedures and high sensitivity of infectious screening tests, the risk of TTI has diminished over the decades. In fact donor deferral criteria may be perceived as excessively restrictive to certain individuals.

Since the commencement of the National Haemovigilance Programme in 2005 there has been one report of a possible TTI, involving coagulase negative Staphylococcus cultured from an apheresis platelet concentrate and growth of the same organism from cultures taken from the recipient's central venous catheter. However no reaction was reported during the transfusion of platelets.

During 2008 there were 3 reports of suspected TTI to the National Haemovigilance Programme. One case involved *Streptococcus bovis* which was cultured from an apheresis platelet concentrate, the second case involved Yersiniosis post-transfusion and in the third case a transfusion recipient developed acute Hepatitis B infection. The details are summarized below.

Streptococcus bovis in Platelet Concentrate

A premature infant was transfused 52mL of an apheresis platelet concentrate over 150 minutes. He became febrile (temperature increase from 36.9 to 38.7˚C) and tachycardic (heart rate increased from 151 to 226/minute). The infant was already on cefuroxime and a blood culture was subsequently negative. The platelet concentrate was Gram stain positive and culture positive within 8 hours. The organism was identified as *Streptococcus bovis,* susceptible to penicillin. The other platelet concentrate from the same donation also gave a positive culture for the same organism.

The infant was treated with intravenous cefotaxime for 2 days followed by 2 days of amoxycillin. He recovered within 24 hours with no ill effects.

The plateletpheresis donor may have had asymptomatic bacteraemia. *Streptococcus bovis* has been implicated as a causative agent of endocarditis and also is associated with colon cancer. This organism has been isolated from asymptomatic donors (not in New Zealand) and implicated in fatal transfusion reactions. No further information regarding the outcome of investigation of the plateletpheresis donor has been reported to the Haemovigilance Programme.

Post-transfusion Yersiniosis

This case involves a 75 year old male with myelodysplasia (refractory anaemia with ringed sideroblasts) who receives 3 units of red cells every 3 weeks. His history includes transfusion-related iron overload and congestive heart failure. He was transfused 3 units of red cells uneventfully in the Day Ward and went home at 4.45pm. He collapsed suddenly approximately 8 hours later and was taken to the emergency department, where he was noted to be febrile (39.1˚C) and hypotensive. He was resuscitated with 3 litres of normal saline and treated with broad spectrum antibiotics. After a day blood cultures grew *Yersinia enterocolitica* from the anaerobic bottle. Stool culture was negative for pathogens.

Transfusion-Transmitted Infections (TTIs) continued

The organism was identified as *Yersinia enterocolitica* Biotype 4 susceptible to ciprofloxacin. The empty blood bags had been discarded and were not retrievable for culture. His sepsis was complicated by fast atrial fibrillation and congestive cardiac failure, requiring admission to the high dependency unit. He was discharged home after 10 days.

He had no symptoms of gastroenteritis and had not been in contact with anyone unwell. No other source of Yersinia was identified. Archived frozen samples from the 3 donations were retrieved and underwent 16S rRNA gene sequencing. Bacterial DNA was not detected in any of the 3 samples. The archived samples contained a small volume of red cells below the gel layer in each tube; blood cultures taken from this layer were negative from all 3 samples. It is possible that a bacterially contaminated unit/sample may yield a negative result. Samples are frozen shortly after collection. Bacteria multiply during storage and are therefore easier to detect in stored units than from frozen samples. Culture from the units transfused would have confirmed if bacterial transmission had occurred. In general, reports of septic events describe more immediate symptoms during or following transfusion. *Yersinia enterocolitica* produces endotoxin causing cytokine release, which presents as acute septic shock.

The imputability was assigned as 1 (possibly attributed to transfusion) because of the delayed onset of symptoms and lack of culture results from transfused units.

Yersinia enterocolitica lack siderophores and its growth is enhanced in an iron-rich environment such as stored red cell units. This patient also had iron overload which is associated with an increased risk of Yersiniosis. In the past *Yersinia enterocolitica* was the predominant bacterium isolated from contaminated red cells, however recent reports involve *Serratia, Pseudomonas* and *Enterobacter* species, as well as *Escherichia coli.*

Acute Hepatitis B Infection

Mrs M is an 80 year old who underwent a re-do aortic valve replacement. The surgery was complicated by excessive bleeding which required re-opening. Several days later a thoracotomy was performed for a loculated haemothorax. Over a 2 week period Mrs M received 15 units of red cells, 4 units of platelets, 10 units of plasma and 4 units of cryoprecipitate.

Approximately 5 – 6 months later she was admitted with lethargy, jaundice (bilirubin 310µmol/L) and transaminitis (ALT 2997 U/L, AST 4059 U/L). Serology confirmed acute Hepatitis B infection (IgM core positive, surface antibody < 10, surface antigen positive, e antigen positive, e antibody positive). She was negative for surface antigen and surface antibody prior to her surgery. An investigation did not identify any community risk factors.

An extensive look-back was undertaken. The 33 units had been produced from 30 donors. One of the 30 donors was Hepatitis B core antibody positive however HBV surface antigen and DNA were negative on 2 separate stored samples. The investigation did not confirm that Hepatitis B transmission via transfusion had occurred. The imputability was assigned as 1 (evidence is indeterminate for attributing the event to transfusion).

Occult Hepatitis B infection is where there is detectable HBV DNA and negative Hepatitis B surface antigen. This pattern may also be seen in the preseroconversion window period. Occult Hepatitis B is a rare event and varies depending on the level of endemic disease that exists in a specific geographic region. Blood donors with occult Hepatitis B may transmit Hepatitis B via blood transfusion. The New Zealand Blood Service commenced testing for HBV DNA on all donations in September 2007. Data on occult Hepatitis B infections in blood donors is presented in Chapter 17.

17 Infectious Diseases Screening

All donations are screened for transfusion transmissible infections. The mandatory tests are performed in Donation Accreditation Laboratories and include:

- Hepatitis B surface antigen, HBV DNA
- Anti-HCV, HCV RNA
- Anti-HIV I and II, HIV RNA
- Syphilis EIA
- Anti-HTLV I and II (all new donors)

Nucleic acid amplification tests (NAT) are performed on single donor samples since HBV NAT was implemented in September 2007. Prior to this HCV and HIV NAT were tested on mini-pools of 16 donor samples.

During 2008 a total of 185,738 donations collected from 99,852 donors underwent accreditation tests. Of the total number of donors tested, 78% had been previously tested and 22% were new donors. Table 17.1 shows the number of donors who were confirmed positive on infectious disease testing. There were no confirmed HIV infections in donors screened during 2008.

Table 17.1 > Donors with Confirmed Positive Serology 2008

		HBV (sAg positive)	HCV	HIV	Syphilis	Anti-HTLV
Number		31 (30 new donors)	16 (15 new donors)	0	14 (all new donors)	1 (new donor)
% positive donations		0.017%	0.009%		0.008%	<0.001%
Frequency of positive donation	New donor	1:725	1:1,451		1:1,554	1:21,762
	Regular donor	1:78,090	1:78,090			
Overall frequency		1:3,221	1:6,241		1:7,132	1:99,852

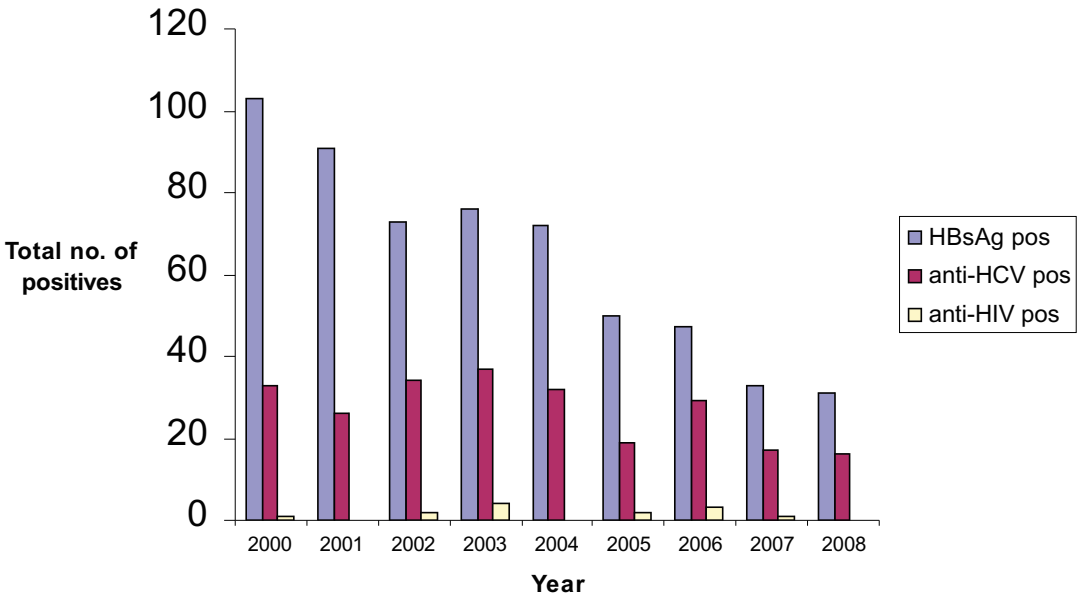
Over the past 9 years there has been a steady decline in the number of donors with confirmed positive serology in New Zealand. This data is shown in Figure 17.1.

Occult Hepatitis B

During 2008 there were 11 donations that were HBV DNA positive and Hepatitis B surface antigen negative. These occult Hepatitis B infections were all identified in donors who had previously donated. 7 of the donors came from the Waikato region and 4 from the Auckland region. No donor occult Hepatitis B infections have been identified in the South Island.
This increases the overall frequency of Hepatitis B positive donors to 1 in 2,377 donors or 0.02% of total donations.

Infectious Diseases Screening continued

Figure 17.1 > Donor Epidemiologic Data 2000 – 2008



Additional Tests

Testing for malaria antibody and Chagas disease is performed on donations where the donor's travel history indicates risk of exposure. Malaria and Chagas disease are not endemic in New Zealand. Donors with detectable malarial antibody are able to donate plasma for manufacture of fractionated blood products. During 2008 there were no confirmed cases of malaria or Chagas disease amongst blood donors.

Monitoring for Bacterial Contamination

Bacterial transmission remains one of the major components of morbidity and mortality associated with transfusion transmitted infection. Cumulative data from SHOT, the United Kingdom Haemovigilance system, published in 2008 identified 38 reported incidents involving 40 recipients over a 12 year period. 10 of these were fatal. 32 of the incidents related to bacterial contamination of platelets. Similar data has been reported from the French Haemovigilance system and from the US FDA.

Increasing concern relating to bacterial transmission of platelet concentrates has led a number of Blood Services to investigate possible methods to reduce the risk. Canada, The Netherlands and Hong Kong have already introduced pre-release bacterial detection systems for platelet concentrates. Australia introduced routine screening of platelet concentrates in 2008. At this stage however there is no clear consensus on the definition of an optimal system for bacterial culture. A number of variables can significantly impact on overall system sensitivity. These include the volume of initial inoculum, the timing of culture (day one or day two post-collection) and the use of a single aerobic bottle versus both aerobic and anaerobic detection.

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.

17 Infectious Diseases Screening continued

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 the BacTalert aerobic 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. During 2008 approximately 71% of all apheresis platelet concentrates and 77% of platelet pools were tested. Apheresis platelet donations are normally split into two components (doses) soon after production. Currently only one of the 2 components is tested. The results of day 2 testing undertaken during 2008 is shown below.

Table 17.2 > Results of Day 2 Testing of Platelet Concentrates

	Apheresis Platelets			Pooled Platelets		
	Collections	Components tested	Day 2 * positive	Produced	Tested	Day 2 * positive
Auckland	2,029	1,156	0	3,728	2,677	1 (8)
Waikato	1,087	837	0(2)	1,435	1,129	0
Wellington	809	574	0(1)	1,401	1,126	0
Christchurch	1,187	911	0(1)	559	534	0
Manawatu	384	360	0			
Otago	325	320	1(1)			
Total	**5,821**	**4,158**	**1(5)**	**7,123**	**5,466**	**1(8)**

** Confirmed positive results provided with total reactive numbers in brackets*

Data from the scheme indicates that NZBS systems compare well with published data. The CoE Guide (13th Edition) identifies a contamination rate of 0.2 to 0.4%.

During 2008 NZBS received its first report of a septic transfusion reaction due to contaminated platelets. This involved an apheresis component. Neither of the two components produced from the collection had been tested. NZBS is currently piloting a system in Auckland that requires one component produced from each apheresis collection being cultured.

Platelets are also sampled at expiry. This data will potentially be of value if NZBS were to consider extension of the shelf life of platelets beyond the current 5 days. 2008 data for product at expiry is shown in Table 17.3.

Infectious Diseases Screening continued

Table17.3 > Results of Testing of Expired Platelets

Site	Total Components Sampled	Number Reactive	% Reactive	Frequency of Reactives
National All reactives	2,324	4	0.2	1:580
National Confirmed reactives	2,324	2	0.09	1:1,200

The confirmed positive rate of 1 in 1,200 suggests that the current system for detecting platelet contamination is only partially effective. This is consistent with international data. Most contamination arises during the collection process. The number of bacteria entering the collection is typically low. Sampling of platelet concentrates early in storage may therefore fail to identify the contamination. The bacteria will proliferate during storage and potentially lead to septic transfusion reactions. The two positive platelet cultures in 2008 were both confirmed as coagulase negative staphylococci.

Data from Ireland and the American Red Cross published during 2007 indicates that bacterial testing might only detect 50% of contaminated platelet concentrates. This data is based on sampling on day 1 of storage as opposed to the day 2 sampling undertaken by NZBS. The clinical significance of positive cultures obtained late in storage is however controversial. It is generally accepted that bacterial culture systems improve considerably the safety of platelets stored for 5 days. The debate becomes more problematic when the role of bacterial culture is considered in the context of an extended seven day shelf life for platelet concentrates.

NZBS continues to utilise bacterial testing as a monitoring scheme. The Australian Red Cross Blood Service introduced testing of all platelet concentrates in early 2008 with the intention of moving progressively to a 'culture negative at release' strategy.

At this stage NZBS plans to continue utilising the bacterial monitoring programme as a quality assurance tool. This is consistent with recommendations contained in the Council of Europe Guide. During 2007 Australian authorities announced a decision to move to 100% pre-release testing by the end of 2008. This will be a significant logistical challenge. NZBS will closely monitor progress with this initiative. The current NZBS policy position will be reviewed in the light of the Australian experience and in the event that sufficient data emerges to indicate that bacterial detection systems can be used to extend the shelf life of platelets to seven days.

18 Adverse Reactions to Fractionated Blood Products

CSL Bioplasma manufactures the following products for the New Zealand Blood Service using plasma from New Zealand donors:

- Albumex (4% & 20%)
- Intragam P (intravenous immunoglobulin), Normal immunoglobulin (intramuscular)
- Biostate (FVIII), MonoFIX (FIX), Prothrombinex (II, IX, X)
- Thrombotrol (antithrombin III)
- Rh D immunoglobulin*
- Hepatitis B immunoglobulin, Zoster immunoglobulin, Tetanus immunoglobulin

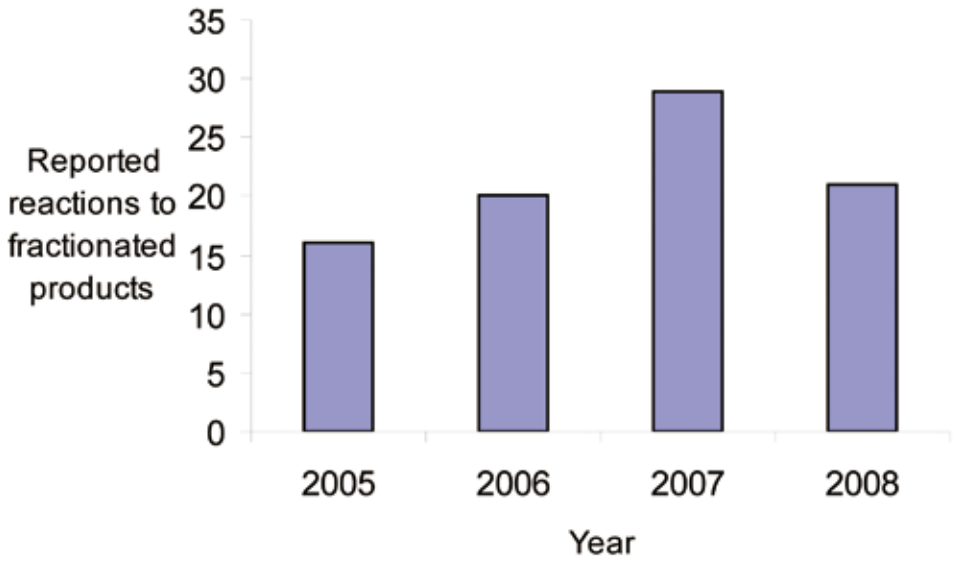
*Rh D immunoglobulin is also manufactured from plasma collected in the USA.

WinRho-SDF is produced in Canada and supplied by the New Zealand Blood Service. It is the only Rh D immunoglobulin preparation available in New Zealand that is suitable for intravenous administration.

Reporting of adverse events associated with fractionated blood products is managed through a separate process. Blood Bank provides a specific notification form (Appendix V) to the clinician involved. The form is forwarded to the Recording Centre. The cases are reviewed and reported to the manufacturer (CSL Bioplasma), the Centre for Adverse Reactions Monitoring (CARM), Medsafe and the New Zealand Blood Service Clinical Advisory Group (CAG).

In 2008 there were 21 notifications of suspected reactions to fractionated blood products. This indicates a decline from the previous year where 29 reactions were reported (Figure 18.1). Events were more frequent in females (12 cases). The age of the recipients ranged from 4 months to 83 years.

Figure 18.1 > Reported Reactions to Fractionated Products 2005 – 2008



Intragam P was implicated in 15 reports and the remaining 6 were associated with Albumex 4. All patients recovered.

18 Adverse Reactions to Fractionated Blood Products continued

The type of reaction is summarized in Table 18.1. There appeared to be a cluster of hypotensive reactions associated with Albumex 4 of which one case was severe. All other reports were categorised as not severe.

Table 18.1 > Adverse Reactions to Fractionated Blood Products 2008

Type of Reaction	Number
Allergic	6
Febrile	5
Hypotension	3*
Chest pain	2
Vasomotor reaction	1
Nausea & vomiting	1
Thrombosis	1
Volume overload	1
Haemolysis	1
Total	**21**

**Albumex 4*

Causality assessments for adverse reactions to fractionated blood products are summarized in Table 18.2.

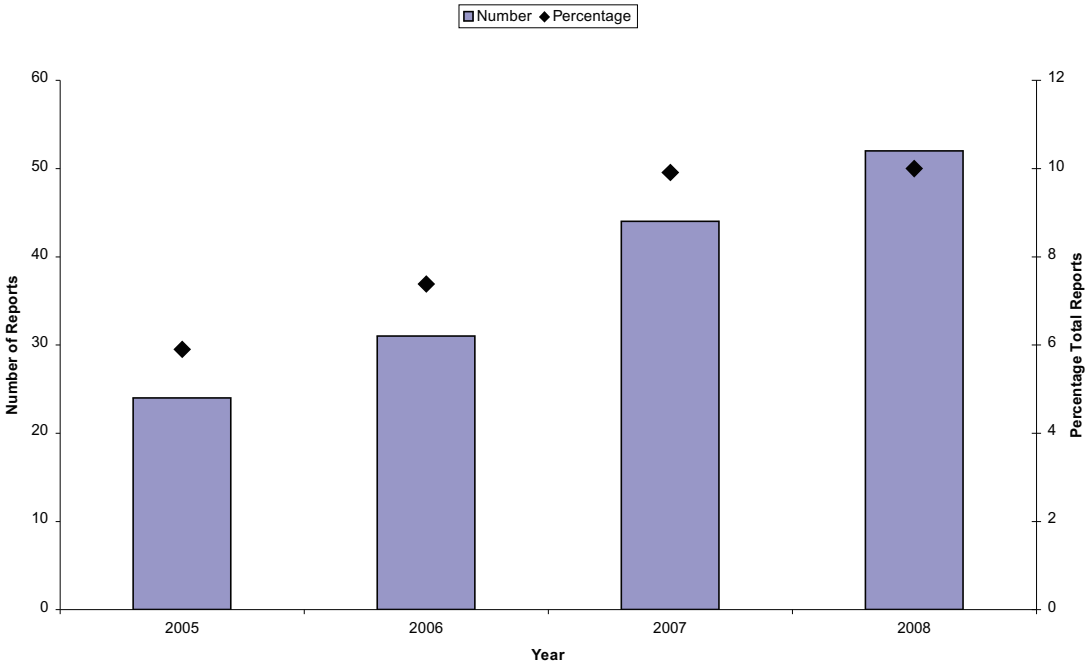
Table 18.2 > Causality Assessments for Reactions to Fractionated Products

Causality	Number
Possible	4
Probable	2
Highly probable	15
Total	**21**

19 Other Notifications to the National Haemovigilance Programme

A number of reports sent to the National Haemovigilance Programme do not meet the criteria for any of the existing categories of transfusion related events. This subgroup is increasing (Figure 19.1) and comprised 10% of the total notifications in 2008.

Figure 19.1 > "Other" Reactions 2005 – 2008



2005: 8 months corrected for 12 month period

Ten reports were excluded from the analysis. Approximately half of the reports analysed were attributable to the transfusion. The imputability assessments are summarized in Table 19.1.

Table 19.1 > Imputability Assessments for "Other" Types of Reactions 2008

Imputability	Number
Excluded	10
Unlikely	13
Unknown	2
Possible	19
Probable	7
Certain	1
Total	**52**

A summary of the types of reactions are outlined in Table 19.2. Hypertension was reported in isolation in 7 reports and occurred in combination with other symptoms such as chest pain, dyspnoea, anxiety and tachycardia in 6 reports.

19 Other Notifications to the National Haemovigilance Programme continued

Table 19.2 > Other Types of Reactions 2008

Nature of Reaction	Number
Pain	14
Hypertension +/- other symptoms	13
Tachyarrhythmia	7
Nausea	2
Respiratory	2
Facial erythema	1
Hyperkalaemia	1
Narcosis	1
Trembling	1
Total	**42**

Acute Pain Transfusion Reactions (APTRs)

APTRs have recently been described and are characterized by abrupt onset of severe pain in the trunk and proximal extremities shortly after starting transfusion and by resolution shortly after discontinuation. The cause of the APTRs is unknown. There were 14 reports of pain associated with blood transfusion in 2008. These reports include chest pain, back pain, arm pain, shoulder pain and a combination of these.

20 Adverse Reactions in Donors

Without the generosity and commitment of voluntary blood donors, it would not be possible for the New Zealand Blood Service to produce and supply therapeutic blood products. Adverse events related to the donation process are recorded in a separate database. Donor staff are trained to identify and manage complications of blood donation. Events may occur during the collection procedure or reported later, after a donor has left the venue.

Specific criteria for blood donation exist in order to ensure that the blood collected is as safe as possible for transfusion whilst minimizing the risk of any complications occurring in the donor.

During 2008 there were 1,416 donor related events, involving 1,306 donors. These included whole blood and apheresis donations, with an overall rate of 1 in 131 donations. Vasovagal reactions, haematoma and bruising were the most frequent complications (Table 20.1 and Figure 20.1).

Table 20.1 > Donor Adverse Events 2008

Nature of Reaction	Number	Frequency	Per 100,000 Donations
Vasovagal reaction	706	1:263	380
Haematoma/bruising	421	1:441	227
Automated procedures	205	1:906	110
Nerve injury	39	1:4,763	21
Other	33	1:5,628	18
Allergic reaction (local)	3	1:61,913	2
Cardiovascular event	3	1:61,913	2
Infection (local)	2	1:92,869	1
Tendon injury	2	1:92,869	1
Thrombophlebitis	2	1:92,869	1
Total	**1,416**	**1:131**	**762**

There was a 70% increase in the rate of reported donor events from 2007 (448 per 100,000 donations). This is likely to be explained by improved reporting rather than a true increase in the rate of events as most event types had increased reports. Figures 20.2 and 20.3 show the rate of reported donor events from 2005 to 2008.

20 Adverse Reactions in Donors continued

Figure 20.1 > Percentage of Donor Adverse Events 2008

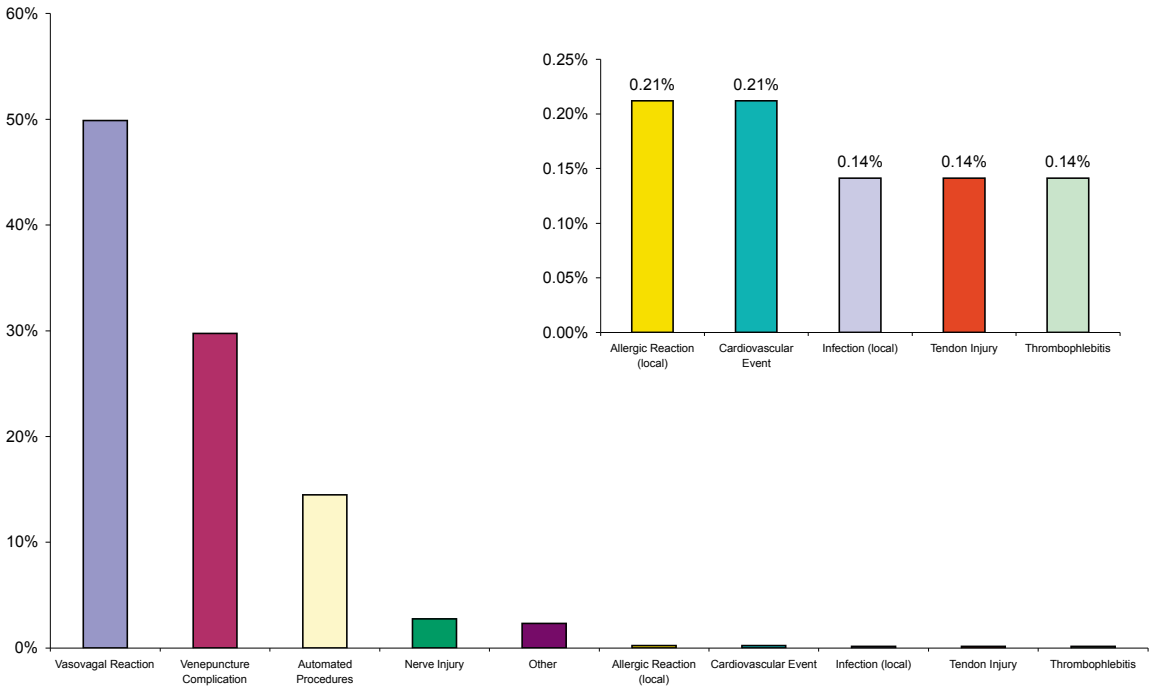
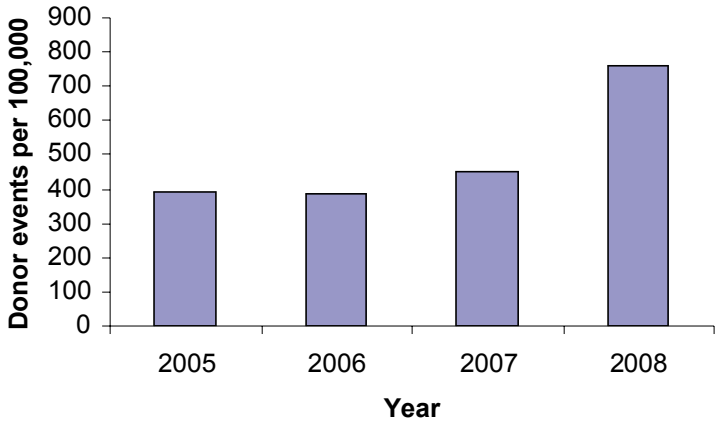
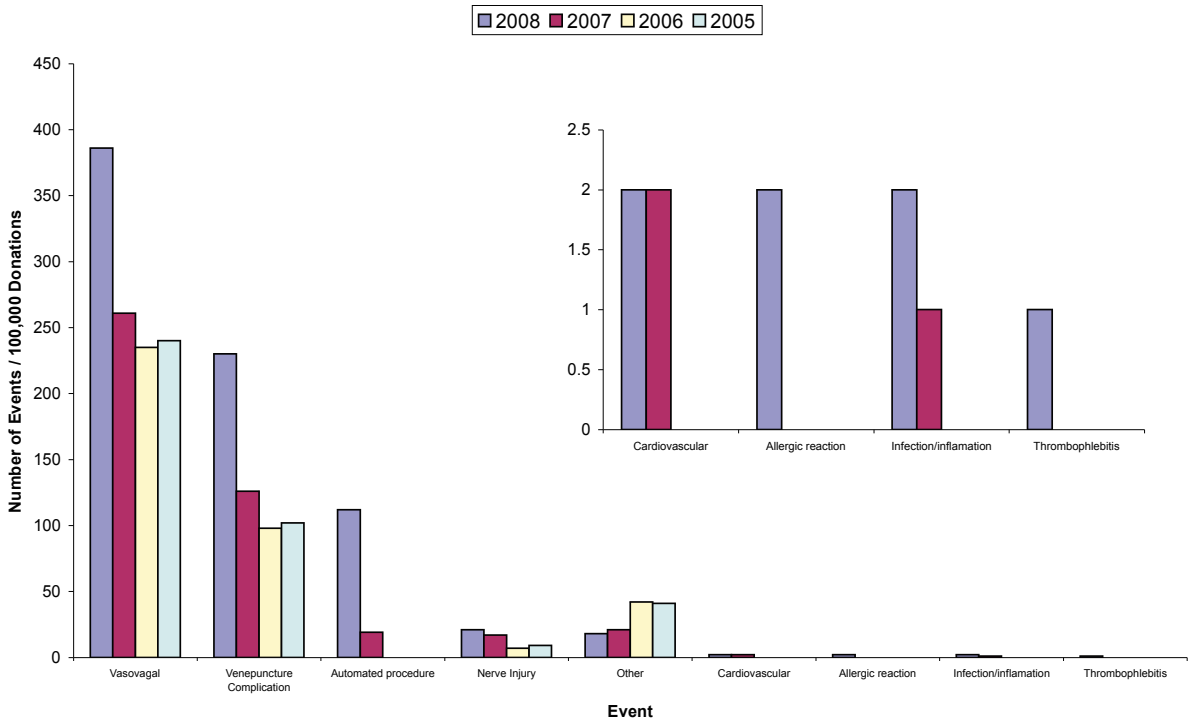


Figure 20.2 > Total Donor Events Per 100,000 Donations



Adverse Reactions in Donors continued

Figure 20.3 > Donor Events by Type 2005 – 2008



Approximately half of the vasovagal reactions resulted in loss of consciousness (syncope) and 14% occurred after the donor had left the collection venue (Table 20.2).

Table 20.2 > Donor Vasovagal Reactions 2008

Vasovagal Reaction	Number
Delayed faint	99
Immediate faint	264
Without faint	343
Total	**706**

Most events relating to apheresis involve red cells not being returned to the donor. Procedures may be aborted because of poor flows, needle not well positioned, donor symptoms or a technical problem with the machine. Most apheresis related events involved loss of red cells (Table 20.3). When this occurs, donors are stood down for a period of one month to allow red cell recovery to occur.

Table 20.3 > Donor Events Related to Automated Procedures 2008

Event Type	Number
Citrate toxicity	4
Diffuse allergic reaction	1
Hypovolaemic hypotension	1
Red cells not returned	199
Total	**205**

21 Request Form and Sample Labelling Errors

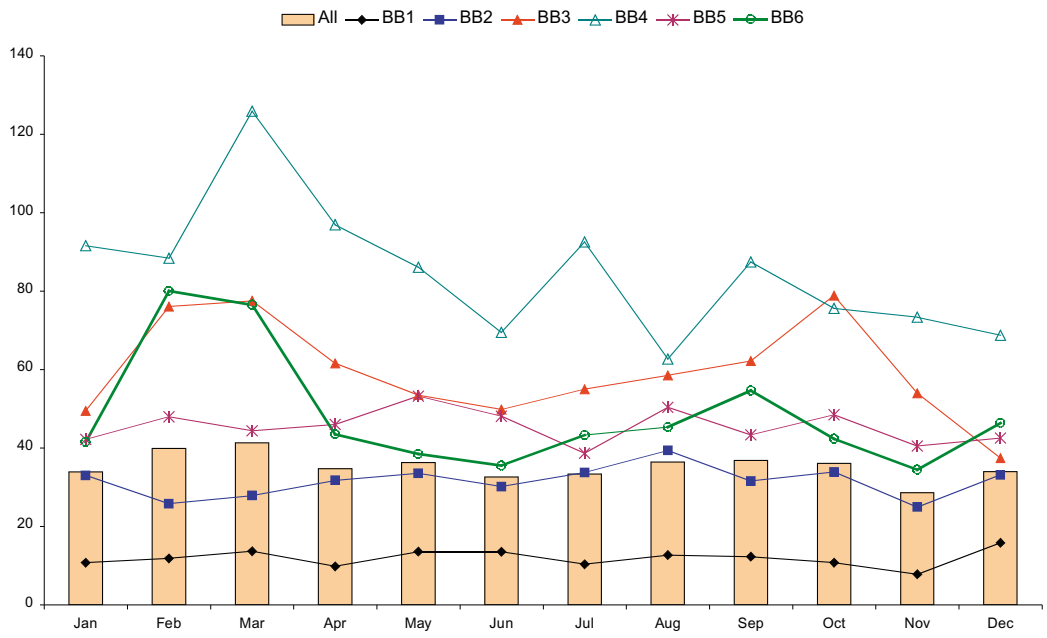
On 1 May 2006 NZBS began collecting standardised national data regarding sample and request form labelling errors at the six NZBS blood banks. Each site records instances of a range of predetermined errors and the associated corrective actions. Data is entered into a Microsoft Access™ database for subsequent analysis.

In 2008 a total of 153,279 requests were received of which 5,358 (equivalent to 1:29) had errors associated with them. A number of requests had more than one error associated with them. There were 5,775 errors in total. The overall error rate for NZBS blood banks for the calendar year 2008 was 3.5% compared to 3.8% for 2007.

Error Rate

Figure 21.1 shows the error rate per 1,000 requests received by the six NZBS blood banks. The decrease in the error rates of BB3 and BB4 is due to a more consistent approach to classifying errors compared to that used by the other four NZBS blood banks.

Figure 21.1 > Number of Requests with Errors per 1,000 Requests for 2008



Types of Error Reported

A total of 5,775 errors were reported in 2008 involving 5,358 samples for testing. Table 21.1 summarizes the specific errors in 2008 that are required to be reported by blood banks according to NZBS policy. Those errors that allow for correction are documented and a declaration is signed by the person responsible for the correction taking full responsibility for the correction.

21 Request Form and Sample Labelling Errors continued

Of all the errors reported (5,775) as required by NZBS policy, 79% were due to the four most prevalent errors:

- Missing, incorrect or incomplete patient details 38.2%
  - Major Error *7.7%*
  - Moderate Error *30.5%*
- Declaration not signed 13.3%
- Sample not signed 13.9%
- Pre-printed label on sample 13.4%

Table 21.1 > Sample and Request Form Errors for 2008

Type of Error	Number
Wrong blood in tube (WBIT) identified	22
Unlabelled sample	105
Missing /incomplete / incorrect patient details	2,209
Patient details discordant with historical record	131
Original details overwritten (or labels overstuck)	97
Declaration not signed	767
Sample not signed	805
Signature on sample and declaration differ	135
No date / time sample collected	123
Person completing request form not identifiable	344
Pre-printed label on sample or evidence of removal	775
Other	120
Total	**5,633**

There were 142 'technical' errors (2.5%) and a new sample was requested in the majority of cases. Examples of technical errors include wrong tube type, insufficient sample, haemolysed sample, leaking/broken sample and maternal contamination of a cord blood sample.

Actions Taken

Table 21.2 summarizes the different actions taken in response to the errors identified by the blood banks. More than one corrective action associated with each request form or sample may be recorded where errors were identified.

Table 21.2 > Summary Of Actions Taken In Response to Errors

Action Taken	Number
No action taken	199
Sample / request not processed	16
New sample requested	2,042
Labelling corrected by collector	1,623
Correct details obtained by telephone/fax	1,164
Request withdrawn	64
Other	109
All	**5,217**

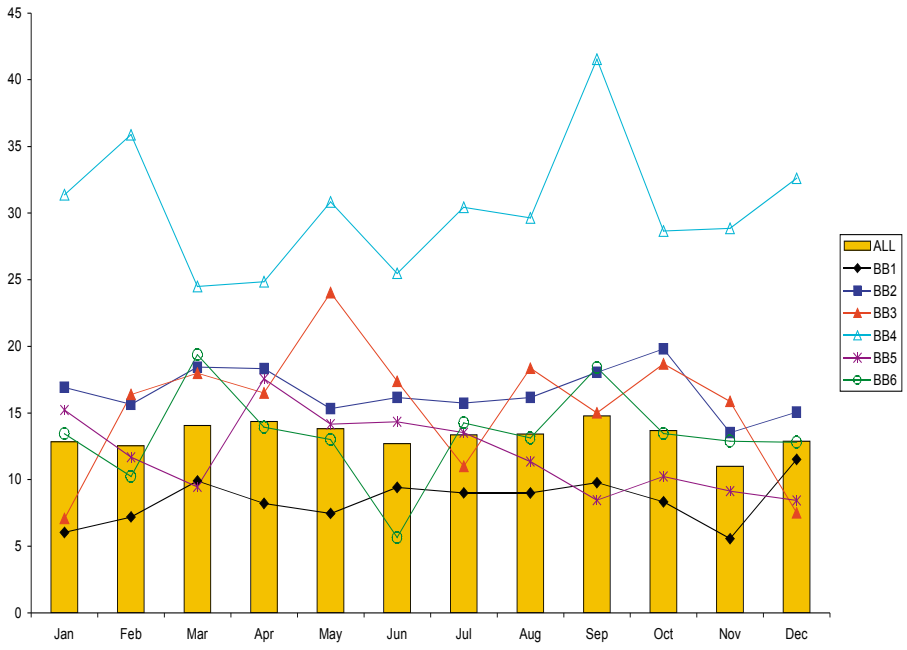
Request Form and Sample Labelling Errors continued

Sample Recollection Rates

2,042 requests received failed to meet NZBS requirements and a new sample and request form were required for pre-transfusion testing. Of the total errors detected 35% required a request for collection of a new sample from the patient. The mean recollection rate for the six NZBS blood banks was 13 per 1,000 samples received. The request for the recollection of a blood sample meant that each patient was subjected to a second venepuncture and potential delays in the provision of compatible blood components.

Figure 21.2 shows the number of recollects per 1,000 requests per month for each of the six NZBS blood banks and the NZBS total, for 2008.

Figure 21.2 > Requests for Recollection of Sample Per 1,000 Requests



Wrong Blood in Tube (WBIT)

A "wrong blood in tube" involves miscollection and is identified when a pre-transfusion sample is tested and found to have an ABO Rh D group that differs from that in the historical record. It occurs as a result of collecting blood from the wrong patient or labelling the sample and request form with a different patient's details.

Historical blood groups were available for 64% of the samples submitted to the six NZBS blood banks in 2008.

There were a total of 22 incidences of WBIT identified by the six blood banks during 2008. In 18 cases the sample received was a WBIT and in 4 instances the historical result was assumed to be incorrect. The reason for the historical incorrect results is unknown, they may be explained by collection of the sample from the wrong patient, incorrect labelling or a laboratory error e.g. sample "mix-up", incorrect result interpretation, transcription or a data entry error.

The raw WBIT rate can be corrected for silent WBIT errors; such errors occur when the wrong patient's blood is collected, but the ABO and Rh(D) group in the tube happens by chance to match the blood group of the historic record. To correct for these, the raw rate is multiplied by a correction factor equal to 1/(1-Q), where Q represents the chance that that two random individuals will have the same ABO Rh D groups[1].

21 Request Form and Sample Labelling Errors continued

Table 21.3 shows the corrected WBIT frequency along with the episodes expressed as a percentage of historical sample (with 95% confidence intervals determined using the Wilson Score Method of binominal confidence levels) for 2008.

Table 21.3 > Frequency of WBIT Reported in 2008

Site	Historic Groups	WBITs	Frequency*	WBIT prop	Lower CI	Upper CI
BB 1	33,160	3	1:6,908	0.00009	0.0000	0.0003
BB 2	18,346	3	1:3,822	0.00016	0.0001	0.0005
BB 3	6,824	4	1:1,066	0.00059	0.0001	0.0012
BB 4	6,739	2	1:2,106	0.00030	0.0001	0.0011
BB 5	19,323	2	1:6,038	0.00010	0.0000	0.0004
BB 6	12,855	4	1:2,009	0.00031	0.0001	0.0008
All	**97,247**	**18**	**1:3,377**	**0.00019**	**0.0001**	**0.0003**

** Corrected to account for silent errors. Corrected WBIT rate = No. historical groups / No. WBIT * Correction Factor. The correction factor (1.6) was derived according to the formula of Murphy et al[1] based on New Zealand blood group frequencies.*

The corrected frequency of WBIT for the NZBS blood banks has increased from 1 in 6,416 samples for 2007 to 1 in 3,377 samples for 2008. This increase in the rate of WBITs raises concern and reinforces the need to educate individuals on the importance of patient identification when labelling pre-transfusion samples.

All six of the NZBS blood banks identified incidences of WBIT. Table 21.4 summarizes the cumulative NZBS national and individual corrected frequencies for WBIT for May 2006 to December 2008.

Table 21.4 > Total WBITs May 2006 – December 2008

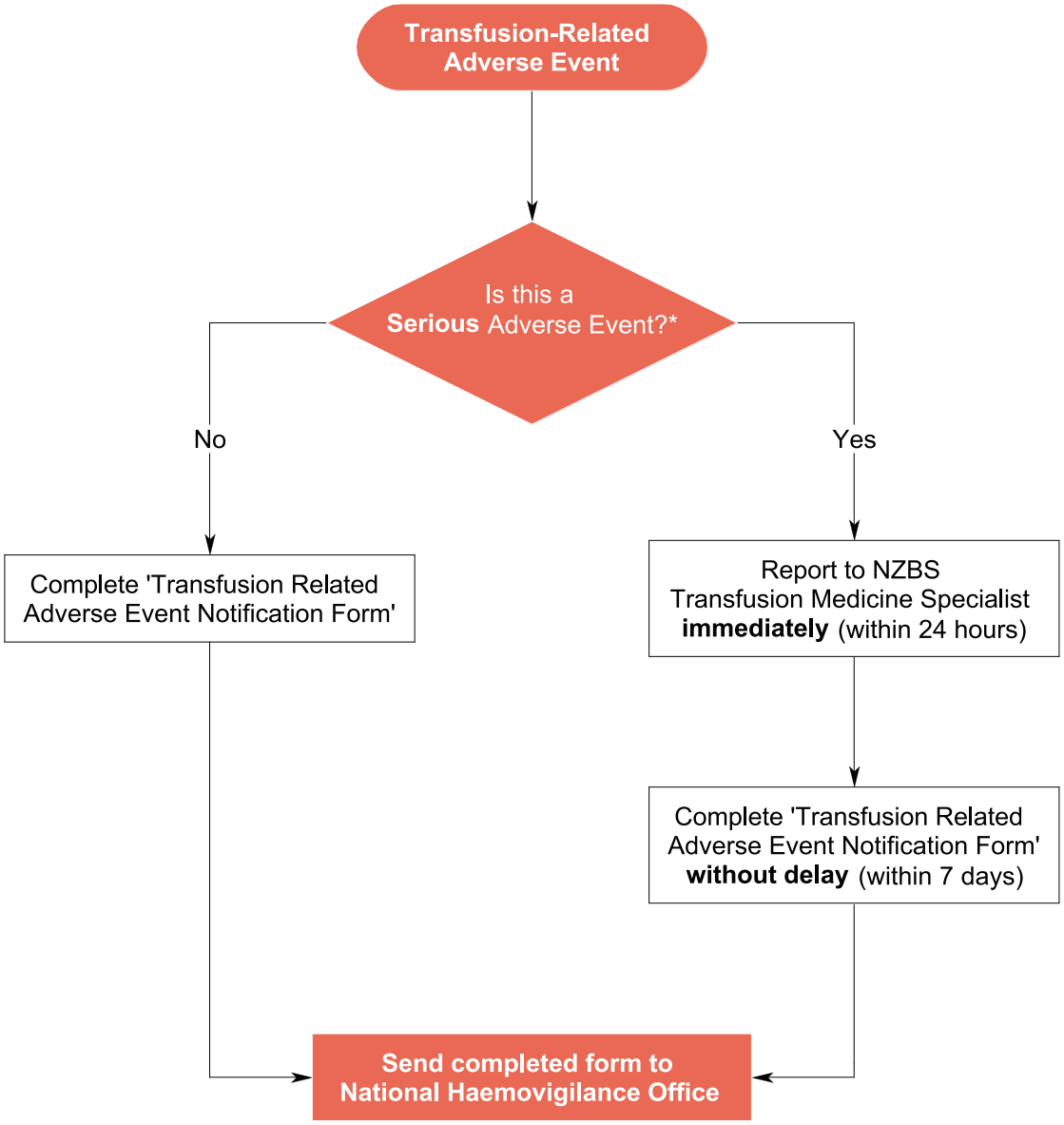
Site	Historic Groups	WBITs	Frequency	WBIT prop	Lower CI	Upper CI
BB 1	76,131	13	1:3,660	0.00017	0.0001	0.0003
BB 2	46,501	4	1:7,266	0.00009	0.0000	0.0002
BB 3	16,759	8	1:1,309	0.00048	0.0002	0.0008
BB 4	18,035	3	1:3,757	0.00017	0.0001	0.0005
BB 5	46,122	2	1:14,413	0.00004	0.0000	0.0001
BB 6	31,889	6	1:3,322	0.00019	0.0001	0.0004
All	**235,437**	**36**	**1:4,087**	**0.00015**	**0.0001**	**0.0001**

Reference

1. Murphy MF, Stearn BE, Dzik WH: Current performance of patient sample collection in UK. Transfusion Medicine 2004; 14: 113-121

Appendix I

Flowchart for Reporting Transfusion Related Adverse Events



Serious Events

A serious event is defined as any adverse event that:

- requires hospitalisation or a prolonged hospital stay
- results in persistent or significant disability or incapability
- necessitates medical or surgical intervention to prevent permanent damage or impairment of a body function
- is associated with severe temporary or permanent morbidity and/or mortality

All such should be reported to a NZBS Transfusion Medicine Specialist **immediately** (i.e. within 24 hours).

Appendix II

Notification and Investigation of Adverse Transfusion Reaction Form page 1

Hospital:	Ward:	Consultant:

Patient NHI: **DOB:** **Sex:**

Surname:

Given Names:

Clinical advice is always available when severe transfusion reactions occur. Contact numbers can be obtained via the blood bank.

List Product(s) transfused & Donation/Batch No	
Whole blood/Red Cell products	
Platelet concentrate	
Fresh Frozen Plasma	
Albumin	
Immunoglobulin	
Other products – specify	

Other details				
Date of transfusion	/ /			
Transfusion started	am / pm			
Reaction noticed	am / pm			
Amount transfused	ml			
	<¼	<½	<¾	>¾

Other blood products administered prior to reaction:

Baseline observations prior to reaction	**Temp:** ^{0}C	**Pulse:** /min	**BP:** / mm Hg

Nature of Reaction Tick or record details in relevant boxes.

Temperature peak ^{0}C	**Red urine:** ☐ Yes ☐ No ☐ Unknown
Pulse peak or trough /min	**Pain:** ☐ Chest pain ☐ Loin pain ☐ Abdo pain
BP peak or trough / mm Hg	**Unexpected bleeding:** ☐ Skin ☐ Wound
Urticaria: ☐ Isolated ☐ Extensive	**Rash:** ☐ Macular, other _____
Resp signs: ☐ Dyspnoea ☐ Stridor ☐ Wheeze	☐ Haemoptysis ☐ Pulmonary oedema
Systemic: ☐ Anaphylaxis/anaphylactoid reaction	**CNS disturbances:**

Comments and further descriptions of symptoms & signs:

Medications & medical/surgical procedures:

Is further transfusion required in the next 24 hours? ☐ **Yes** ☐ **Possibly** ☐ **No**

Type of products required:

Record of any actions and investigations taken at bedside:

- ☐ Bags & giving set returned to Blood Bank
- ☐ EDTA & Serum samples to Blood Bank
- ☐ FBC ☐ Serum biochem ☐ Urine for Hb
- ☐ Coag screen ☐ Blood gases
- ☐ Blood culture from patient

Signature & print name Pager/locator

Follow up investigations should be performed if a moderate or severe reaction has occurred. Please send samples, this form, blood bag and attached IV set promptly to the Blood Bank. Please phone the Blood Bank staff to notify dispatch of samples. Turn over for recommendations on clinical assessment, blood samples required, and other relevant information.

Appendix II

Notification and Investigation of Adverse Transfusion Reaction Form page 2

Guidelines for Management of Adverse Transfusion Reactions

First mild reaction

➢ **Mild febrile reaction**
- Temp up: < 1.5°C
- Stable haemodynamics
- No respiratory distress
- ***and*** no other symptoms

OR

➢ **Mild allergic reaction**
- Occasional urticarial spots
- ***and*** no other symptoms

Action:
1. Check labels & recipient ID
2. Slow transfusion
3. Consider giving medication:
   - ✶ Antipyretic for pyrexia, e.g. paracetamol
   - ✶ Antihistamine for urticaria
4. Continue transfusion at a slower rate with increased monitoring, e.g. BP/P/T 15-30 m
5. *If symptoms increase treat as a moderate or severe reaction*

Further transfusion and -

➢ **Recurrence of mild allergic reactions,**

OR

➢ **Recurrence of mild febrile reactions**

Action:
1. Consider giving premedication:
   - ✶ Febrile reaction – antipyretic (e.g. paracetamol)
   - ✶ Urticarial reaction – antihistamine
2. Hydrocortisone - not usually needed

Moderate and severe reactions: may include any of -

1. Fever: ≥1.5°C from baseline; or fever with rigors / chills
2. Unexpected tachycardia
3. Unexpected change of BP
4. Acute breathlessness, stridor or cyanosis; pharyngeal/ laryngeal oedema
5. Extensive erythematous or urticarial rash; pain up transfusion arm
6. JVP acutely elevated
7. Loin pain; haemoglobinuria
8. Severe apprehension

Action if a moderate or severe reaction is suspected:
1. **Stop** transfusion and review
2. **Check** label and recipient ID information is correct
3. **Replace** IV set; give saline to keep vein open and, or maintain BP
4. **Call** for medical assessment
5. **Obtain specimens:**
   - Blood group serology: 1 x 7 or 10 ml clotted (red) & 1 x 7 ml EDTA (lavender) tube *(collect away from site of transfusion)*
   - FBC and Serum biochemistry

   And consider need for:
   - Blood cultures if sepsis suspected
   - Blood gases if respiratory distress present
   - Urine to check for haemoglobinuria
   - Coagulation screen if bleeding
6. **Send** adverse reaction notification form, blood product with IV set attached (in plastic bag) to Blood Bank and specimens to relevant labs.
7. **Notify** Blood Bank by phone: discuss urgency of follow up tests and further transfusion needs.
8. **Discuss** with TMS* if severe reaction present
9. **Further treatment – depends on cause:**
   - Septic reaction likely: antibiotics (eg gentamicin & piperacillin)
   - Anaphylaxis/anaphylactoid reaction: adrenaline sc/im Adverse reaction recurs: discuss use of washed cellular products with TMS* / Haematologist
   - Other: based on clinical state, test results & TMS* consultation
   - HLA antibodies: Red cell and platelet products are now leucocyte-depleted. HLA antibodies are unlikely to cause clinical reactions.

✶ TMS = *NZ Blood Service Transfusion Medicine Specialist.*

Blood Bank Action: Blood Bank will: re-check the blood group of the patient and the units, re-screen for unexpected blood group antibodies, and when appropriate arrange for specialised microbiological cultures.

- Special methods are required to obtain microbiological samples from a unit, if sepsis is suspected.
- If a patient reacts to more than one unit, or has a severe reaction, it is essential that investigations are performed promptly. Blood Bank may provide modified blood products after appropriate investigations.

FOR ANY SEVERE TRANSFUSION REACTION AND ANY SPECIAL TRANSFUSION REQUIREMENT

➢ ***CONTACT TRANSFUSION MEDICINE SPECIALIST / HAEMATOLOGIST OR BLOOD BANK REGISTRAR IMMEDIATELY,***
CONTACT DETAILS CAN BE OBTAINED FROM THE BLOOD BANK.

Prepared by the New Zealand Blood Service, 71 Great South Road, Epsom, Auckland. Telephone 09 523 5744 Fax 09 523 5754.

Appendix III

Transfusion-Related Adverse Event Notification Form page 1

Event Identification Number (NZBS Office Use Only)

Haemovigilance | HV | | | | | | |

A. Patient Details

Hospital	Ward / Location	NHI Number	Date-of-birth / /	Gender

B. Nature Of Adverse Event

* *Notify a NZBS Transfusion Medicine Specialist Immediately.*

Type Of Adverse Event *(For definition of categories see 'Guidelines For Completing The Transfusion Related Adverse Events Notification Form' 111I042)*		***Please*** *(✓)*
(i) Incorrect Blood Component / Product Transfused *(Specify)*		
• ABO and/or Rh(D) incompatible	*	
• ABO and/or Rh(D) compatible	*	
• Other red cell incompatibility	*	
• Special requirements not met *(e.g. CMV-, irradiated; Specify)* _____	*	
• Inappropriate transfusion	*	
• Anti-D	*	
• Other *(Specify)*_____	*	
(ii) Acute Haemolytic And Other Severe Acute Transfusion Reaction *(Occurring <u>less</u> than 24 hours post transfusion)*	*	
(iii) Delayed Transfusion Reaction *(Occurring <u>more</u> than 24 hours post transfusion)*	*	
(iv) Non-Haemolytic Febrile Transfusion Reaction:		
• Mild		
• Moderate / Severe	*	
(v) Transfusion-Related Acute Lung Injury (TRALI)	*	
(vi) Transfusion-Associated Graft-versus-Host Disease (TA-GvHD)	*	
(vii) Post-Transfusion Purpura (PTP)	*	
(viii) Allergic Reaction:		
• Minor Allergic Reaction *(Urticarial or skin rash <u>without</u> fever or other symptoms)*		
• Anaphylactoid / Anaphylactic Transfusion Reaction	*	
(ix) Transfusion Associated Circulatory Overload (TACO)	*	
(x) Transfusion Transmitted Infection (TTI) *(Bacterial / viral / parasitic)*	*	
(xi) Equipment-related *(Specify)* _____		
(xii) Component-related *(Specify)*_____		
(xiii) Other type of reaction / event *(Specify)* _____		

Appendix III

Transfusion-Related Adverse Event Notification Form page 2

Event Identification Number (NZBS Office Use Only)

Haemovigilance | HV | | | | | | |

C. Component / Product Transfused *(Record details of each component / product transfused)*

Component / Product	Donation / Batch Numbers *(Indicate whether or not modified e.g. irradiated, washed plasma etc)*
Red Cells	
Platelets (Apheresis)	
Platelets (Pooled)	
Fresh Frozen Plasma	
Cryoprecipitate	
Blood products	
Other	

C1. Date of transfusion / /	**C2. Time transfusion started**_____am / pm
C3. Volume transfused _____ ml	**C4. Was this transfusion an emergency** ☐ Yes ☐ No

D. Symptoms Present During Reaction *(Tick relevant boxes)*

☐ Fever / Temperature rise ____ °C	☐ Stridor / Wheeze	☐ Falling urinary output / Oliguria
☐ Chills / Rigors	☐ Falling O_2 saturation	☐ Haemoglobinuria
☐ Urticaria	☐ Rising pCO_2	☐ Jaundice
☐ Non-urticarial rash	☐ Loin pain	☐ Pain along infusion site
☐ Hypertension	☐ Chest pain	☐ Restlessness / Anxiety
☐ Hypotension	☐ GI symptoms (inc. abdo pain)	☐ Shock
☐ Tachycardia	☐ Unexpected bleeding	☐ No symptoms
☐ Dyspnoea	☐ Falling haemoglobin	☐ Patient under anaesthesia

☐ Chest X ray changes *(specify)*

☐ Other *(specify)*

D1. Patient's baseline observations prior to reaction

Temp _____Pulse _____BP_____

D2. Patient's observations at time of reaction

Temp _____Pulse _____BP_____

Appendix III

Transfusion-Related Adverse Event Notification Form page 3

Haemovigilance

Event Identification Number (NZBS Office Use Only)

HV						

D2. Interval between start of transfusion and onset of symptoms

E. Patient History And Diagnosis

E1. What is the patient's primary diagnosis

E2. What was the reason for transfusion

E3. Other relevant medical and/or surgical history

E4. Pregnancy / miscarriage

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

E5. Transfusion history

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

E6. Pretransfusion haematology

a. If red cells transfused state pretransfusion Hb _____ Date / / Time_____ am / pm

b. If platelets transfused state pretransfusion platelet count _____ Date / / Time _____ am / pm

c. If plasma transfused state pretransfusion INR _____ Date / / Time _____ am / pm

d. If cryoprecipitate transfused state pretransfusion fibrinogen _____ Date / / Time_____ am / pm

F. Comments

Appendix III

Transfusion-Related Adverse Event Notification Form page 4

Haemovigilance

Event Identification Number (NZBS Office Use Only)

HV						

G. *Imputability assessment*

Imputability Scale		Explanation	Event (✓)
NA	Not assessable	When there is insufficient data for imputability assessment	☐
0	Excluded	When there is conclusive evidence beyond reasonable doubt for attributing the event to alternative causes	☐
0	Unlikely	When the evidence is clearly in favour of attributing the event to causes other than the transfusion	☐
1	Possible	When the evidence is indeterminate for attributing the event either to the transfusion or alternative causes	☐
2	Likely, probable	When the evidence is clearly in favour of attributing the event to the transfusion	☐
3	Certain	When there is conclusive evidence beyond reasonable doubt for attributing the event to the transfusion	☐

Assessment Made In Consultation With:

☐ Patient's Doctor ☐ Patient's Nurse ☐ Transfusion Nurse Specialist

☐ NZBS Transfusion Medicine Specialist ☐ NZBS MO

☐ Other *(specify)*: _____

Completed By: _____

H. *Notification And Reporting*

H1. NZBS TMS informed ☐ Yes ☐ No

TMS name _____ Time_____ am / pm Date / /

H2. Notification form completed by Name_____ Date / /

Tel _____ Fax_____ Email _____

Please send completed form to:

National Haemovigilance Office
New Zealand Blood Service
Private Bag 7904
WELLINGTON

04 380 2243
04 389 5608
haemovigilance@nzblood.co.nz

NZBS Office Use Only

Notification Form Received Date / / Acknowledgement Email Sent ☐ Yes ☐ No Date / /

Follow Up Form(s) Sent *(indicate below ✓)* Date / /

☐ Incorrect Blood Component Transfused ☐ Transfusion-Associated Graft versus Host Disease

☐ Transfusion Reaction ☐ Transfusion Transmitted Bacterial Infection

☐ Post Transfusion Purpura ☐ Transfusion Transmitted Viral Infection

Appendix IV

Categories for Reporting Events page 1

<table>
<tr><th>Type of event</th><th colspan="3">Definition</th></tr>
<tr><td rowspan="2">Acute haemolytic transfusion reaction (AHTR)</td><td colspan="3">Onset within 24 hours of transfusion
Clinical and laboratory features of haemolysis are present. AHTR may also be due to red cell autoantibodies or non-immunological factors e.g. malfunction of a pump, blood warmer, use of hypotonic solutions etc.</td></tr>
<tr><td colspan="2">Signs/symptoms of AHTR:
• Fever
• Chills/rigors
• Facial flushing
• Chest pain
• Abdominal pain
• Back/flank pain
• Nausea/vomiting
• Diarrhoea
• Hypotension
• Pallor
• Jaundice
• Oligouria/anuria
• Diffuse bleeding
• Dark urine</td><td>Laboratory features:
• Haemoglobinaemia
• Haemoglobinuria
• Decreased serum haptoglobin
• Unconjugated hyperbilirubinaemia
• Increased LDH and AST levels
• Decreased haemoglobin levels
• Positive DAT
• Red cell antibody/evidence of incompatibility</td></tr>
<tr><td rowspan="3">Allergic reaction</td><td colspan="3">Mucocutaneous signs and symptoms during or within 4 hours of transfusion:

• Morbilliform rash with pruritus
• Urticaria (hives)
• Localised angioedema
• Oedema of lips, tongue and uvula
• Periorbital pruritus, erythema and oedema
• Conjunctival oedema

Grade1 = non-severe
Anaphylactic reaction is when, in addition to mucocutaneous symptoms, there is airway compromise or cardiovascular involvement.</td></tr>
<tr><td>Laryngeal symptoms include:
• Tightness in throat
• Dysphagia
• Dysphonia
• Hoarseness
• Stridor</td><td>Pulmonary symptoms include:
• Dyspnoea
• Cough
• Wheeze/bronchospasm
• Hypoxaemia</td><td>Cardiovascular symptoms include:
• Hypotension
• Hypotonia
• Syncope</td></tr>
<tr><td colspan="3">Grade 2 = severe
Grade 3 = life-threatening
Grade 4 = death</td></tr>
<tr><td>Component-related event</td><td colspan="3">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.</td></tr>
<tr><td>Delayed haemolytic transfusion reaction (DHTR)</td><td colspan="3">Usually manifests between 24 hours and 28 days after a transfusion and signs of haemolysis are present. Signs/symptoms are similar to AHTR but are usually less severe. 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.</td></tr>
</table>

Appendix IV

Categories for Reporting Events page 2

Delayed serologic transfusion reaction (DSTR)	Synonymous with alloimmunization. After a transfusion, there is demonstration of clinically significant red cell antibodies which were previously absent and no clinical or laboratory signs of haemolysis.
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.
Febrile non-haemolytic transfuson reaction (FNHTR)	One or both of: • Fever (≥38˚C and a change of ≥1˚C from pre-transfusion value) • Chills/rigors Occurring during or within 4 hours of transfusion without other cause such as haemolytic transfusion reaction, bacterial contamination or underlying condition.
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. May be associated with other symptoms such as facial flushing, dyspnoea, abdominal cramps.
Haemosiderosis	Ferritin level of ≥ 1000μg/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.

Appendix IV

Categories for Reporting Events page 3

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 and occurs during or within 6 hours of completion of transfusion Alternative risk factors for ALI: • Direct lung injury: aspiration, pneumonia, toxic inhalation, lung contusion, near drowning • Indirect lung injury: severe sepsis, shock, multiple trauma, burn injury, acute pancreatitis, cardiopulmonary bypass, drug overdose
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. The donor may have evidence of the same transmissible infection or the component transfused may be shown to contain the infectious agent.
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 V

Notification of Adverse Reactions to Fractionated Blood Products page 1

RECIPIENT

Family Name First Names	National Health Index No.	Gender	NZBS Use
Address	Date of Birth dd/ mmm/yyy	Height	Weight
Diagnosis & Main Health Problems: pre-existing conditions, surgical Procedure(s) with dates, pregnancy with LMP, smoking, alcohol use, etc			Pregnancy ☐ 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

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 or Use / Comments

DESCRIPTION OF ADVERSE REACTION OR EVENT

Location of Patient at Time of Treatment that Caused Reaction: ☐ Hospital ☐ Home/Other

Transfusion started or Product administered: Date _____ Time _____ Route: ☐ IV ☐ IM ☐ SC ☐ Other

Onset of Reaction(s): Date _____ Time _____ End of Reaction(s) *if relevant* Date _____ Time _____

Rate of Infusion (IV products): initial _____, at time of reaction _____. Usual daily dose, if relevant (with units) _____

For lyophilised Products: concentration of solution infused: _____ solvent used for reconstitution _____

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

Treatment of reaction

Appendix V

Notification of Adverse Reactions to Fractionated Blood Products page 2

Adverse Reaction Information

Seriousness

Is the event serious? ☐ Yes ☐ No

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

☐ Life-threatening
☐ Persistence of significant disability / incapacity
☐ Required intervention to prevent permanent impairment / damage
☐ Congenital anomaly / birth defect
☐ Hospitalisation – initial or 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 _____, ☐ 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

Blood Group ABO/D (if relevant)
Direct antiglobulin test (if relevant)

Causality assessment

☐ Highly probable	☐ Possible	☐ Unlikely	☐ Unassessable

OTHER FACTORS LIKELY TO HAVE INFLUENCED THE ADVERSE REACTION OR INCIDENT

☐ Renal Disease	☐ Hepatic Disease	☐ Cardiac Disease	☐ Respiratory Disease	☐ Allergy	☐ Other medical conditions: ☐ Chemical Exposure:

REPORTER DETAILS

This information will be used for follow up of the result by NZ Blood 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: If the reporter is the patient, has consent been given to contact the Treater to follow up the adverse reaction? ☐ Yes ☐ No **Organisation / Address:** **Phone:** **Fax:** **Email:**	**Name:** **Organisation / Address:** **Phone:** **Fax:** **Email:** **Registrar** (if relevant): **Pager contact:**

INSTRUCTIONS

If the reaction is serious, telephone the Transfusion Medicine Specialist via the Blood Banks listed below.
All adverse reactions to blood products must be notified to NZ Blood Service and should be reported on this form.
Please fill in all sections relevant to you, your patient and the clinician responsible for treating the patient.
Use pre-printed identification labels for patient information, if available.
Use only standard abbreviations.
Record all medicines in use, including medicines not known to be implicated in the adverse effect. Continue report on a separate page, if necessary, so that full information is provided.
Return the completed form to the Blood Bank as soon as possible. The form will then be forwarded to the Regional Transfusion Medicine Specialist and the NZBS National Reporting Centre. Relevant information will be forwarded to the manufacturer of the product. A non-identifying summary report will be forwarded to Medsafe and CARM.

Blood Bank	Telephone	Fax
Auckland Hospital Blood Bank	09 307 2834	09 307 2823
Waikato Hospital Blood Bank	07 839 8919	07 858 0988
Palmerston North Hospital Blood Bank	06 350 8558	06 350 8557
Wellington Hospital Blood Bank	04 918 6961	04 385 5982
Christchurch Hospital Blood Bank	03 364 0314	03 364 0159
Dunedin Hospital Blood Bank	03 470 9369	03 470 9513

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