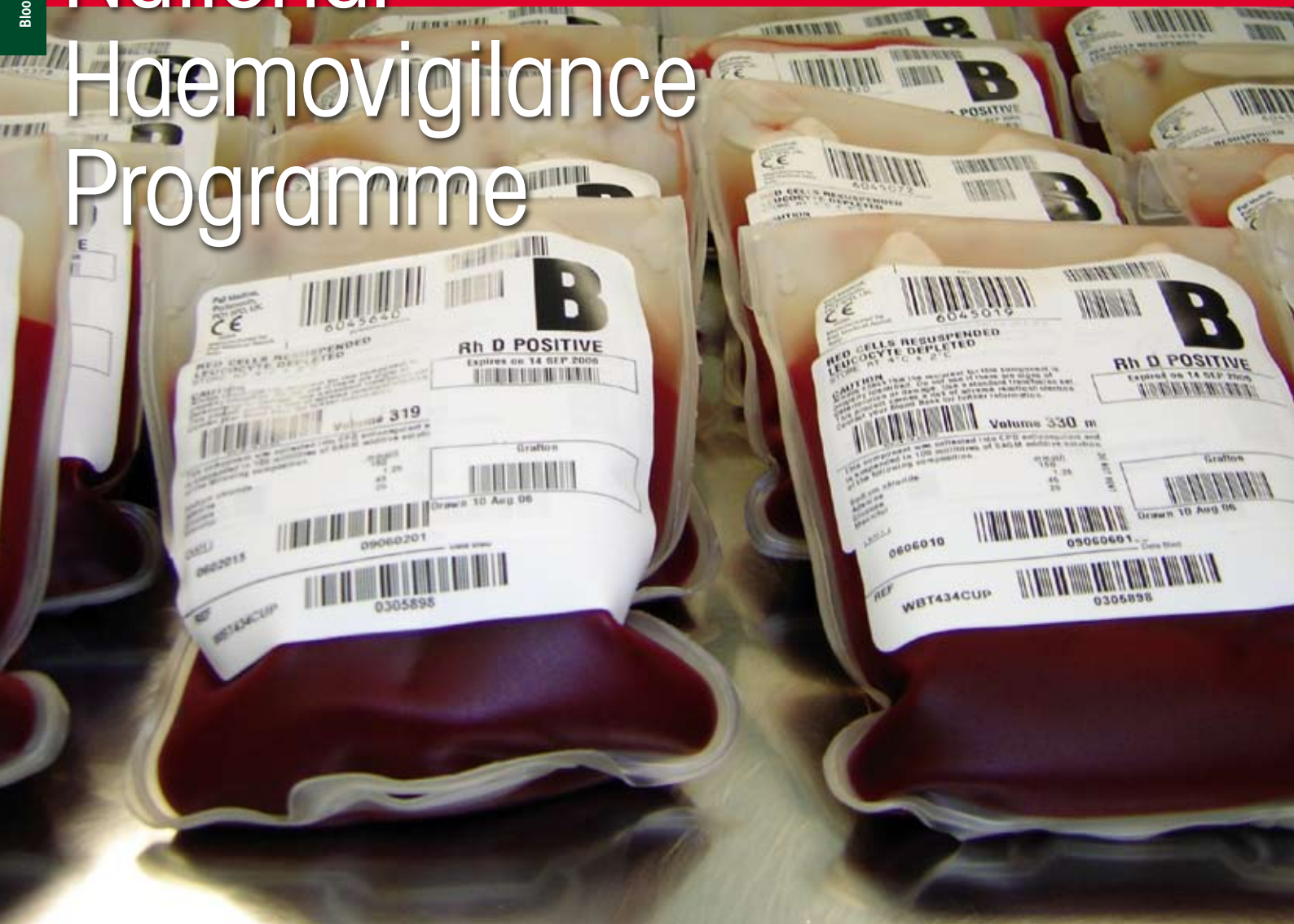
NZBLOOD
Te Ratonga Toto O Aotearoa

Haemovigilance

Annual Report 2006

Blood ready for issue

National Haemovigilance Programme



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Disclaimer

Protected Quality Assurance Activity

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 (Quality Assurance Activity: New Zealand Blood Service) 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 a 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.

Patient Privacy

Patient identification in the form of NHI (National Health Index) number is collected as part of the initial notification of events. This identifier is used solely to enable follow up of patients in serious events or where further information is required to complete (or verify) the initial notification.

Patient information may subsequently be shared with only those District Health Board (DHB) and NZBS health professionals directly involved in the reporting, investigation and management of individual Haemovigilance events.

The electronic data relating to the cases on which this annual report are based have been placed into an archival database from which the NHI information and unique Haemovigilance number have been removed. Patient identifier information has also been removed from the original notification forms. These have then been placed into secure document storage according to NZBS policy.

From the information held in the electronic and paper archives it is not possible to identify individual patients.

Abbreviations

AABB	American Association of Blood Banks
AML	Acute myeloid leukaemia
ATE	Adverse transfusion event
CAG	Clinical Advisory Group
CoE	Council of Europe
Cryo	Cryoprecipitate
DAT	Direct antiglobulin test
DHB	District Health Board
EHN	European Haemovigilance Network
FDA	(US) Food and Drug Administration
FFP	Fresh frozen plasma
Hb	Haemoglobin
HBsAg	Hepatitis B surface antigen
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HIV	Human immunodeficiency virus
HLA	Human leucocyte antigen
HNA	Human neutrophil antigen
HTC	Hospital transfusion committee
IANZ	International Accreditation New Zealand
IBCT	Incorrect blood component transfused
ISBT	International Society of Blood Transfusion
NHFTR	Non-haemolytic febrile transfusion reaction
NHI	National health index

NZBS	New Zealand Blood Service
PMF	Plasma master file
SHOT	Serious hazards of transfusion
SOP	Standard operating procedure
TACO	Transfusion-associated circulatory overload
TA-GVHD	Transfusion-associated graft-versus-host disease
TMS	Transfusion Medicine Specialist
TNS	Transfusion Nurse Specialist
TRALI	Transfusion-related acute lung injury
TSO	Transfusion Safety Officer
TTI	Transfusion-transmitted infection
vCJD	Variant Creutzfeldt-Jacob disease
WHO	World Health Organisation

Foreword

Publication of this, the second, annual Haemovigilance report for New Zealand, provides evidence that the scheme continues to work effectively and that the data arising from it is now assisting with priority setting within NZBS. The ability to produce a report of this type requires support from all those many individuals, including doctors, nurses and laboratory staff involved in the delivery of transfusion to patients. NZBS is very appreciative of the time and effort that these individuals have given to ensure the success of the initiative.

This report provides information on the adverse events associated with transfusion in New Zealand. It will hopefully assist health professionals to better understand the risks associated with transfusion in the 21st century and to communicate these to potential recipients of blood and blood products. Easy access to blood transfusion has underpinned many of the successes of modern medicine and surgery. Each year approximately 1% of New Zealanders will receive treatment involving use of a blood product.

Haemovigilance schemes provide an opportunity to improve our understanding of the type and frequency of adverse events linked to transfusion. Information from similar schemes in other countries has shown that a proportion of adverse events are avoidable. These events generally result from breakdown in the complex systems used to delivery blood products to patients. Not surprisingly similar problems have been identified in New Zealand. In recent years much emphasis has been placed on improving clinical delivery systems for blood products to patients. Interestingly as data accumulates on adverse events in New Zealand it is increasingly apparent that a significant proportion of incidents arise from errors within hospital laboratories. It will be important to ensure that appropriate training and support is provided in order to reduce the frequency of errors in this setting.

In common with other quality initiatives the introduction of a Haemovigilance system should be seen as part of a journey rather than a destination in itself. There are opportunities to improve the quality of data collected and the way in which these are analysed. Nonetheless publication of this, the second, Haemovigilance annual report is a clear indication that the basic building blocks are in place and are working well. This will form a good base for future improvements.

Dr Peter Flanagan
NZBS National Medical Director

1

Blood Product Usage Trends

New Zealand is self sufficient in blood and blood products. With few exceptions the blood products used in New Zealand are obtained from voluntary donations given by New Zealanders. NZBS is the sole supplier of blood and blood products and is responsible for provision of blood, blood products and related services to hospitals throughout the country. Given this, NZBS must carefully match overall collection levels to the predicted demands for blood products. This involves monitoring of activity levels and trends in clinical demand.

Blood products can be divided into two main categories. The first type is blood components. These are produced from individual donations at NZBS sites. Blood components include red cells, platelet concentrates and fresh frozen plasma. The second type of blood product is plasma derivatives. These are manufactured from large pools of plasma (each pool containing approximately 7.5 tonnes or the equivalent of 26000 individual whole blood donations). NZBS sends its plasma to CSL Bioplasma in Melbourne, Australia. During processing New Zealand plasma is segregated from that of other countries. All products manufactured from New Zealand plasma are returned to NZBS for distribution to hospitals across New Zealand.

Table 1.1 shows the level of issues of blood products to hospitals by NZBS during the five-year period 2002 to 2006.

Table 1.1: Blood Products Issues

Calendar Year	Red Cells	Platelets *	FFP	Intragam® P **
2002	135481	14423	24481	13024
2003	137031	13981	22191	13813
2004	136385	16037	24452	15110
2005	136238	15327	22303	16246
2006	135109	15364	22578	17512

** Standard adult doses* *** Intragam ®P 200ml equivalents*

Demand for red cells, platelets and fresh frozen plasma (FFP) remains reasonably stable. In contrast there is a significant, and ongoing, increase in clinical requirements for Intragam P® (intravenous immunoglobulin) with the increase seen in New Zealand mirroring international trends. Clinical demand for Intragam P® is the main driver of blood collection in New Zealand. NZBS is using plasmapheresis to meet the increased requirement for plasma. This involves the use of automated machines to collect plasma from donors. With the use of plasmapheresis NZBS avoids excessive collection of whole blood and the consequent expiry of red cell components.

NZBS provides a national blood management system called Progesa. This is used within NZBS to track donors and donations and is also used in all main DHB blood banks responsible for providing blood products to patients. In international terms this is possibly unique and provides an opportunity to analyse transfusion patterns across the country.

NZBS is increasingly using data extracted from Progesa to inform and assist DHBs in improving overall practice of transfusion in New Zealand. Table 1.2 provides information from Progesa regarding the number of people receiving blood products during the 2006 calendar year.

Table 1.2: Blood Product Recipients During 2006

		Red Cells	Platelets	FFP	Intragam® P
Number of recipients	Female	14940	1157	1883	388
	Male	11323	1974	2828	471
	Unknown	94	4	8	10
	Total	26357	3135	4719	869
Age of recipients	Mean	52	46	58	46
	Median	68	52	65	48
	Maximum	106	100	100	93
	Minimum	0	0	0	0
Units transfused per recipient [1, 2]	Mean	5	4	5	235
	Median	3	2	3	156
	Maximum	136	98	418	1755
	Minimum	1	1	1	3

Notes

1. Standard adult doses

2. Intragam P® usage in grams

A total of 26357 people were transfused with red cells during 2006. These included newborn infants and people over 100 years old. A small number of transfusions will also have been given to fetuses in utero. The maximum number of red cells transfused to any recipient during the year was 136 units. The mean number of transfusions per recipient was 5 units with a median of 3 units.

Platelet transfusions were received by 3135 patients, and overall recipients were younger than those receiving red cells. The maximum number of adult doses given to one patient was 98, with a mean of 4 doses and a median of 2.

A total of 4719 recipients received treatment with FFP. The maximum number of units received was 418 with a mean of 5 units and a median of 3 units.

Finally, 388 recipients received treatment with Intragam® P. The age range of recipients was between 0 and 93 years with a mean of 46 and a median of 48. The largest dose received by a single individual was 1755 g with a mean of 235 g and a median of 156 g.

2

Introduction To Haemovigilance

Blood transfusion therapy is now a well-established component of modern medicine. It is often reported that up to 80% of the population will require a transfusion at some point in their lives.

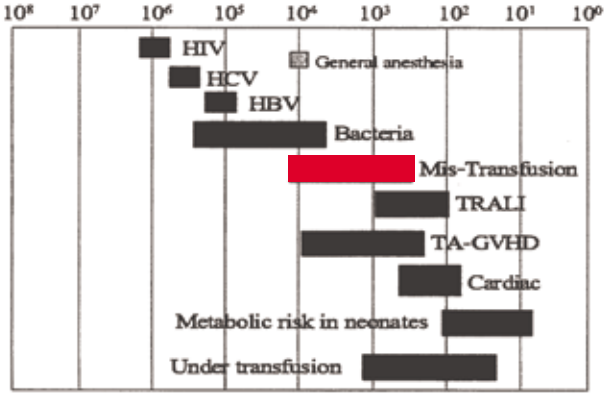
From collection of the source material from donors to transfusing the recipient, blood transfusion is a complex process or chain of events involving many different activities, technologies and staff groups. Any failure in the transfusion chain has the potential to cause significant harm to donors or patients.

The provision of **safe transfusion** therapy can be considered a basic requirement of advanced medical care. Safe transfusion should however be distinguished from **safe blood**:

- **Safe Blood**
  Safety of products particularly as regards transmission of infectious agents for example HBV, HCV, HIV.

- **Safe Transfusion**
  Safety of the whole transfusion process from 'vein-to-vein' but particularly in the hospital environment where the majority of transfusions are performed.

Blood products are undeniably increasingly safe from the perspective of major advances in viral and bacterial detection, with the risk of viral transmission being virtually eliminated. Blood products are however biologic material and so not unexpectedly there is a risk that patients may experience reactions.



Paling Risk Scale for major Transfusion hazards (Source: Dzik 2001)

Unfortunately a significant number of patients will experience adverse outcomes that are often due to preventable lapses in the processes that constitute the transfusion chain. For example the UK's SHOT (Serious Hazards Of Transfusion) scheme has identified that the occurrence of 'mistransfusion' events, where patients receive blood products that did not meet appropriate requirements or which were intended for another patient, is unacceptably high.

The transfusion literature also clearly shows that the risk of mistransfusion events is several orders of magnitude higher than those for viral infections such as HIV, HBV or HCV. There

are also gaps in our knowledge of the potential harm to recipients of transfusions. Finally, many studies in the international literature have also shown that near-patient activities such as patient identification, phlebotomy and sample labelling have unacceptably high error rates.

What Is Haemovigilance?

Haemovigilance has become an important and integral part of transfusion medicine. For example a recent international forum in the transfusion journal *Vox Sanguinis* (1) presented information and data on Haemovigilance activities in 22 countries. Similarly, groups such as the 'European Haemovigilance Network' and the International Society Of Blood Transfusion (ISBT) 'Working Party on Haemovigilance' attract members from many of the countries, including New Zealand, with (or interest in introducing) Haemovigilance programmes.

NZBS has adopted the Council of Europe definition of haemovigilance:

"… the organised surveillance procedures related to serious adverse or unexpected reactions in donors, or recipients and the epidemiological follow up of donors …" (2)

Haemovigilance reporting is voluntary but should be seen as part of professional responsibility for the safety and well being of both donors and patients. It also serves as a very important source for identifying emerging trends in hazards of blood transfusion.

NZBS collects a wide range of data, which are considered under the umbrella of Haemovigilance. In addition to transfusion-related events these include data on the number of donations collected, number of components transfused, wastage and outdating of components, bacterial monitoring of platelets, reporting of adverse reactions to fractionated products, donor-related incidents, donor infectious disease epidemiology amongst others.

In this report data from a range of haemovigilance activities are reported: transfusion-related adverse events, donor adverse events, infectious disease screening of donors, adverse reactions to plasma derivatives, bacterial monitoring of platelet components and sample and request form labelling errors (associated with pretransfusion testing).

3

Overview Of Transfusion-Related Adverse Event Data

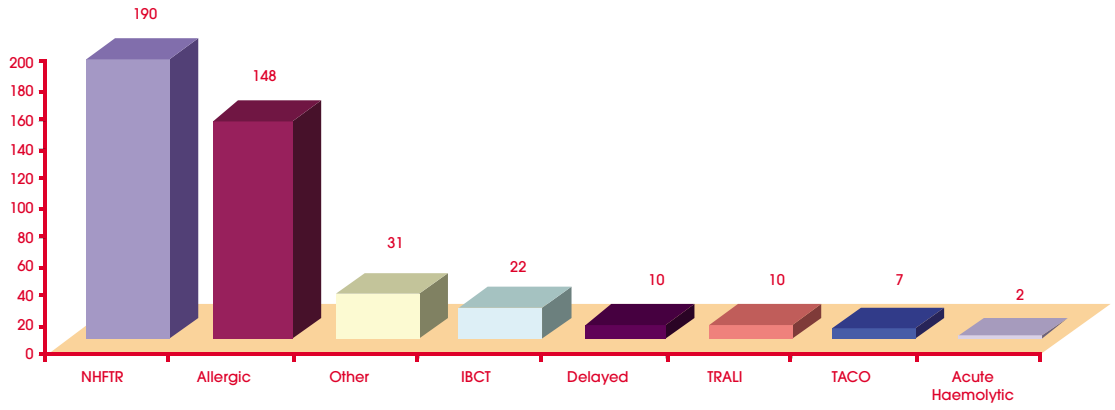
Adverse transfusion reactions are reported to the hospital blood banks using the NZBS *Notification And Investigation Of Adverse Transfusion Reaction* form (3) (or similar local DHB forms). The NZBS form provides guidelines for the management of adverse transfusion reactions. Further information on the complications of transfusion can be also found in appendix 2.

Details of these reactions or other transfusion-related adverse events are then forwarded to the National Haemovigilance Office using the *Transfusion-Related Adverse Event Notification Form* (111F042) (4) for entering into the haemovigilance database.

Types Of Event Reported During 2006

During the year 1 January to 31 December, 420 events (involving 385 recipients) were reported. Chart 3.1 shows the number of events categorised by type of event and chart 3.2, which follows, shows the number of events expressed as a percentage of total events reported.

Chart 3.1: Types Of Event Reported During 2006 (n=420)



Key

NHFTR: Non-haemolytic febrile transfusion reaction (mild and moderate/severe)

Allergic: Allergic reactions (allergic reactions and anaphylactoid/anaphylactic reactions)

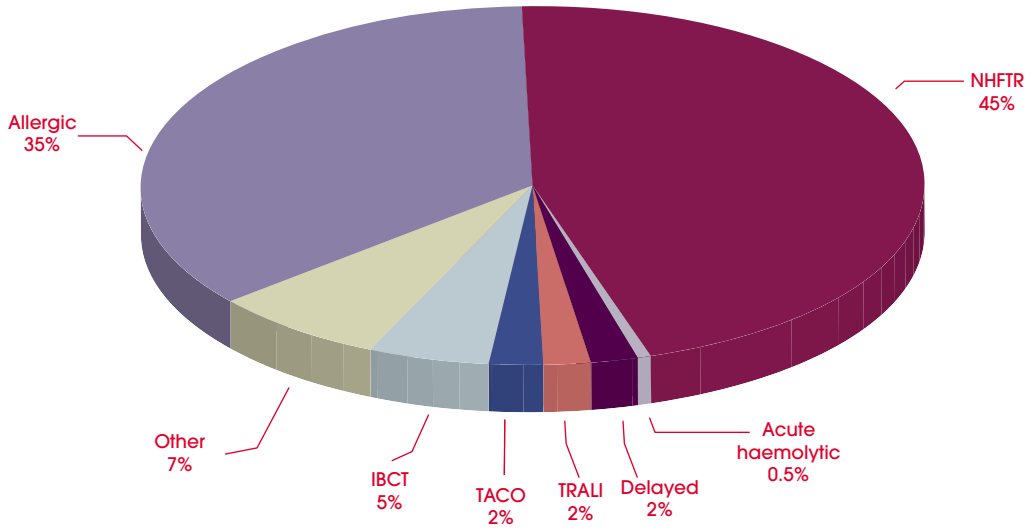
IBCT: Incorrect blood component transfused

TRALI:Transfusion-related acute lung injury

TACO: Transfusion-associated circulatory overload

Acute Haemolytic: Acute haemolytic and other severe acute reactions

Chart 3.2: Percentage Distribution Of Event Reported During 2006 (n=420)



Profile Of Recipients Experiencing Transfusion-Related Adverse Events

There is a greater proportion of males experiencing events compared to females (53.3% versus 46.7%) which reverses the situation seen in 2005.

The age distribution of this group of recipients is weighted towards the older end of the spectrum, with nearly half (47.6%) aged 60 years or more. In contrast, paediatric recipients (defined as those aged 18 years or less) account for 16.0% of events. This reflects the age profile of patients receiving blood products in New Zealand.

Table 3.1: Age And Gender Profile Of Recipients Experiencing Events (n=420)

Gender	No.	Median Age	Mean Age	Max Age	Min Age
Female	196	56.5	52.9	99	0 (1 day)
Male	224	59.5	52.7	92	0 (1 day)
All	**420**	**59.0**	**52.8**		

Origin Of Notification Forms

Notification forms were received from 46 hospitals (37 public and 9 private). These reports represent 20 of the 21 DHBs with the total number of notifications received from each DHB shown in table 3.2.

Table 3.2: Origin Of Reports (By DHB)

DHB	No.	%
Auckland	72	17%
Bay Of Plenty	18	4%
Canterbury	45	11%
Capital And Coast	49	12%
Counties Manukau	28	7%
Hawkes Bay	7	2%
Hutt	6	1%
Lakes	8	2%
Mid Central	28	7%
Nelson Marlborough	7	2%
Northland	5	1%
Otago	17	4%
South Canterbury	1	0.2%
Southland	1	0.2%
Tairawhiti	3	1%
Taranaki	7	2%
Waikato	79	19%
Wairarapa	5	1%
Waitemata	17	4%
West Coast	2	1%
Whanganui *	0 *	0%
Private	15	4%

** Nil events to report during 2006 (compared with 2 in 2005)*

The 46 hospitals submitting reports represent approximately one third of the facilities where transfusions were performed during 2006. For the remaining facilities it cannot be assumed that no transfusion-related adverse events or reactions occurred but simply that none were notified to either the supplying blood bank or the haemovigilance office.

Blood Products Implicated In Events

The notification form provides information on the component(s) implicated in the event being notified. In some cases only the unit being transfused at the time of the event is recorded whilst in others all units transfused up until the event are included.

Of the 420 events analysed, 379 reportedly involved a single product. Table 3.3 provides a breakdown of the number of events where either a single product or multiple products were reported as being implicated, categorised by event type and product type.

Table 3.3: Single Or Multiple Products Implicated In Events

Event Type	Number Of Events Where Single Product Reported								Multiple Products*
	Red Cells	Platelets (Apheresis)	Platelets (Pooled)	FFP	Cryoprecipitate	Cryodepleted Plasma	Plasma Derivatives	Anti-D	
Acute Haemolytic		1	1						
Allergic	46	24	14	42	1	3			18
Delayed Reaction	9								1
IBCT-ABO/Rh(D) compatible	1								
IBCT-ABO/Rh(D) incompatible	1	1							
IBCT-anti-D								3	
IBCT-inappropriate transfusion	6	2		1			1		
IBCT-special requirements not met	5	1							
NHFTR	161	6	2	6					15
Other	23	3		4	1				
TACO	5								2
TRALI		2	1	2					5
All	257	40	18	55	2	3	1	3	41

** Events may include transfusions where both components and plasma derivatives given*

Total Numbers Of Blood Components Transfused

Table 3.4 shows the number of each individual component type transfused for the period 1 January to 31 December 2006.

Table 3.4: Total Numbers Of Individual Components Transfused

Component	No. Transfused
Red cells	117688
Platelets (apheresis) *	6758
Platelets (pooled) *	4657
Fresh frozen plasma	20619
Cryoprecipitate	1847
Cryodepleted plasma	690
Total	**152259**

** Equivalent to one standard adult dose*

Transfusion-Related Adverse Events Analysed By Component Transfused

Using data from table 3.4 the frequency and incidence (per 100000 units transfused) of transfusion-related adverse events was determined for each component and this is shown in table 3.5.

Table 3.5: Frequency And Incidence Of Transfusion-Related Adverse Events (In Relation To Number Of Components Transfused)

Component	No. Transfused	No. Events *	Frequency	Per 100000 Transfused
Red cells	117688	294	1:400	250
Platelets (Apheresis)	6758	53	1:128	784
Platelets (Pooled)	4657	28	1:166	601
Fresh frozen plasma	20619	84	1:245	407
Cryodepleted plasma	690	3	1:230	435
Cryoprecipitate	1847	8	1:231	433
All	**152259**	**420**	**1:363**	**276**

** Figures for individual components include those from events where multiple components implicated.*

Similarly, table 3.6 shows the frequency and incidence of events in relation to recipients of red cells, platelets and fresh frozen plasma.

Table 3.6: Frequency And Incidence Of Transfusion-Related Adverse Events (In Relation To Recipients)

Product	Recipients	Events	Frequency	Per 1000 Recipients
Red Cells	26357	294	1:90	11
Platelets	3135	81	1:39	26
FFP	4719	84	1:56	18

As well as assessing the risk of events in relation to the number of components transfused it is useful to understand the relative risk of specific events for recipients. In table 3.7 the frequency and incidence of each specific category of transfusion-related adverse event is shown relative to the number of recipients experiencing each event.

Table 3.7: Frequency And Incidence Of Specific Events (In Relation To Recipients)

Event	Recipients *	Frequency	Per 1000 Recipients
Acute haemolytic	2	1:18489	0.1
Allergic	126	1:293	3
Delayed	10	1:3698	0.3
IBCT - ABO and/or Rh(D) compatible	1	1:36978	0.03
IBCT - ABO incompatible	1	1:36978	0.03
IBCT - Rh(D) incompatible	1	1:36978	0.03
IBCT - anti-D	3	1:12326	0.1
IBCT - inappropriate transfusion	10	1:3698	0.3
IBCT - special requirements not met	6	1:6163	0.2
NHFTR	184	1:201	5
Other	30	1:1233	0.8
TACO	7	1:5283	0.2
TRALI	10	1:3698	0.3
Plasma derivative events	16	1:2311	0.4
All	**407**	**1:91**	**11**
All (excluding plasma derivatives)	**391**	**1:95**	**11**

* *The number of recipients shown in this table is greater than the 385 individual recipients experiencing events during 2006. This is due to a small number of recipients experiencing more than one type of event during the year.*

Cumulative Data: May 2005 To December 2006

During the 20-month period May 2005 to December 2006 a total of 691 events were reported, which is equivalent to an average of 35 reports per month. As can be seen in chart 3.3 the numbers of reports received each month was relatively consistent.

Chart 3.3: Monthly Totals Of Reports Received For Period May 2005 –December 2006

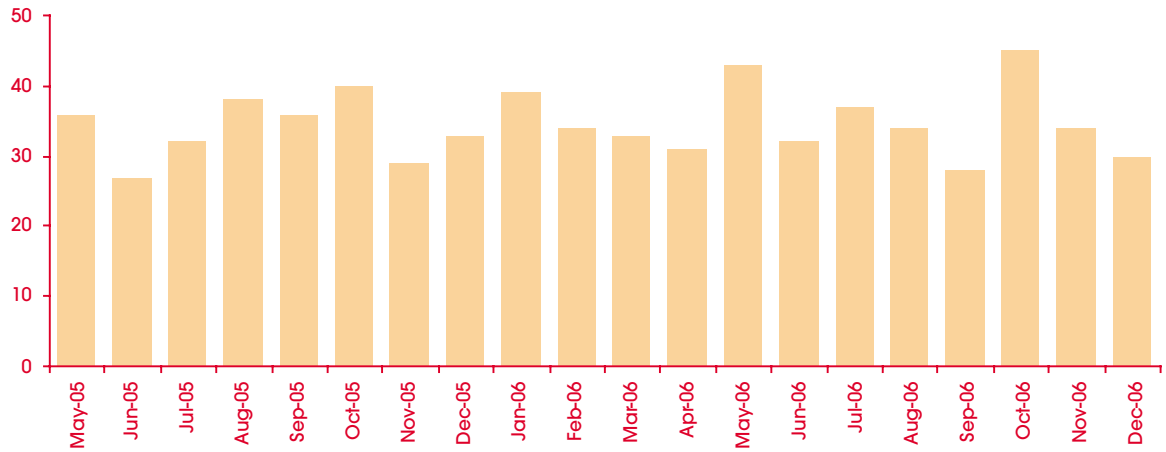


Table 3.8 shows the number of each type of event reported for the 2005 and 2006 years along with the combined total. To allow comparison the frequency of each event in relation to the total number of blood components transfused is also shown.

Table 3.8: Frequency Of Transfusion-Related Adverse Events (In Relation To Number Of Components Transfused)

Event	Number Of Events			Frequency		
	2005	2006	All	2005	2006	All
Acute haemolytic	0	2	3	0	1:76130	1:128597
Allergic	89	148	237	1:1179	1:1029	1:1085
Delayed reaction	6	10	16	1:17489	1:15226	1:16075
IBCT	7	18	25	1:14991	1:8459	1:10288
NHFTR	131	190	321	1:801	1:801	1:801
Other	16	31	47	1:6558	1:4912	1:5472
TACO	8	7	15	1:13117	1:21751	1:17146
TRALI	10	10	20	1:10493	1:15226	1:12860
TTI (bacterial)	1	0	1	1:104934	0	1:257193
All	268	416	684	1:392	1:366	1:376

Notes

1. *Reporting period for 2005 was 8 months (May to December)*
2. *Does not include events where plasma derivatives or serum eye drops were implicated*

As can be seen from the table 3.9 the relative percentages of female and male recipients experiencing events are similar, with the small difference being due to slightly more males.

The median and mean ages are also similar for both sexes. There is clearly a wide age-range in the group of recipients with the reported median ages reflecting that nearly half (49.9%) were aged 60 years or more compared with 14.8% aged 18 or less.

Table 3.9: Age And Gender Of Recipients Experiencing Events (n=691)

Gender	No.	Median Age	Mean Age	Max Age	Min Age
Female	340 (49.2%)	59	53.5	99	0 (1 day)
Male	351 (50.8%)	61	53.2	92	0 (1 day)
All	**691**	**59**	**53.4**		

Table 3.10 shows the frequency of events per recipient of red cells, platelets and fresh frozen plasma.

Table 3.10: Frequency Of Transfusion-Related Adverse Events Per Recipient

Product	Recipients			Events			Frequency		
	2005	2006	Total	2005	2006	Total	2005	2006	Total
Red Cells	18405	26357	**44762**	203	294	497	1:91	1:90	**1:90**
Platelets	3156	3135	**6291**	47	81	128	1:67	1:39	**1:49**
FFP	3157	4719	**7876**	43	81	124	1:73	1:58	**1:64**

Notes

1. *2005 data is for 8 month period May to December*
2. *Recipients may be counted more than once if they received more than one component*

Table 3.11 shows the frequency of events per unit of red cells, platelets and fresh frozen plasma transfused.

Table 3.11: Frequency Of Transfusion-Related Adverse Events Per Component

Product	Transfused			Events			Frequency		
	2005	2006	Total	2005	2006	Total	2005	2006	Total
Red Cells	81545	117692	199237	203	294	497	1:402	1:400	1:401
Platelets	7690	11415	19105	47	81	128	1:164	1:141	1:149
FFP	14063	20619	34682	43	81	124	1:327	1:255	1:280

Notes

1. *2005 data is for 8 month period May to December*
2. *Recipients may be counted more than once if they received more than one component*

Once again it is useful to understand the relative risk of specific events for recipients. Table 3.12 shows the frequency and incidence of each specific category of transfusion-related adverse event relative to the number of recipients experiencing each event.

Table 3.12: Frequency And Incidence Of Specific Transfusion-Related Adverse Events In Relation To Recipients

Event	No.			Frequency			Per 1000 Recipients		
	2005	2006	All	2005	2006	All	2005	2006	All
Acute haemolytic	0	2	2	0	1:17106	1:29465	0	0.1	0.03
Allergic	83	125	208	1:298	1:274	1:283	3.4	4	4
Delayed transfusion reaction	5	10	15	1:4944	1:3421	1:3929	0.2	0.3	0.3
IBCT - ABO and/or Rh(D) compatible	0	1	1	0	1:34211	1:58929	0	0.03	0.02
IBCT - ABO and/or Rh(D) incompatible	1	2	3	1:24718	1:17106	1:19643	0.04	0.1	0.1
IBCT - inappropriate transfusion	5	9	14	1:4944	1:3801	1:4209	0.2	0.3	0.2
IBCT - special requirements not met	1	6	7	1:24718	1:5702	1:8418	0.04	0.2	0.1
NHFTR	129	184	313	1:192	1:186	1:188	5.2	5	5
Other	16	29	45	1:1545	1:1180	1:1310	0.6	0.8	0.8
TACO	8	7	15	1:3090	1:4887	1:3929	0.3	0.2	0.3
TRALI	10	10	20	1:2472	1:3421	1:2946	0.4	0.3	0.3
TTI (bacterial)	1	0	1	1:24718	0	1:58929	0.04	0	0.02
All	**259**	**385**	**644**	**1:95**	**1:89**	**1:92**	**10**	**11**	**11**

As can be seen from table 3.13 all 21 DHBs are represented for the period 1 May 2005 to 31 December 2006. It should however be noted that one DHB did not report any events during 2006. A total of 52 hospitals are represented in the events reported (47 public and 5 private).

Table 3.13: Origin Of Reports (By DHB)

DHB	No.	%
Auckland	126	18%
Bay Of Plenty	31	5%
Canterbury	64	9%
Capital And Coast	82	12%
Counties Manukau	50	7%
Hawkes Bay	18	3%
Hutt	10	1%
Lakes	8	1%
Mid Central	46	7%
Nelson Marlborough	8	1%
Northland	9	1%
Otago	33	5%
South Canterbury	4	1%
Southland	8	1%
Tairawhiti	7	1%
Taranaki	9	1%
Waikato	119	17%
Wairarapa	8	1%
Waitemata	24	4%
West Coast	4	1%
Whanganui	2	0.3%
Private	21	3%

Imputability Assessment

It is necessary to understand the relationship between the reported event and transfusion. At the time of transfusion there are many factors contributing to the patient's physiological status, for example their underlying condition(s), concurrent treatment or medication. One, some or all of these may cause a reaction or other observable change in the patient.

Consideration is therefore given to the likelihood that a serious adverse event or reaction can be attributed to the blood component or product being transfused. NZBS assessment of *imputability* is based on the following CoE classification:

Table 3.14: Imputability Assessment Scale

Imputability Scale		Explanation
NA	Not assessable	When there is insufficient data for imputability assessment
0	Excluded	When there is conclusive evidence beyond reasonable doubts 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 blood or blood components
1	Possible	When the evidence is indeterminate for attributing the event either to the blood or blood components or alternative causes
2	Likely, probable	When the evidence is clearly in favour of attributing the event to the blood or blood components
3	Certain	When there is conclusive evidence beyond reasonable doubt for attributing the event to the blood or blood components

Of the specific events categories occurring during 2006 and subsequently described in this report, only TACO and TRALI events have imputability assessments associated with them. However routine assessment of imputability for all events is being introduced during the 2007 reporting year.

4

Non-Haemolytic Febrile Transfusion Reaction (NHFTR)

Definition

Non-haemolytic febrile transfusion reactions (NHFTR) are defined as mild, moderate, or severe dependent on the symptoms experienced by the patient:

- ***Mild febrile transfusion reaction***
  Fever ≤ 38.5°C or an increase of <1.5°C from pretransfusion value without any other symptoms, and not due to a haemolytic transfusion reaction (HTR) or bacterial infection.
- ***Moderate / severe febrile transfusion reaction***
  Fever ≥ 38.5°C or an increase of ≥1.5°C from pretransfusion value plus one or more of the following: chills, cold, rigor, headache or nausea / vomiting.

NHFTR account for 190/420 (45.2%) of events and were experienced by 184/385 (47.8%) recipients. These are the most common type of transfusion-related adverse event but are generally under-reported. Table 16 below categorises NHFTR cases by severity, either 'mild' or 'moderate / severe', as defined above.

Table 4.1: NHFTR Categorised According To Severity (n=190)

Type Of Event	No.
NHFTR – mild	67
NHFTR – moderate / severe	123

Profile Of Recipients Experiencing NHFTR

The number of NHFTR was similar for both female and males. The median age for both sexes was essentially the same although the older age groups predominate in this category with those 60 years or older accounting for 104/190 (54.7%) of events. Conversely the paediatric age group only accounted for 15/190 (7.9%) cases. The age and sex profile of recipients is shown in table 4.2.

Table 4.2: Age And Gender Profile Of Non-Haemolytic Febrile Transfusion Reactions (n=190)

Gender	No.	Median Age	Mean Age	Max	Min
Female	98	63.5	59.1	99	3
Male	92	63	57.9	92	4
All	**190**	**63**	**58.5**		

It was not always possible to clearly assign one specific event to a case report with a number of what were thought to be non-haemolytic febrile transfusion reactions accompanied by other types of event (as defined by the symptoms provided).

These are summarised in table 4.3 and in all cases the primary event was assumed to be the non-haemolytic febrile transfusion reactions.

Table 4.3: Other Events Reported Alongside NHFTR

Secondary Event	No.
Allergic reaction	6
Allergic reaction – possibly drug related	1
Allergic reaction / dyspnoea	1
Haemolysis associated with high titre anti-B	1
Hypertension	5
Hypotension	2
Dyspnoea	2
Possible anaphylactoid reaction / underlying sepsis	1
Hypertension / allergic symptoms / special requirements not met	1

5

Allergic Reaction

Definition

Allergic reactions are categorised according to the nature and severity of the symptoms observed in the recipient:

- ***Allergic reaction***
  One or more of the following: rash, allergic dyspnoea (stridor, cyanosis, wheezing), angioedema, generalised pruritis or urticaria, without hypotension during or within 24 hours of transfusion.
- ***Anaphylactoid / Anaphylactic reaction***
  An allergic reaction with hypotension (drop in systolic blood pressure by ≥ 30 mm Hg) during or within 24 hours of transfusion; or
- ***Shock** associated with blood transfusion without any signs of shock of other origin.*

Allergic reactions are the second most numerous category of events after NHFTR, accounting for 148/420 (35.2%) of events reported and 126 (32.7%) recipients. The table below further categorises the events according to severity, either 'allergic' reaction or `anaphylactic/anaphylactoid' reaction as defined above.

Table 5.1: Allergic Reactions (Categorised According To Severity)

Type Of Event	No.
Allergic reactions	137
Anaphylactic / anaphylactoid reaction	11

Profile Of Recipients Experiencing Events

The patients in this category of event were predominantly male (57%) compared with female (43%). The median age *for males is also higher, although in comparison to the NHFTR category the median ages are lo*wer overall for both males and females.

Table 5.2: Age And Gender Profile Of Allergic Reaction Cases (n=148)

Gender	No.	Median Age	Mean Age	Max Age	Min Age
Female	64	40	43.3	94	0 (1 day old)
Male	84	55.5	45.4	89	0 (3 months old)
All	**148**	**50**	**44.5**		

In a few cases an allergic reaction could not solely be assigned to the case report as additional symptoms suggested another coincidental event had also occurred.

Table 5.3: Other Events Reported Alongside Allergic Reactions

Secondary Event	No.
NHFTR	9
TACO	3
Hypertension	1

6

Incorrect Blood Component Transfused (IBCT)

Definition

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

A total of 22 IBCT events were reported. These events were experienced by 22 recipients and represent 5% of all events, an increase from 3.7% the previous year.

Table 6.1 details the types of IBCT event notified to NZBS during the year.

Table 6.1: IBCT Events Categorised By Type

Type Of Event	No.
ABO and/or Rh(D) compatible	1
ABO and/or Rh(D) incompatible	2
Anti-D	3
Inappropriate transfusion	10
Special requirements not met	6

Profile Of Recipients Experiencing Events

Although the number of males versus females for IBCT events is equal there are clear differences in both the median and mean ages between the sexes.

Table 6.2: Age And Gender Profile Of IBCT Cases (n=22)

Gender	No.	Median Age	Mean Age	Max	Min
Female	11	27	39.5	91	3
Male	11	58	54.2	79	1
All	**22**	**52**	**46.9**		

Site/Stage Of Primary Error

One of the parameters noted during the follow up of IBCT events is the location or stage within the transfusion process where the event occurred.

The location or stage of the transfusion process where the primary error or breakdown occurred is shown in table 6.3.

Table: 6.3: Site Of Primary Error

Site Of Error	No.
Prescription, sampling and request	7
Hospital blood bank / laboratory	9
Collection and administration	3
Supplying blood centre	3

International evidence shows that the bedside is the commonest site of failure in the transfusion process. However for the events reported to NZBS during 2006 the majority of failures were seen to occur in earlier steps in the process, namely at prescription sampling or requesting and in the blood bank or laboratory.

'Wrong Blood' Episodes

A transfusion represents the culmination of many interconnected steps with failure in any one (or more) having the potential to cause serious harm or even death of the recipient.

Transfusion of the 'wrong blood', whether this is a blood component intended for a different patient or a unit of the incorrect group (given to the correct patient), places the recipient at risk of a life-threatening haemolytic transfusion reaction. Yet these events, like most others, are preventable and indeed inexcusable.

Case 1: Laboratory Error Leading To ABO-Incompatible Transfusion

In the early hours of a weekday morning a 46-year-old female patient whose blood group was incorrectly entered into the national blood management computer system (Progesa) received an ABO-incompatible unit of red cells. The error was discovered approximately 18 hours later, when the blood bank was asked to provide another unit of red cells for the patient.

The patient did not have any historical immunohaematology results; accordingly the patient's sample was grouped twice to assign a confirmed blood group in accordance with ANZSBT Guidelines For Pretransfusion Testing. Since the sample was received out-of-hours both blood groups were performed by the same scientist, on separate aliquots of the original sample tested by different techniques. The results from both tests were also recorded on separate worksheets with the expectation that they would be entered independently into Progesa.

The primary blood group was correctly determined (and interpreted) as O Rh(D) positive but was not immediately entered into Progesa as the scientist was responsible for all laboratory testing out-of-hours and had to go and perform other laboratory testing for the patient.

Case 1 continued...

On returning to the blood bank the second group was performed prior to the release of blood. The scientist now entered both the primary and check groups into Progesa. The results were entered at the same time but unfortunately the second group had been misinterpreted as A Rh(D) positive and this was the group entered into Progesa against both tests. On this basis two units of A Rh(D) positive red cells were reserved (electronically crossmatched) for the patient.

Normally non-group O red cells would undergo an abbreviated serological crossmatch (immediate spin room temperature method) but for some reason this was omitted.

This physical, serological check would be expected to detect the incompatibility between the patient's (group O) sample and the chosen (group A) donor red cells.

The patient was subsequently transfused one of the reserved units. During the transfusion the patient reportedly experienced fever, chills and rigors, hypertension, tachycardia, nausea and vomitting although this information was not discovered until the blood bank alerted the patient's clinician on discovering the incompatible transfusion. The reported symptoms despite being noticed during the transfusion (and initially raised with the blood bank) were ultimately assumed to be associated with the patient's underlying condition and transfusion allowed to continue to its conclusion. The patient was however given promethazine and hydrocortisone presumably to relieve the observed symptoms.

When a request was received by blood bank for the second unit of red cells, routine pre-release checks revealed the earlier error. The event was then immediately reported to a NZBS Transfusion Medicine Specialist.

The patient apparently experienced no complications arising from this event and was discharged four days later having recovered with no ill effects.

Case 2: Transfusion Of Red Cells Intended For Another Patient

Mr Smith, a 58 year old male in the 'Post-Anaesthetic Care Unit' (PACU), received a unit of red cells that had been issued by blood bank to the Theatre/PACU blood refrigerator for Mr Jones. Fortunately the blood groups of both patients were the same and so there was no transfusion reaction (due to ABO-incompatibility).

Mr Smith was admitted to the busy PACU following surgery for a fractured femur. The patient's nurse was asked by the anaesthetist to check his haemoglobin which was found to be low. The anaesthetist requested that the patient receive two units of red cells.

The nurse rang blood bank to order some red cells but was told by the anaesthetist that there were already units in the OR/PACU blood refrigerator for Mr Smith. Because the PACU nurses were busy, a health care assistant (HCA) was sent to retrieve a unit of red cells from the refrigerator for Mr Smith. In doing so, the HCA was not given any patient identification, for example a patient ID sticker from the clinical notes, to check that the unit taken from the refrigerator was for the appropriate recipient.

As the red cells were being collected Mr Smith became unstable and his nurse and a colleague were actively engaged in dealing with this. The red cells arrived at the patient's bedside and bedside checks were performed by the two nurses and the unit transfused.

Case 2 continued...

The checking procedure consisted of:

- comparing the patient's wristband details with the details in the clinical notes
- checking the donation number of the unit with the compatibility label attached to the unit
- checking the expiry date of the unit; and
- checking the blood group of the unit was the same as recorded in the patient's notes

Unfortunately the unit of red cells was actually intended for Mr Jones, which apparently thorough checking failed to detect. As can be seen the checks used omitted a vital step namely a check of the patient's details recorded on the compatibility label (attached to the unit) against the patient's wristband.

The compatibility label from the transfused unit was subsequently stuck onto the blood administration sheet in the patient's notes, but it was not noticed that the name on the label was actually Mr Jones and not that of the recipient. This was discovered later when the label from the next transfused unit (this time correct) was stuck on the blood administration sheet.

Incidentally, the HCA when interviewed after the event was sure that the patient she was asked to collect blood for was Mr Jones and not Mr Smith.

As can be seen none of the checking procedures actually confirmed that the right person's blood was being given.

Because of inadequate checking at the final bedside check a patient received a unit of red cells intended for another patient. The red cells transfused were the same blood group as the recipient and so no reaction occurred.

What these two preceding cases show, and it cannot be over emphasised, is that the bedside check is vital for ensuring both that the correct patient is receiving transfusion and that the right blood product has been received. The bedside check represents the final opportunity to detect earlier error. However it is important to ensure that appropriate checking procedures are in place at all steps of the transfusion process.

The final example of a 'wrong blood' episode is the case of an Rh(D) negative female patient who inappropriately received a dose of Rh(D) positive platelets.

Case 3: Rh(D)-Incompatible Platelets

A 3 year old Rh(D) negative female requiring an urgent platelet transfusion was given Rh(D) positive platelets because no Rh(D) negative platelets were immediately available. Furthermore the patient's clinician was not advised that Rh(D) immunoglobulin should be administered.

The patient, a newly diagnosed leukaemic, required an urgent platelet transfusion because of a low platelet count in advance of surgery to insert a portacath. Initially given O Rh(D) negative platelets because her group was unknown, the patient's blood group was subsequently found to be A Rh(D) negative.

A second, urgent transfusion was required but because no Rh(D) negative platelets were immediately available Rh(D) positive platelets were given. NZBS policy requires that Rh(D) negative female recipients under the age of 55 should normally receive Rh(D) negative red cell or platelet components as a clinical priority.

Case 3 continued...

If these are unavailable and transfusion urgently required, Rh(D) products may be selected but only following authorisation by a NZBS Transfusion Medicine Specialist. The patient's clinician should also be advised that Rh(D) immunoglobulin should be considered. Clearly this policy was not observed by blood bank staff.

The event was discovered three days after the original transfusion when further platelets were requested. At this time the failure to give Rh(D) immunoglobulin was noted and a dose subsequently administered.

However, because of the delay in administering Rh(D) immunoglobulin the patient, a female with child-bearing potential, was put at risk of Rh(D) sensitisation.

Special Requirements Not Met

Table 6.4 summarises the individual events reported in this category.

Table: 6.4: Special Requirements Not Met

Special Requirement Not Met?	No.
CMV-negative platelets not provided	1
Irradiated components not provided	3
Patient required group O red cells as part of conditioning for stem-cell transplant but was given group A instead	1
Patient with paroxysmal cold haemoglobinuria did not receive warmed red cells as indicated	1

When a patient has special transfusion requirements the blood bank must be made aware of these. Any such requirements must be entered into the laboratory information system and at the point of issue must be observed.

Case 1: CMV-Unknown Platelets Given Because Computer Warning Overridden

Despite CMV-negative platelets being available a patient received a unit of platelets with unknown CMV status. The Progesa protocol and subsequent alert was overridden allowing the platelets to be issued.

Subsequent discussion with the patient's haematologist regarding the event and the requirement for CMV-negative components identified that CMV-negative platelets were not actually necessary. Reporting of the event was however valid since at the time of issuing the platelets a failure of the transfusion process had occurred, and in particular staff actions that were inappropriate.

Cases 2 / 3 / 4: Irradiated Products For Patients On Fludarabine

Patients being treated with fludarabine were found to have been transfused non-irradiated red cells.

In two of the three cases it appears that the issuing blood bank was neither informed of the treatment nor the requirement for irradiated products.

In the third case a patient with AML being treated with fludarabine received non-irradiated red cells despite there initially being a Progesa protocol in place. Apparently the protocol for irradiated components was inadvertently deleted by a blood bank staff member when entering a new protocol specifying antigen-negative red cells.

Case 5: Patient Being Conditioned For Stem Cell Transplant

A patient who was supposed to receive group O red cells from the start of conditioning prior to their stem cell transplant received group A red cells. The blood bank was informed of this requirement however relevant protocols were not entered into Progesa.

Case 6: Patient Required Warmed Red Cells

Patient experienced rapid haemolysis following transfusion, with their haemoglobin falling from 49 g/L to 6 g/L. The patient has paroxysmal cold haemoglobinuria with a positive Donath-Landsteiner test. The red cell units should have therefore been transfused through a blood-warmer but this was not done. Unfortunately the NZBS blood bank supplying the red cell units did not advise the receiving hospital blood bank accordingly.

Inappropriate Transfusion

In each of the events in this category a patient either received a transfusion that they did not need or received the wrong product (whether wrongly prescribed or incorrectly issued). The cause of each of the inappropriate transfusion events is described in table 6.5.

Table 6.5: Causes Of Inappropriate Transfusion

Cause Of Inappropriate Transfusion	No.
Patient transfused without check of Hb and post transfusion Hb found to be 171 g/L	1
Patient's pretransfusion sample expired, but units issued and transfused	2
Group A patient transfused group O platelets with high-titre anti-A,B	1
Platelets transfused despite prescribing doctor being informed that pretransfusion platelet count was incorrectly low (due to platelet aggregation in sample)	1
Patient transfused despite Hb of 139 g/L	1
Normal immunoglobulin issued by blood bank, instead of the requested zoster immunoglobulin. Missed by all checks and subsequently transfused	1
Red cells transfused after being stored in un-monitored ward refrigerator	1
Irradiated red cell unit transfused although expired. Product had not been modified in Progesa so original 35-day expiry in place instead of reduced post-irradiation expiry	1
Albumin prescribed but nurse requested FFP from blood bank which was then transfused	1

Appropriate and timely transfusion of the right patient requires that a number of steps are followed with due care and attention to detail. It requires accurate laboratory results on which to base the decision to transfuse, prescription of the correct blood product based on relevant guidelines, issue of the correct blood product by the blood bank and selection by the ward of the blood product for the correct patient.

In each of the cases described inherent safeguards which may have prevented the event from happening obviously failed, were overlooked or simply ignored exposing the patient to unnecessary risk.

Anti-D Related Events

It is important that Rh(D) immunoglobulin is given appropriately and in a timely manner. Clearly if a patient is Rh(D) positive or has preformed alloimmune anti-D then an injection of Rh(D) immunoglobulin is not required.

In each of the three reported cases an Rh(D) positive women received an injection of Rh(D) immunoglobulin which was deemed to be inappropriate. In all instances there was information available to the hospital blood bank that the patient was Rh(D) positive but this was either overlooked (in error) or the patient's clinician insisted that the patient's group was Rh(D) negative based on information available to them and requested immunoglobulin accordingly.

Table 6.6 shows the reported incidence of events associated with recipients of Rh(D) immunoglobulin.

Table 6.6: Incidence Of Events Associated With Anti-D

No. Anti-D Recipients	No. Events	Incidence
6409	3	1:2136

When Rh(D) immunoglobulin is given inappropriately this may appear to be of minor consequence to the recipient but it in fact exposes them to an unnecessary risk.

The decision to administer Rh(D) immunoglobulin should be made in the knowledge that the patient is Rh(D) negative, although this is not always so. The Rh(D) typing results available to the clinician may come from the hospital blood bank or from a community laboratory (for example following antenatal testing). Furthermore, community laboratory results are often not available to the hospital blood bank.

Patients may occasionally receive Rh(D) immunoglobulin when it is not clinically indicated. This usually occurs due to decisions being made based on hearsay information without access to laboratory reports. In some cases the situation is confounded by conflicting results from different laboratories. These discrepancies may happen for a number of reasons, for example testing failures, differences in the performance characteristics of typing antisera and differences between testing methodologies used by the hospital blood bank and community laboratory, particularly in cases where the patient has a weakened or variant form of the Rh(D) antigen.

NZBS has recently produced guidelines for laboratories on the reporting of anomalous Rh(D) typing results and these should reduce the likelihood of similar events occurring in the future.

7

Delayed Haemolytic Transfusion Reaction

Definition

Delayed haemolytic reaction due to the development of red cell antibodies with evidence of positive direct antiglobulin test or evidence of haemolysis.

A total of 10 delayed haemolytic reactions were reported during 2006 accounting for 2.4% of events.

Profile Of Recipients Experiencing Events

The age and sex profile of recipients is shown in table 7.1.

Table 7.1: Age And Gender Profile Of DHTR Cases (n=10)

Gender	No.	Median Age	Mean Age	Max	Min
Female	4	71.5	71	80	61
Male	6	81.5	74.8	90	47
All	**10**	**77**	**73.3**		

Delayed Haemolytic Transfusion Reactions

Delayed haemolytic transfusion reactions are generally the result of an anamnestic response to a previously stimulated antibody which has subsequently diminished to undetectable levels. Most often the patient has been immunised by previous transfusion or pregnancy. Antibodies in the Kidd system (anti-Jk^a and anti-Jk^b) are typically, though not exclusively, responsible for this type of reaction.

Transfusion of antigen-positive red cells causes the secondary stimulation of IgG antibodies that react with the transfused red cells resulting in a positive direct antiglobulin test (DAT). The DAT will remain positive until all the incompatible transfused red cells have been removed from the circulation. In some cases the causative antibody may only be present on the red cells and not in the plasma, with the positive DAT the only evidence of antibody.

In most cases of delayed reaction there is no evidence of haemolysis, although typically the patient will present with a drop in haemoglobin and mild jaundice. In some cases there is not the anticipated increment in haemoglobin post transfusion.

In the cases described, occurrence of a DHTR was suggested by the finding of an unexpected positive antibody screen (or new antibody) and/or a positive direct antiglobulin test in a new pretransfusion sample tested between 2 and 55 days following a previous transfusion. In all but one case the implicated antibody was found in an eluate made from the patient's red cells.

As can be seen in table 7.2 several antibody specificities were reported to have been stimulated post transfusion although clearly not all of these are implicated as the cause of DHTR. Not unexpectedly 4/10 cases of DHTR were due to Kidd system antibodies, either anti-Jk^a (3/10) or anti-Jk^b (1/10). The remaining implicated antibodies were as follows: anti-C, -Fy^b, -K, -Fy^a, - and -s.

Only two of the patients reported as having a DHTR presented with clear symptoms of a haemolytic episode. The remaining events were detected when testing a subsequent pretransfusion sample.

Table 7.2: Findings Associated With DHTR

Case	Antibody Screen Results		DAT	Eluted Antibody	Comments	Days Post Transfusion
	Pretransfusion	Post Transfusion				
1	Negative	Positive (anti-s)	Positive	Anti-s	↓ Hb; historical anti-E, - K, -C^W	6
2	Negative	Positive (anti-Jk^a)	Positive	Anti-Jk^a		2
3	Negative	Positive (anti-C, -K, -Fy^b, -E)	Positive	Anti-C, -Fy^b	↓ Hb / ↑ reticulocytes / ↑ bilirubin / ↓ haptoglobin / ↑ creatinine / spherocytes	21
4	Negative	Positive (anti-K)	Positive	Anti-K	One of transfused units reported to be K+	31
5	Negative	Positive (anti-Jk^a)	Positive		Unclear if DHTR but haemoglobinuria seen; eluate not done as DAT positive due to complement only (IgG not detected)	9
6	Negative	Positive (anti-Jk^a)	Positive	Anti-Jk^a		4
7	Negative	Positive (anti-Ch^a/Rg^a)	Positive	Anti-Fy^a		25
8	Positive (anti-E)	Positive (anti-E + Fy^a)	Positive	Anti-Fy^a		55
9	Negative	Positive (anti-Jk^a)	Positive	Anti-Jk^a	↑ urobilinogen; also unidentified antibody post-transfusion	8
10	Negative	Positive (anti-Jk^b)	Positive	Anti-Jk^b	↑ LDH / ↑ bilirubin / ↔ haptoglobin	10

8

Transfusion-Associated Circulatory Overload (TACO)

Definition

TACO is characterised by respiratory distress, tachycardia and increased blood pressure within 12 hours of completion of the transfusion. Diagnosis is supported by typical signs of cardiogenic pulmonary oedema in the chest x-ray and a positive fluid balance and/or a known compromised cardiac status. TACO is especially a risk in transfusion of patients with low body weight, the elderly, infants/children and those with histories of cardiac, respiratory or renal insufficiency or chronic anaemia.

7 cases of TACO were reported during 2006 accounting for 1.7% of events.

Profile Of Recipients Experiencing Events

Of the recipients 4/7 were aged 60 years or older, with the others 37, 53 and 55 respectively.

Table 8.1: Age And Gender Profile Of TACO Cases (n=7)

Gender	No.	Median Age	Mean Age	Max	Min
Female	5	55	58.8	81	37
Male	2	64.5	64.5	66	63
All	**7**	**63**	**60.4**		

Imputability Assessment And Patient Outcome

An imputability score and associated patient outcome were assigned to the reported TACO events and these are shown in table 8.2.

Table 8.2: Imputability Assessment Of TACO Cases

Imputability	No.	Patient Outcome	Comment
Unknown	1	Not recorded	
1	4	3 patients recovered no ill effects 1 patient recovering at time of initial report.	Final outcome not recorded. Complex case: possible underlying C1-esterase deficiency, rare example worsening with FFP. Exhibited fluid overload (but oedema not generalised)
2	1	Patient recovering at time of initial report.	Final outcome not recorded
3	1	Patient recovered no ill effects	

9

Transfusion-Related Acute Lung Injury (TRALI)

Definition

Transfusion-Related Acute Lung Injury (TRALI) is characterised by acute respiratory distress and non-cardiogenic lung oedema developing during or within 6 hours of transfusion and which is not temporally related to another cause of acute lung injury (ALI).

The diagnosis of TRALI is a clinical and radiographic diagnosis and is not dependent on the results of laboratory tests or any proposed pathophysiologic mechanisms. TRALI should be considered a clinical syndrome rather than a disease with single cause.

A consensus definition of TRALI was developed at a conference in Canada in April 2004 and subsequently reported in the transfusion literature (5). The definition used by NZBS is consistent with this.

10 cases of TRALI were reported representing 2.4% of events. TRALI is a significant transfusion-related event and undoubtedly poorly recognised and under-reported. The UK SHOT programme has consistently identified TRALI as one of the most common causes of fatal transfusion reactions.

Profile Of Recipients Experiencing Events

The age and gender profile of the reported TRALI cases is as shown in table 9.1.

Table 9.1: Age And Gender Profile Of TRALI Cases (n=10)

Gender	No.	Median Age	Mean Age	Max	Min
Female	4	46	52.5	79	39
Male	6	55	50.7	72	12
All	**10**	**52**	**51.4**		

Imputability Assessment And Patient Outcome

An imputability score and associated patient outcome were assigned to the reported TRALI events and these are shown in table 9.2.

Table 9.2: Imputability Assessment Of TRALI Cases

Imputability	No.	Patient Outcome
Unknown	5	One patient outcome not recorded Two patients recovered no ill effects Two patients recovered with continuing ill effects
1	2	One patient recovered no ill effects One patient recovered continuing ill effects
2	1	One patient recovered no ill effects
3	2	One patient recovered no ill effect One patient died probably related to transfusion

Testing Of Donors Implicated In TRALI Events

One proposed mechanism for TRALI is the interaction between donor white cell (HLA) or neutrophil (HNA) antibodies and the recipient's white cells.

NZBS has introduced a standard national procedure for investigating TRALI events. Where available, samples from the recipient and implicated donor(s) are sent to the NZBS Tissue Typing Laboratory for further investigation including HLA and HNA antibody testing and a crossmatch between donor serum and recipient white cells.

In a review of TRALI investigations performed by the NZBS Tissue Typing Laboratory during the period mid-2004 to late-2006 (and which included 4 of the 2006 cases described in this report) it was noted that in 12/14 cases HLA antibodies were present in one or more donors implicated in the event. Only 1 donor, however, was found to be positive for HNA antibody (along with coexisting HLA antibodies).

Finally, of the 25 individual donors who were found to have HLA antibodies, 21/25 were female. Furthermore, in 2 of these female donors the identified HLA antibodies were specific for one or more of the HLA antigens expressed by their respective recipients.

Male-Only Fresh Frozen Plasma

A number of countries have introduced a strategy for reducing the frequency of TRALI involving the use of FFP manufactured from plasma collected only from male donors. Female donors and in particular multiparous women often have HLA antibodies. The use of male-only donors for FFP may therefore reduce the incidence of TRALI.

NZBS has undertaken a feasibility study for implementing a male-only FFP programme. A system for implementation of this is currently being developed.

10

Acute Haemolytic Transfusion Reaction

Definition

A reaction occurring at any time up to 24 hours following a transfusion of blood or blood components, excluding cases of acute reactions due to an incorrect component being transfused. The major concern in evaluating these is exclusion of bacterial contamination of the component or haemolysis due to incompatible red cells.

Profile Of Recipients Experiencing Events

There were two recipients who reportedly experienced acute haemolytic reactions. Both were male and aged 17 and 53 years old respectively.

Case 1

Following transfusion the patient experienced a fall in haemoglobin from 84 g/L to 59 g/L, along with a positive DAT (IgG and C3d). Patient is group B and had received group O platelets. An eluate from the patient's red cells showed anti-B specificity.

Case 2

A group A patient received group O platelets. Although there was no laboratory evidence of haemolysis the patient's haemoglobin fell from 94 g/L to 82 g/L. Group A red cell units crossmatched using the patient's plasma were incompatible due to passively acquired anti-A from the plasma of the transfused platelets. An eluate of the patient's red cells showed anti-A1 specificity.

11

Transfusion-Transmitted Infections

Definition

Transfusion-transmitted infections (TTI) are classified as clinically suspected, possible or confirmed:

Infection clinically suspected

If within 4 hours of transfusion the patient experiences:

- *fever ≥ 38.5°C or a change of ≥ 1.5°C from pretransfusion value and*
- rigors and
- *tachycardia ≥ 120 beats / min or a change of ≥ 40 beats / min from pretransfusion value or a rise or drop of 30 mm Hg in systolic blood pressure*

Possible infection

A clinically suspected infection supported by:

- *the detection of bacteria in the transfused blood product but no positive blood culture; or*
- *a positive blood culture but no detectable bacteria in the transfused blood product if the blood culture is in a timely manner with the transfusion and no other reasons are ascertainable for the positive blood culture*

Confirmed infection

Detection of the same bacterial strain in both the recipient's blood and transfused blood component / product (using approved techniques).

No transfusion-transmitted bacterial infections were reported to NZBS during 2006.

12

Other Types Of Reaction

The final category of transfusion-related adverse events is 'other types of reaction'. These are cases which do not clearly fit into categories already described. In this category 27 events were reported and are described in table 12.1.

Table 12.1: Types Of Event Classified As 'Other Types Of Reaction'

Type Of Event	No.
Abdominal pain / vomiting	1
Chills / tachycardia / slight shortness of breath	1
DAT positive red cells after platelet transfusion	1
Dyspnoea	5
Feeling hot / flushed / sweating / increased shortness of breath / severe thoracic back pain	1
Hypertension	4
Hypertension / dry retching	1
Hypertension / tachycardia	2
Hypertension / unexplained nausea	1
Hypoglycaemia	1
Hypotension	6
Hypotension - possibly due to beta blockers	1
Hypotension - possibly related to ACE inhibitor	1
Tachycardia	1

Profile Of Recipients Experiencing Events

The age and gender profile of the recipients experiencing 'other types of reaction' patients is shown in table 12.2.

Table 12.2: Age And Gender Profile For 'Other Types Of Reaction' Cases (n=16)

Gender	No.	Median Age	Mean Age	Max	Min
Female	11	64	59.2	83	13
Male	16	71.5	59.2	91	2
All	**27**	**65**	**59.2**		

Not included in the above figures are four events categorised as equipment-related and component-related events:

Equipment related

- Infusion pump and giving set used without filter
- Haemoglobinuria during cardiac bypass

Component related

- *Bacterial contamination of washed red cell unit*
  The pre-wash sample from the implicated unit was negative but the organism Ochrobactrum anthropi was reported in the post-wash sample.

  The patient was intubated in ICU, on antibiotics, and no additional treatment was required. There were no apparent side effects from transfusion and the organism was not demonstrated in the patient (patient cultured and found negative).

  It was therefore suspected that contamintion of the laboratory sample had occurred.

- *Confusion over product being transfused*
  A neonate was prescribed both platelets and cryoprecipitate. However two doses of cryoprecipitate were subsequently transfused.

  The ward requested and received a unit of cryoprecipitate. On receipt there was confusion over the nature of the product. It appears that the cryoprecipitate was mistakenly identified as platelets and transfused as if it were platelets based on this assumption. In the belief that the prescribed platelets had been given a unit of cryoprecipitate was then requested and subsequently transfused.

13

Adverse Reactions In Donors

NZBS takes the well being of its donors very seriously. A key aspect of this is monitoring the occurrence of adverse reactions during the donation process.

Adverse reactions are either observed during donation by collection staff or reported to the collection centre by the donor after they have left the collection venue.

Initial care and advice to the donor as well as follow-up of the reaction is provided by a Registered Nurse. A Medical Officer reviews the adverse reaction report and provides clinical advice and support if required.

Reports are entered into the NZBS electronic quality reporting system (Q-Pulse®) and statistics are collated by individual NZBS sites and on a national basis. The following categories of adverse reactions are currently used by NZBS:

- Faints
- Soft tissue/tendon damage (including bruises and haematomas)
- Arterial puncture
- Nerve damage
- Thrombophlebitis
- Injury (occurring as the result of an accident at the session, or in the vicinity of the session, or otherwise related to donation and may include, for example, a fall resulting in head injury or a car accident)
- Medical/fits (including symptoms and/or signs not otherwise differentiated such as a fit, stroke or a suspected myocardial infarct)
- Other events (including skin infections and allergic reactions)

Events are not currently graded according to severity nor are they differentiated as to whether they occur during automated procedures or during manual whole blood collection. This aspect of data collection is presently under review and awaits internationally standardised definitions for both the types of event and assessment of severity.

Types Of Donor Adverse Reactions Reported

During 2006 there were 651 adverse reactions reported in donors, from the total of 169979 donations collected. This represents an overall risk of 0.38% or 1:261 donations bled.

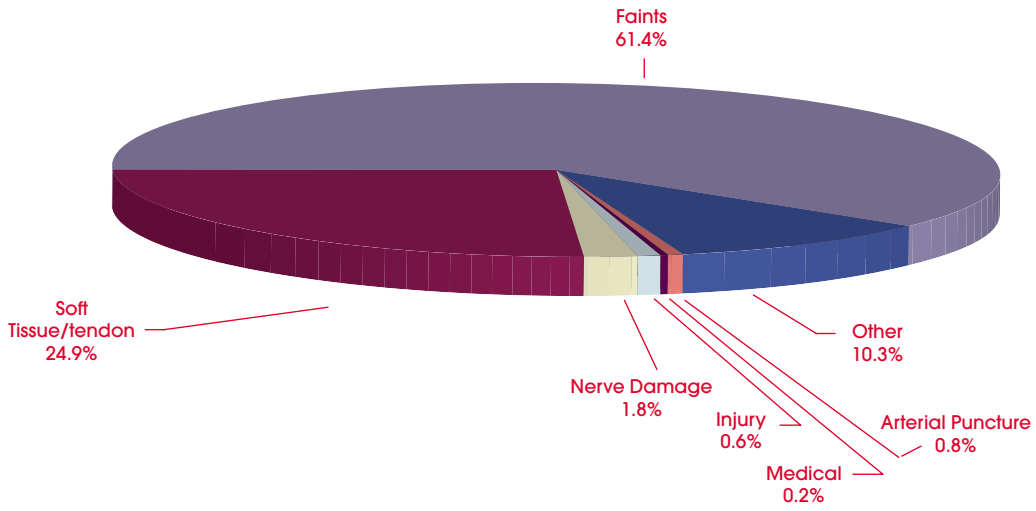
Table 13.1 shows the total numbers of each type of donor adverse reactions:

Table 13.1: Total Number Of Donor Adverse Reactions Reported

Nature of reaction	No.	Frequency	Per 100,000 Donations
Faints	400	1:425	235
Soft tissue / tendon	162	1:1049	95
Other	67	1:2537	39
Nerve damage	12	1:14165	7
Arterial puncture	5	1:33996	3
Injury	4	1:42495	2
Medical	1	1:169979	1
All	**651**	**1:261**	**383**

Faints and soft tissue reactions are the two most frequently reported events, between them accounting for 86% of the total.

Chart 13.1: Percentage Distribution Of Adverse Reactions In Donors (n=651)



14

Donor Infectious Disease Screening

Donor epidemiological data relating to the number of donations that are confirmed positive for Hepatitis B, C and HIV is collected nationally by NZBS.

This data is also reported annually to CSL Bioplasma (the plasma fractionator) as part of the regulatory process associated with manufacturing human-derived plasma products, and in particular to meet the scientific data requirements for the plasma master file (PMF) (6). The data for 2006 is shown in table 14.1.

Table 14.1: Blood Donor Epidemiological Data

Regular Donors [a]	**HBsAg**	**HIV 1/2**	**HCV**
Number of donations screened	149113	149113	149113
Number of positive donations [b]	2	1	3
% Positive donations	0.001	0.001	0.002
Frequency of positive donations	**1:74557**	**1:149113**	**1:49704**
New Donors			
Number of donations screened	22955	22955	22955
Number of positive donations	45	2	26
% Positive donations from new donors	0.196	0.009	0.113
Frequency of positive donations	**1:510**	**1:11478**	**1:883**
All Donors			
Number of donations screened	172068	172068	172068
Number of positive donations	47	3	29
% Positive donations	0.027	0.002	0.017
Frequency of positive donations	**1:3661**	**1:57356**	**1:5933**

Notes

(a) A regular donor is defined as one who has previously undergone serological testing (following donation) with a negative result.

(b) When a donor who has previously donated is found to have a confirmed positive result an extensive look-back process is initiated to investigate previous donations.

15

Adverse Reactions To Plasma Derivatives

Adverse reactions to plasma derivatives are reported to the manufacturer, which for most products is CSL Bioplasma, which acts as the fractionator for NZBS. Events are also reported to the New Zealand regulator Medsafe.

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

- Albumex® (4 and 20)
- Intragam® P
- Biostate®
- MonoFIX™
- Thrombotrol®
- Prothrombinex™
- Fibrogammin P
- Hepatitis B Immunoglobulin
- Rh(D) Immunoglobulin
- Normal Immunoglobulin
- Tetanus Immunoglobulin
- Zoster Immunoglobulin

During 2006, CSL Bioplasma supplied the Cangene product WinRho-SDF to meet the demand for Rh(D) Immunoglobulin by New Zealand patients. Other products that are supplied by NZBS include the commercial products, Hyper HepB, Berinert P and Fibrogammin.

Events associated with fractionated products are notified to NZBS using the NZBS *Notification of adverse reaction to a fractionated product form* (7).

During 2006 there were 20 cases of adverse reactions to fractionated blood products an increase from the 16 reactions reported in 2005.

Table 15.1: Products Implicated in Adverse Reactions To Fractionated Blood Products

Implicated Product	No.
Albumex® 20	1
Biostate®	2
Intragam® P	13
Prothrombinex™-HT	1
Tetanus Immunoglobulin	1
WinRho SDF™	2

Each event is assessed for outcome causality and seriousness according to the following criteria (which are based on international terminology used by both CSL and other manufacturers for pharmacovigilance reporting):

Table 15.2: Outcome, Causality And Seriousness Criteria

Outcome	Causality	Seriousness
Recovered	Certain	Life threatening
Not yet recovered	Probable	Causes hospitalisation (or prolonging of existing hospitalisation)
Unknown	Possible	Causes significant disability/incapacity
Fatal	Unknown	
Congenital abnormality/birth defect	Not related	

A description of each of the 2006 events can be found in table 15.3.

Table 15.3: Adverse Events Due To Plasma Derivatives

Blood Product	Case #	Gender	Age (yrs)	Condition	Event	Outcome	Causality	Serious
Albumex® 20	2006/5	F	2	Congenital nephrotic syndrome	Septicaemia, hypotension, impaired circulation and altered level of consciousness during Albumex® 20 infusion. Event assessed as central line sepsis unrelated to transfusion.	Recovered	Unknown	No
Biostate®	2006/1	F	41	Von Willebrand Disease	Possible angina during infusion. Patient being treated with both desmopressin (abandoned because of an adverse reaction) and then Biostate®.	Recovered	Possible	No
	2006/2	F	55	Haemophilia A	Urticarial reaction 30 min after infusion (second reaction in recipient). Reaction settled slowly over 2-3 hours.	Recovered	Probable	No
Intragam® P	2006/4	M	32	Common variable hypogammaglobulinaemia (b)	Macular rash during infusion. Patient has had four sporadic allergic-type reactions following Intragam® P in previous 5 years.	Recovered	Probable	No
	2006/7	F	11	Intractable epilepsy (b)	Itchy, swollen and red right palm together with itching soles of feet.	Recovered	Possible	No
	2006/8				Itching of hands during infusion. Fourth similar reaction in this patient.	Recovered	Possible	No
	2006/9	M	37	Guillain Barré syndrome (b)	Single episode of headache, nausea and vomiting. Event related in time to infusion but probably an unrelated event.	Recovered	Possible	No
	2006/10	M	60	Hypogammaglobulinaemia	Left sided swelling of neck with discomfort, difficulty swallowing and shortness of breath. Subsequent treatment given with antihistamine / hydrocortisone prophylaxis without adverse effects.	Recovered	Probable	No
	2006/12	F	33	Pregnant with a past history of fetal alloimmune thrombocytopenia (b)	Probable aseptic meningitis with severe headache and photophobia lasting 3 days during a rapid high dose infusion of Intragam® P.	Recovered	Certain	No
	2006/13	M	50	Polyneuropathy (b)	Widespread allergic rash with blistering during second course of treatment.	Recovered	Probable	No

Table 15.3: Adverse Events Plasma Derivatives continued

Blood Product	Case #	Gender	Age (yrs)	Condition	Event	Outcome	Causality	Serious
Intragam® P *continued*	2006/14	M	61	Allergic/inflammatory [b]	History of frequent unreported febrile reactions associated with Intragam® P. This reaction more severe than usual, including a rigor, severe aching in legs and other joints. Symptoms settled the following day.	Recovered	Probable	No
	2006/15	F	35	Hypogammaglobulinaemia [b]	Abdominal pain after Intragam® P , later right-sided neck swelling, itching and erythema of hands and feet and swelling of feet. Patient often feels mildly unwell for 24 hours after Intragam® P.	Recovered	Probable	No
	2006/16	M	94	Chronic inflammatory demyelinating polyneuropathy	Haemolysis after Intragam® P (2g/kg) Haemoglobin fell from 122 g/L to 97 g/L. Anti-A eluted from patient's red cells.	?	Probable	No
	2006/17	M	49	Hypogammaglobulinaemia	Angina shortly after start of infusion, no evidence of infarction. Subsequent infusions uneventful. Been receiving Intragam / Intragam P® for hypogammaglobulinaemia for approximately 10 years.	Recovered	Possible	Yes
	2006/19	M	79	Demyelinating polyneuropathy [b]	Allergic skin rash 3 weeks after the first course (2g/kg) Settled slowly on prednisone medication.	Recovered	Probable	No
	2006/20				Second event for patient. Patient challenged with Intragam® P to evaluate cause of allergic reaction as had shown good improvement in the neuropathy but subsequently relapsed. The challenge resulted in an immediate reaction, further treatment discontinued.	Recovered [c]	Probable	No

Table 15.3: Adverse Events Plasma Derivatives continued

Blood Product	Case #	Gender	Age (yrs)	Condition	Event	Outcome	Causality	Serious
Prothrombinex™-HT	2006/6	M	74	Intracerebral haemorrhage in a warfarinised patient (b)	Treated with Prothrombinex™-HT, FFP and vitamin K with further Prothrombinex™-HT 24 hrs later. Subsequently developed pulmonary emboli, cerebral and myocardial infarcts, and possible renal ischaemia.	Not yet recovered (a)	Probable	Yes
Tetanus Immunoglobulin	2006/2	M	66	Prophylaxis of a contaminated wound	Localised erythematous / allergic rash settling over 18 hours with antihistamine treatment.	Recovered	Probable	No
WinRho SDF™	2006/11	F	40	Rh(D) prophylaxis	Allergic reaction with extensive papular, itchy rash lasting 34 days injection.	Recovered	Possible	No
	2006/18	F	32	Rh(D) prophylaxis	After injection in left thigh patient developed shooting pain into head and neck, later complaining of tingling in the right face and right eye, with right arm weakness. Symptoms resolved over several hours.	Recovered	Unknown	No

Notes

(a) Outcome of 'Not yet recovered' applies only to the last point of contact with the event's reporter. Limited resources and lack of responses from reporters means that information is often incomplete.

(b) Patient received two different batches of product during infusion episode

(c) Patient's clinical notes lost but it is inferred that the patient recovered in absence of information to the contrary

16

Other Haemovigilance-Associated Activities

DHB Clinical Oversight Programme

The NZBS *DHB Clinical Oversight Programme* provides the DHBs with specialist transfusion medicine support (both clinical and technical) in line with the requirements of NZS/ISO 15189:2003 '*Medical Laboratories - Particular requirements for quality and competence*' (8).

The programme's key activities also provide assistance in implementing strategies to enhance transfusion medicine knowledge and best practice and efficient utilisation of blood products. The four elements of the programme are as follows:

- **Clinical Audit Of DHB Transfusion Policies And Procedures**
  One clinical audit every two years of hospitals where transfusions are carried out, encompassing blood product storage and refrigeration, informed consent, dispensing systems and clinical records documenting transfusion and traceability.
- **Site Visits**
  One formal site visit per year (to non-NZBS) blood banks or laboratories where pretransfusion testing is performed) intended as a collaborative review of systems and processes to promote best practice. Wherever possible an NZBS TMS will also attend DHB HTC meetings or education sessions e.g. grand rounds. 24 hour 7 day access to a clinical advice is available via the NZBS TMS on-call roster.
- **Regional Meetings/Seminars**
  Three 'customer focussed' meetings per year are held by each of the four main NZBS centres (Auckland, Waikato, Wellington and Christchurch). These regional meetings and/or seminars are intended to supplement the site visit programme.
- **Education**
  Developing and maintaining appropriate educational and training resources.

The programme is now well established with all DHBs opting to participate. A total of 22 hospitals received one (or more) site visits from an NZBS TMS and/or senior scientist during the year. In addition the NZBS Quality Systems team performed clinical audits at 10 hospitals. Finally regional meetings were hosted by the four main NZBS centres (Auckland, Waikato, Wellington and Christchurch).

Clinical Audits

As well as supplying blood components and products, NZBS also operates six of the country's largest blood banks and is the only organisation in New Zealand to manage so many blood banks. This environment lends itself to audit of clinical transfusion practice. In addition, because the DHBs are charged for blood products, on a cost recovery basis, the DHBs are motivated to understand their demand of blood components and products and they have been supportive of audit work.

NZBS employs six Transfusion Nurse Specialists (TNS), one situated in each of its blood banks. Agreements are in place between NZBS and each of the six DHBs covering the TNS role, in effect, double-badging the TNSs as DHB employees. The TNSs have a high visibility and credibility within the DHBs based on their educator, liaison and change management functions.

Because transfusions are not without risks, and because blood is a precious gift, it is important to ensure that transfusions are given appropriately. Each year one or more collective audits involving these DHBs and, in some cases, other DHBs, are undertaken by the TNSs, co-ordinated by a NZBS TMS, on different aspects of transfusion medicine. In addition local audits are undertaken, some of which act as pilots for the larger collective audits. These audits take place as part of a more general service of demand management, including monthly blood utilisation reports and retrospective data analyses.

In 2006 an audit of FFP use, involving over 900 units of FFP, was conducted at the six DHB blood banks managed by NZBS along with the blood bank at Counties Manukau DHB. The report from this audit is currently with the hospital transfusion committees for comment and will be circulated to the CEO and Demand Management contacts of all 21 DHBs.

The partnership between NZBS and the DHBs has enabled the audit process to provide useful insights into blood product use within New Zealand. This has, to a large extent, reassured clinicians and managers of the appropriateness of use and helped concentrate improvement in areas shown to have problems.

Table 16.1 summarises the clinical audits performed by NZBS along with key findings, recommendations and outcomes.

Table 16.1: Summary Of NZBS Audits

Audit Topic	Findings	Recommendations And Outcomes
Overnight Transfusions	• 15% of overnight transfusions could have waited until the following day • Nursing care more problematic outside of routine working hours • Frequency of overnight transfusion lower in those hospitals that had clear policies on this issue	• Overnight transfusions should be restricted to clinically necessary cases • This issue must be addressed in DHB Policy documents • Hospitals policies implemented discouraging overnight transfusions
Use of Cryoprecipitate	• 82% of episodes deemed clinically appropriate • 24% of episodes involved under-dosage by at least 50% of recommended dose • Low dosage associated with increased likelihood of further transfusion • 27% of non recipients, where fibrinogen <1 g/L, would have benefited from treatment.	• Increased awareness of recommended dose • Blood Banks request weight of patient prior to issue to ensure appropriate dose is provided. • Rise in use by DHBs shown to have been underdosing
Use of Irradiated Blood Components	• 22% of recipients who should have received irradiated components received at least one non-irradiated component • 100% compliance where a Progesa protocol for irradiation was in place • Significant debate on appropriateness of irradiation for certain clinical conditions included in Australasian Guidelines.	• Progesa protocols should be developed for 'at-risk' patients • Links between blood banks and hospital pharmacies for Fludarabine prescriptions • reminders included in some chemo protocols
Use of Intravenous Immunoglobulin (IVIG)	• 81% of requests conformed to Australasian standards • The use of more rigorous guidelines may potentially reduce use by up to 10%	• Development of a pre-approval form for access to IVIG • Consideration of the establishment of a peer-review process for 'non standard' requests • 27% reduction in use of IVIG in one hospital

Table 16.1: Summary Of NZBS Audits continued

Audit Topic	Findings	Recommendations And Outcomes
Use Of Platelet Concentrates	• 87% of observed episodes deemed clinically appropriate • 44% of platelets were transfused in prophylactic settings, 84% of which conformed to guidelines • Increment twice as high for ABO compatible platelets as compared to ABO incompatible transfusions • 11% transfusions involved 'double' adult doses, a proportion of which were inappropriate	• Requirement to improve education of clinicians in relation to: - the correct dose of platelets - triggers for platelet transfusion in accordance with international guidelines - the value of anti-fibrinolytics such as tranexamic acid as an adjunct therapy in bleeding patients
Use of Fresh Frozen Plasma (FFP)	• Audit commenced in 2006	• Report with Hospital Transfusion Committees for review

17

Bacterial Monitoring Of Platelet Concentrates

Bacterial Monitoring Of Platelet Concentrates

Bacterial contamination may occur in any fresh blood component and is a well recognised complication of transfusion. However, it is most often demonstrated in platelet products due to the storage temperature of 22°C ± 2°C. Potential sources of contamination include donor skin, donor bacteraemia, faulty blood collection or contamination during blood processing.

The reported rate for bacterial contamination of platelet concentrates varies widely across studies but averages approximately 1 in 2000. In comparison the reported fatality rate is within the range of 1 in 50,000 to 1 in 500,000 platelet concentrates transfused. For platelet transfusions in particular it is the most commonly reported cause of mortality and morbidity arising from transfusion-transmitted infections (TTI).

Requirements to reduce this risk have been established by several international authorities. A new standard requiring the implementation of systems to reduce and detect bacterial contamination in platelet concentrates was introduced by the AABB in March 2004. Guidelines for the microbiological safety of blood components and possible approaches for monitoring bacterial contamination have been outlined by the Council of Europe.

The organisms detected are usually aerobic and those most frequently implicated in clinical cases of transfusion-associated sepsis include *Staphylococcus, Streptococcus, Bacillus cereus, E. coli, Salmonella* and *Serratia*.

A variety of potential strategies to reduce bacterial contamination are used by NZBS. These include detailed donor screening with deferral of those identified to be at risk of bacteraemia, augmented disinfection of the venepuncture site to reduce the entry of skin flora into the unit and diversion of the first 10-40 mL of blood collected prior to collection of the unit. This latter approach has been shown to significantly reduce the rate of bacteria contamination and has been used by NZBS since 2002.

A number of pathogen inactivation methods involving photochemical treatment of blood components are also under development. These have an ability to destroy both bacteria and viruses.

To determine the contamination rate of platelet concentrates in New Zealand, testing using the BacT/ALERT microbial detection system was introduced in April 2004. Samples are taken from platelet concentrates on day 2 post collection (day of collection = day 0). Samples are obtained from both platelet pools (manufactured from the buffy coats harvested from four whole blood donations) and apheresis platelets. In the case of apheresis platelets, which are generally split into two bags, only one of the pair was tested.

12 mL of platelet concentrate is sampled into a pouch from which 6 mL is inoculated into an aerobic culture bottle and incubated in the BacT/ALERT 240 instrument. The bottle remains in the incubator for 7 days unless flagged as positive. The remaining 6 mL of platelet concentrate is retained for follow-up testing in the event of a positive result being obtained.

Any platelet doses sampled on day 2 that had not been transfused by day 5 are held until day 7 and re-tested using the same method. The incubation period for day 7 samples is 24 hours.

Initially positive tests are further investigated and all components associated with the positive sample traced and those not already transfused placed into quarantine. Samples of the implicated components are sent to an accredited microbiology laboratory for confirmatory testing. The following tables (17.1 and 17.2) show data collected between December 2003 and December 2006 with the terms 'true' and 'false' positive used as defined by the AABB.

Day 2 Testing

Table 17.1: Day 2 Testing Of Platelet Concentrates

Site	Total Number Doses [c]	Reproducible Positive [a]			Non-reproducible Positive [b]		
		No.	(%)	Frequency	No.	(%)	Frequency
Auckland	8093	7	0.09	1:1156	8	0.1	1:1012
Christchurch	1250	1	0.08	1:1250	2	0.16	1:625
Waikato	1230	2	0.16	1:615	1	0.08	1:1230
Wellington	972	1	0.1	1:972	2	0.21	1:486
Totals	**11545**	**11**	**0.1**	**1:1050**	**13**	**0.11**	**1:888**

Day 7 Testing

Table 17.2: Day 7 Testing Of Platelet Concentrates

Site	Total Number Doses [c]	Reproducible Positive [a]	Non-reproducible Positive [b]		
			No.	(%)	Frequency
Auckland	1482	0	3	0.2	1:494
Christchurch	312	0	0		
Waikato	234	0	0		
Wellington	257	0	2	0.78	1:129
Totals	**2285**	**0**	**5**	**0.2**	**1:457**

Note

a. ***Reproducible positive***: *confirmatory culture performed on sample taken from the implicated unit, or if already transfused taken from the initial sample pouch, was positive.*

b. ***Non-reproducible positive***: *confirmatory culture performed on sample taken from the implicated unit, or if already transfused taken from the initial sample pouch, was negative*

c. *Number of platelet doses sampled*

The 7 reproducible-positives recorded at the Auckland site is higher than expected. On further investigation it was noted that a cluster of 5 cases had occurred during August 2006 and which were subsequently found to be due to the introduction of a faulty sterile docking device (used in the preparation of platelet pools). As a consequence of this whenever a change of sterile docking device is made 100% testing of platelets is undertaken until it is shown that there is no associated increase in the observed bacterial contamination rate.

Table 17.3 summarises the organisms isolated from the reproducible-positive samples noted above:

Table 17.3: Organisms Detected During Bacterial Monitoring

Site	Organism(s) Reported	No.
Auckland	*Staphylococcus epidermidis*	1
	Coagulase-negative *Staphylococcus*	2
	Coagulase-negative *Staphylococcus* + *S. epidermidis*	3
	Mixed culture – alpha-haemolytic *Streptococcus* + coagulase-negative *Staphylococcus*	1
Christchurch	Coagulase-negative *Staphylococcus*	1
Waikato	*Enterobacter aerogenes*	1
	Streptococcus agalactiae (group B)	1
Wellington	Staphylococcus species, Coagulase-negative Staphylococcus	1

Finally, NZBS is continuing to monitor bacterial contamination in platelets to determine the appropriateness of continuing the approach described previously or progressing to a policy of 'culture-negative at release' for platelet products.

18

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 blood banks. Each site records instances of a range of predefined errors (based on the NZBS sample collection policy) and the associated corrective actions. Data is then entered into a Microsoft Access™ database for subsequent analysis.

In the eight month period 1 May to 31 December 2006 a total of 98987 requests were received, of which 4473 (equivalent to1:22) had errors associated with them. The number of errors reported for each request ranged from one to five, with the majority (98%) having either one or two errors (87% and 11% respectively).

Table 18.1: Monthly Summary Of Total Number Of Errors Reported

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
No. Requests	13358	11961	12509	13308	12440	13003	11985	10423	98987
Requests with errors	696	703	571	565	463	498	482	495	4473
No. of errors	830	861	638	621	508	557	546	573	5134

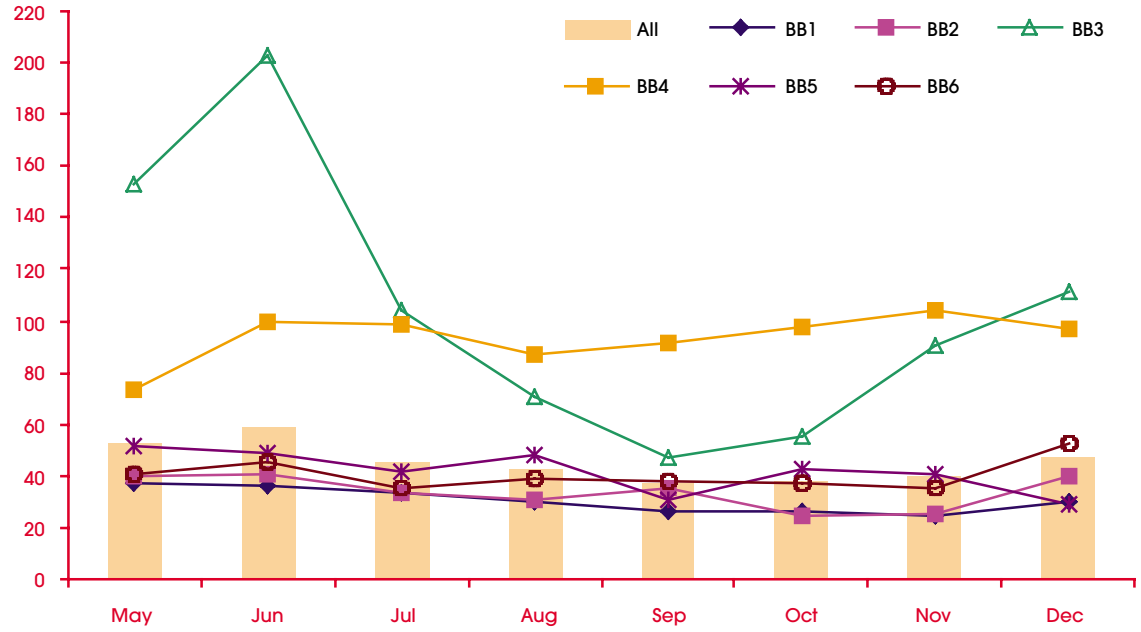
Error Rate

To allow a comparison between sites the number of requests with errors per 1000 requests was calculated and this is shown in table 18.2.

Table 18.2: Monthly Summary Of Errors Per 1000 Requests

Site	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	All
BB1	38	36	34	30	26	26	24	30	30
BB2	40	41	33	31	35	24	25	40	33
BB3	153	203	104	71	47	55	91	111	104
BB4	74	99	99	88	91	98	104	97	93
BB5	52	49	42	48	31	42	41	29	42
BB6	40	46	35	39	38	37	35	52	40
All	**52**	**59**	**46**	**42**	**37**	**38**	**40**	**47**	**45**

Chart 18.1: Number of requests with errors per 1000 requests



As can be seen in chart 18.1 the error rate for site BB3 is disproportionately high for May and June. This was due to the local DHB requirement to record the occurrence of requests not having the patient's location and/or consultant code specified, errors which are not routinely monitored.

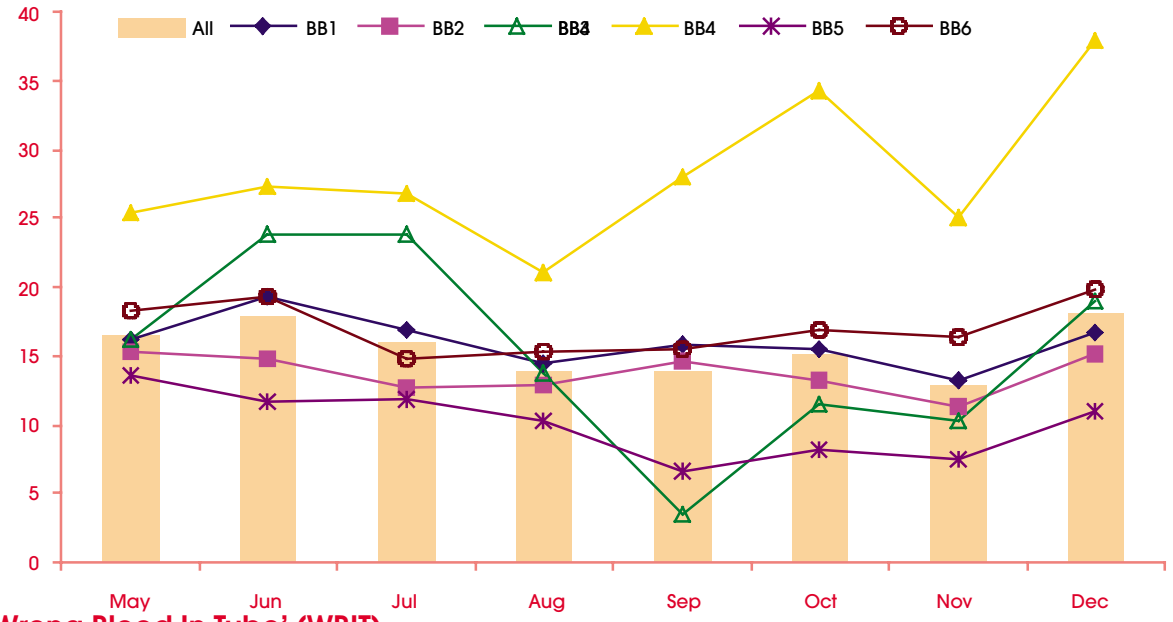
Sample Recollection Rate

Table 18.3 and chart 18.2 show the number of recollects requested and the rate of recollects per 1000 requests, respectively.

Table 18.3: Number of recollects per 1000 requests

Site	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
BB1	16	19	17	14	16	15	13	17	**16**
BB2	15	15	13	13	15	13	11	15	**14**
BB3	16	24	24	14	4	11	10	19	**15**
BB4	25	27	27	21	28	34	25	38	**28**
BB5	14	12	12	10	7	8	7	11	**10**
BB6	18	19	15	15	16	17	16	20	**17**
All	**17**	**18**	**16**	**14**	**14**	**15**	**13**	**18**	**15**

Chart 18.2: Number of recollected samples per 1000 requests



'Wrong Blood In Tube' (WBIT)

For comparative purposes the internationally used definition for a WBIT is used, namely "…(a pretransfusion sample) *where the current blood group differs from that in the historical record…"*

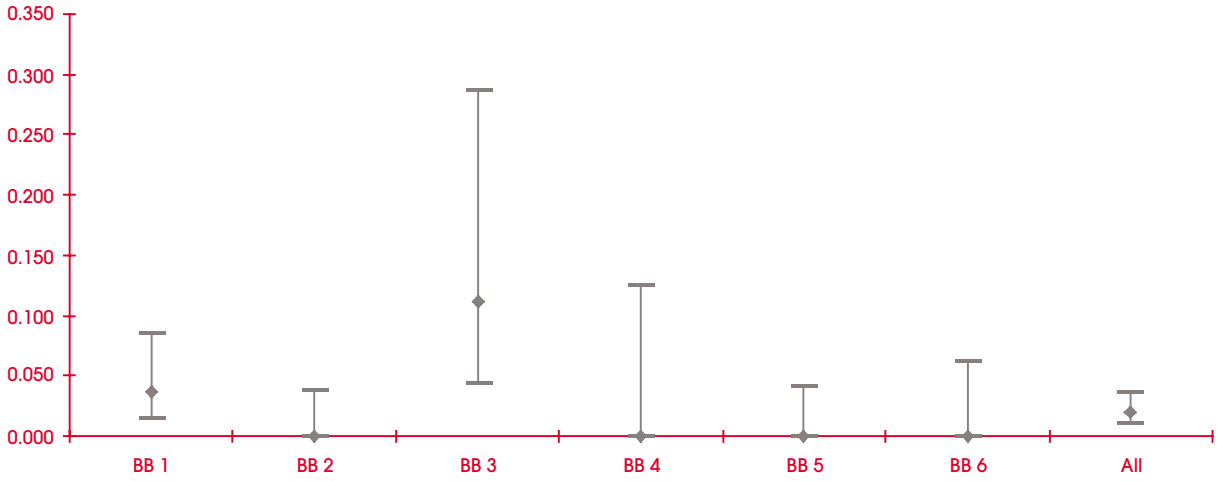
Table 18.4 and chart 18.3 show the corrected WBIT frequency along with the number of episodes expressed as a percentage of historic samples (with 95% confidence intervals determined using the *Wilson Score Method* of binomial confidence intervals).

Table 18.4: Frequency of WBIT

Site	Historic GPs	WBITs	Frequency *	WBIT prop	Lower CI	Upper CI
BB 1	13731	5	1:2746	0.00036	0.0002	0.0009
BB 2	10143				0.0000	0.0004
BB 3	3569	4	1:892	0.00112	0.0004	0.0029
BB 4	3046				0.0000	0.0013
BB 5	9185				0.0000	0.0004
BB 6	6123				0.0000	0.0006
All	**45797**	**9**	**1:5089**	**0.00020**	**0.0001**	**0.0004**

* *Corrected to account for silent errors. Corrected WBIT rate = No. historical groups / (Number of WBIT * Correction Factor). The correction factor (of 1.6) was derived according to the formula of Murphy et al (9) based on New Zealand blood group frequencies*

Chart 18.3: WBIT As Percent Of Historic Samples, With 95% CI



As is shown in table 18.4, only BB1 and BB3 have reported WBIT errors for the period. If historical blood group data is included for the remaining four sites a 'national' corrected WBIT rate of 1:5089 samples is obtained.

Types Of Error Reported

Tables 18.5 and 18.6 summarise the specific errors reported. It should be noted that there may be more than one error associated with any one request form and/or sample.

The main focus of the error reporting process is errors C01 to C13 shown in table 18.5. These errors are required to be reported by the blood banks according to NZBS policy. For the remaining errors listed data is only recorded if required by individual DHBs, routine recording is not expected. However, specific recording of these errors may be requested from time-to-time as part of a NZBS audit of non-compliance. Table 18.6 shows 'technical' errors which may prevent a request being processed.

Table 18.5: 'Clerical' Errors

Clerical Errors	Totals
C01: Wrong Blood In Tube (WBIT)	9
C02: Unlabelled Sample	84
C03: Missing / Incomplete Patient Details	633
C04: Patient Details: Discrepancy Between Sample And Form	1026
C05: Patient Details Do Not Agree With Historical Record	173
C06: Original Details Overwritten (Or Labels Overstuck) On Sample Or Form	102
C07: Declaration Not Signed	629
C08: Sample Not Signed	826
C09: Signature On Sample And Declaration Differ	67
C10: No Date / Time Sample Collected (Sample And/or Form)	17
C11: Name / Signature Requesting Practitioner Not Given	258
C12: Sticky Label On Sample	747
C13: Cord Blood - Labelled With Mother's Details Only	4
C14: Neonatal Sample - No Mother's Details	9
C15: No Clinical Details / Diagnosis	48
C16: No Obstetric / Transfusion / Other Relevant History	10
C17: Tests / Components Not Specified	3
C18: No Indication For Transfusion Given	1
C19: Patient's Location Not Specified	133
C20: Other Clerical Error	200
All	**4979**

Table 18.6 'Technical' Errors

Technical Errors	Totals
T01: Haemolysed Sample	8
T02: Wrong Tube Type	105
T03: Insufficient Sample	20
T04: Leaking / Broken Sample	8
T05: Maternal Contamination Of Cord Blood Sample	0
T06: Other Technical Error (Specify In Comments)	14
All	**155**

Actions Taken

Table 18.7 summarises the different actions taken in response to the errors received by the blood banks. As with the recording of errors it should be noted that there may be more than one corrective action associated with each request form or sample where errors are found.

Table 18.7: Summary Of Actions Taken In Response To Reported Errors

Action Taken	Totals
No Action Taken	271
Sample Discarded	1133
Sample / Request Not Processed (Held)	45
New Sample Requested	1533
Labelling Corrected By Collector	1401
Correct Details Obtained By Telephone/Fax	596
Request Withdrawn	93
Crossmatch Using Earlier Sample	27
Not Indicated On Error Record Form	41
Other	618
All	**5758**

Three main indicators have been chosen for wider reporting, namely error rate per 1000 requests, sample recollect rate and incidence of 'wrong blood in tube' events. The aim is that data is available for discussion within each the DHBs, for example at the hospital transfusion committee or at education sessions run by the NZBS Transfusion Nurse Specialists.

The database is starting to yield useful data and from this data it is hoped to gain an understanding of the nature and scope of labelling errors seen in the NZBS blood banks. This knowledge provides a unique opportunity for raising the awareness within the respective DHBs of what errors are occurring, awareness of which will hopefully lead to a reduction in the number of errors seen.

19

New Zealand Blood Service Standards

NZBS standards outline the technical requirements used in the collection, manufacture, distribution and storage of blood and blood components. These standards in conjunction with the *New Zealand Code of Good Manufacturing Practice For Manufacturing And Distribution Of Therapeutic Goods* (10) provide the basis for the NZBS quality system.

The standards are in two volumes namely *Collection Standards* (11) and *Manufacturing Standards* (12). The *Collection Standards* detail the requirements relating to donors and include detailed information on the selection and care of donors. The *Manufacturing Standards* detail the requirements for premises, equipment and personnel along with requirements for processes used in the manufacture of blood and blood components. A separate document, the NZBS *Quality Manual* (13), outlines NZBS quality system policies and procedures.

The standards are owned by NZBS with the Clinical Advisory Group (CAG) being responsible for their development and maintenance. The CoE *Guide To The Preparation, Use And Quality Assurance Of Blood Products,* which is updated annually, is used as an external reference standard and NZBS has observer status on the CoE committee responsible for its maintenance. In developing standards, CAG takes account of other international standards relating to blood with the intention of ensuring that the standards are consistent with International best practice.

Changes to the standards are undertaken through a controlled process involving consultation with Medsafe (New Zealand Medicines and Medical Devices Safety Authority).

In New Zealand, blood and blood products intended for therapeutic purposes are defined as medicines and, therefore subject to the *Medicines Act 1981*, *Medicines Regulations 1984* and subsequent amendments. Medsafe is responsible for administering this legislation, which includes the issuing of licenses to manufacturer medicines. Medsafe carries out annual audits of all NZBS Manufacturing sites to ensure that good manufacturing practice standards are being met.

Selection/Exclusion Criteria For Donors

On 10 March 2006, Medsafe approved the following changes to the NZBS Collection Standards:

- Alteration of the HIV geographical exclusion relating to heterosexual transmission of HIV. This arose from a review of WHO publications. The NZBS Infection Risk by Country document was amended to include countries in Eastern Europe and Central Asia as being at risk for HIV.
- An amendment to the NZBS Infection Risk by Country list relating to malarial risk. This arose from a review of the WHO *International Travel and Health Publication* (14) for 2005 and also data from the USA Center for Disease Control. The section on the malarial risk for China in the NZBS Infection Risk by Country document was changed.

- NZBS extended the vCJD precautionary measures to ensure that prospective donors who have cumulatively spent 6 months in the Republic of Ireland or France between 1980 and 1996 are no longer eligible to donate blood in New Zealand. Potential donors who have also received transfusions in those countries since 1980 are also excluded.

Changes To The NZBS Collection And Manufacturing Standards

In September 2006 Medsafe approved the following changes to the NZBS *Collection* and *Manufacturing Standards*:

- The sections on malaria in the Infection Risk by Country and A-Z Guidelines of the NZBS *Collection Standards* documents were changed to reflect the implementation of malarial antibody testing.
- The section on the Standards for Infectious Marker testing in the NZBS *Manufacturing Standards* was changed to reflect the implementation of malarial antibody testing.
- A change was made to the *Standards for the Processing and Storage of Blood Components and Blood Products* document in the NZBS *Manufacturing Standards* to clarify the temperature requirements for blood donations transported to an NZBS processing site for manufacture.

Haemovigilance Steering Group

NZBS Haemovigilance Steering Group

The Haemovigilance programme is overseen by the NZBS 'Haemovigilance Steering Group' under the auspices of the NZBS 'Clinical Advisory Group' (CAG) and direction of the NZBS National Medical Director.

The members of the steering group are as follows:

- Dr Krishna Badami, Transfusion Medicine Specialist, NZBS Christchurch
- Simon Benson, Clinical Support Officer, NZBS National Office, Auckland
- Dr Susanta Ghosh, Transfusion Medicine Specialist, NZBS Waikato

In addition to the above the following also contributed to the writing of the annual report:

- Dr Peter Flanagan, NZBS National Medical Director, Auckland
- Dr Richard Charlewood, NZBS Transfusion Medicine Specialist, Auckland
- Irene Tunzelman, Clinical Support Officer, NZBS National Office, Auckland
- Clare Lamont, Technical Support Officer, NZBS National Office, Auckland

Requests For Further Information

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Finally, the Haemovigilance Steering Group wishes to acknowledge and thank the many medical, nursing and scientific staff from NZBS, the DHBs and private hospitals that participated in the various NZBS Haemovigilance activities during 2006.

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10. Ministry of Health: *New Zealand Code of Good Manufacturing Practice for Manufacture And Distribution of Therapeutic Goods*

11. NZBS: *Collection Standards* (2003)

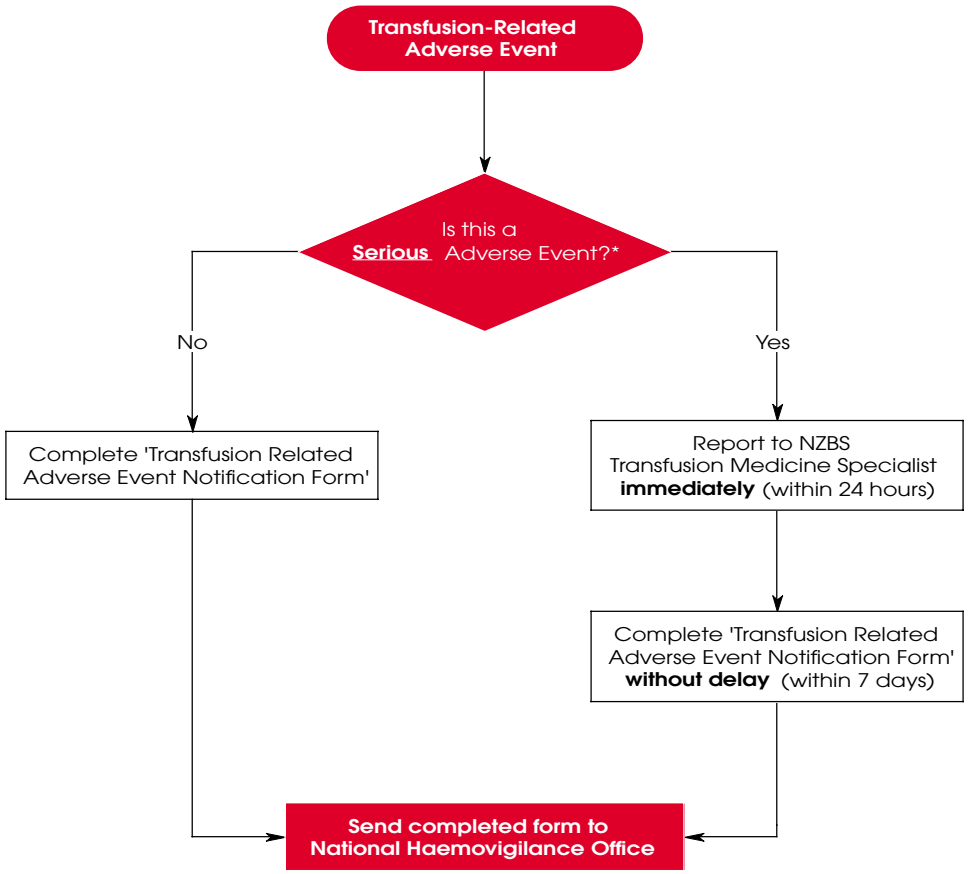
12. NZBS: *Manufacturing Standards* (2003)

13. NZBS: *Quality Manual* (2006)

14. World Health Organisation: *International Travel And Health* (2005)

Appendix 1: Reporting Transfusion-Related Adverse Events

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 2: Complications Arising From Transfusion

Complications Arising From Transfusion

The following definitions of complications arising from transfusion are based on a consultation document produced by the European Haemovigilance Network (EHN) 'Working Party on definitions of adverse transfusion events (ATEs)' in 2004.

1. Transfusion-Transmitted Infections (TTI)

Infectious agent	Definition
Viral Infection	The recipient has evidence of viral infection post-transfusion where there was no evidence of infection prior to transfusion; and Either at least one component received by the infected recipient was donated by a donor who had evidence of the same infection; or At least one component received by the infected recipient was shown to be contaminated with the infective agent.
Bacterial Infection	• Infection clinically suspected, if within 4 hours of transfusion the patient experiences: • fever ≥ 38.5°C or a change of ≥ 1.5°C from pretransfusion value and • rigors and • tachycardia ≥ 120 beats / min or a change of ≥ 40 beats / min from pretransfusion value or a rise or drop of 30 mm Hg in systolic blood pressure **Possible infection** A clinically suspected infection supported by: • the detection of bacteria in the transfused blood product but no positive blood culture or • a positive blood culture but no detectable bacteria in the transfused blood product if the blood culture is in a timely manner with the transfusion and no other reasons are ascertainable for the positive blood culture **Confirmed infection** Detection of the same bacterial strain in both the recipient's blood and transfused blood component / product (using approved techniques).
Parasite Infection	Detection of a parasite infection in the recipient's blood with no means of acquiring the infection other than transfusion.

2. Immune Complications of Transfusion

Complication	Definition
Haemolytic Transfusion Reaction (HTR) Reactions may be further defined as *Acute* or *Delayed*	HTR is clinically suspected if one or more of the following is present in a temporal association with transfusion: • fever and a variety of other symptoms (including dyspnoea, hypotension, tachycardia, flank or back pain, etc) • inadequate rise of the hemoglobin level after red cell transfusion • drop in haemoglobin level (≥ 2g/dl within 24 hours) • rise in LDH (≥ 50% within 24 hours) • rise in bilirubin, free haemoglobin (in plasma or urine), decrease in haptoglobin HTR is confirmed by a: • a positive direct antiglobulin test and • a positive red cell cross-match Two types of HTR are distinguished clinically: • Acute HTR: reaction occurs within 24 hours of transfusion • Delayed HTR: reaction occurs within 1 - 28 days after transfusion
Non-Haemolytic Febrile Transfusion Reaction (NHFTR) Reactions may be further defined as *mild, moderate*, or *severe*	**Mild febrile transfusion reaction** Fever ≤ 38.5°C or an increase of <1.5°C from pretransfusion value without any other symptoms (including HTR and bacterial infection). **Moderate / severe febrile transfusion reaction** Fever ≥ 38.5°C or an increase of ≥1.5°C from pretransfusion value plus one or more of the following: • chills • cold • rigor • headache • nausea / vomiting
Transfusion-Related Acute Lung Injury (TRALI)	Clinical diagnosis of TRALI and possible TRALI • acute respiratory distress • hypoxaemia ($PaCO_2/FiO_2$ < 300 or oxygen saturation < 90% or other clinical evidence) • bilateral lung infiltrations in the chest radiograph • occurrence during or within 6 hours of the transfusion • no evidence of TACO • no other risk factors for acute lung injury (ALI) present: sepsis, aspiration, multiple trauma, pneumonia, cardiopulmonary bypass, burn injury, inhalation injury, lung contusion, acute pancreatitis, drug overdose **Possible TRALI** TRALI with one or more risk factors for ALI: sepsis, aspiration, multiple trauma, pneumonia, cardiopulmonary bypass, burn injury, inhalation injury, lung contusion, acute pancreatitis, drug overdose

Complication	Definition
Transfusion-Related Acute Lung Injury (TRALI) ***continued***	**TRALI subtypes** • *Immunogenic (antibody-mediated) TRALI* Confirmed by the detection of leucocyte antibodies in the donor's or recipient's blood and a corresponding leucocyte antigen typing or a positive granulocyte crossmatch • *Non-immune (not antibody-mediated) TRALI*
Transfusion-Associated Graft Versus Host Disease (TA-GvHD)	Fever, rash, liver dysfunction, diarrhoea and cytopenia 1 - 6 weeks following transfusion with no other apparent cause. TA-GvHD is confirmed by GvHD-typical biopsy and by genetic analysis confirmed identity of recipient's lymphocyte chimerism and donor lymphocytes.
Post Transfusion Purpura (PTP)	Purpura and thrombocytopenia within 12 days of transfusion. Confirmed by the detection of platelet-specific antibodies (usually anti-HPA-1a) in the recipient's blood and corresponding platelet antigen typing of the donor or by a positive platelet cross-match.
Allergic Reaction	One or more of the following (without hypotension) during or within 24 hours of transfusion. • rash • allergic dyspnoea (stridor, cyanosis, wheezing) • angioedema • generalized pruritis • urticaria
Anaphylactoid Reaction	Allergic reaction with hypotension (drop in systolic blood pressure by ≥ 30 mm Hg) during or within 24 hours of transfusion.
Anaphylactic Shock	Shock associated with transfusion without any signs of shock of other origin.
Alloimmunisation	Formation of alloantibodies to RBC, HLA, HPA and HNA antigens which were not detectable pretransfusion.
Transfusion-Associated Autoimmune Haemolytic Anaemia	Haemolysis-related symptoms (paleness, tachycardia, hyperventilation etc) in a temporal association with transfusion. Confirmed by a drop in hemoglobin level, a positive direct antiglobulin test and an eluate revealing a red cell autoantibody that was not present in the recipient's blood pretransfusion.

3. Cardiovascular and Metabolic Complications of Transfusion

Complication	Definition
Transfusion-Associated Circulatory Overload (TACO)	Respiratory distress, tachycardia and increased blood pressure within 12 hours of completing transfusion. TACO is supported by typical signs of cardiogenic lung oedema in the chest x-ray and a positive fluid balance and/or a known compromised cardiac status.
Transfusion-Associated Dyspnoea	Respiratory distress in temporal association with transfusion and no evidence of TRALI, allergic dyspnoea or TACO.
Hypothermia	Decrease of body temperature after transfusion resulting in dyspnoea, hypotension and/or cardiac dysfunction.

Complication	Definition
Hyperkalaemia	Abnormal increase of the potassium level after transfusion, which can result in cardiac arrhythmias and/or dysfunction.
Hypocalcaemia	Abnormal decrease of the calcium level after transfusion, which can result in carpopedal spasm and/or cardiac arrhythmias and/or dysfunction.
Haemosiderosis	Iron overload as indicated by laboratory findings or biopsy due to chronic transfusion which can result in injury of heart, liver, lung and/or endocrine glands.
Hypotension	Drop in systolic blood pressure ≥ 30 mm Hg during or within 4 hours of completing transfusion and no evidence of other complications described above.
Hypertension	Rise in systolic blood pressure by ≥ 30 mm Hg during or within 4 hours of completing transfusion and no evidence of other complications described above.