TRIP REPORT 2018

Hemovigilance

Extended version

TRIP
Hemo-en biovigilantie

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TRIP
Hemo- en biovigilantie

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Content

Foreword

TRIP-II

In 2016, I was invited to present on patient safety at The Haga Hospital. For this presentation, Jan Klein, professor of patient safety at TU Delft, recommended I study Hollnagel's Safety-II philosophy.
In Hollnagel's philosophy, the aim is not to study what causes errors, but do study how processes take place on a day-to-day basis and why they often occur without errors. In practice, "work-as-imagined" often turns out to be different from "work-as-done", and it often turns out that experienced professionals contribute more to processes running smoothly than rules do. In fact, in a complex environment such as health care, deviating from rules can often help prevent errors from happening. The Safety-II philosophy has been embraced by the Dutch Federation for Medical Specialists (FMS), the Netherlands Federation of University Medical Centres (NFU), the Dutch Hospital Association (NVZ), the Netherlands Patients Federation, the Dutch Association for Nurses and Nursing Care Professionals (V&VN), as is exhibited in the "Time to Connect" ("Tijd voor Verbinding") report published by the Dutch Ministry of Health, Welfare and Sport, which outlines the next step in patient safety, the follow up to the safety management system programme. MediRisk has even set up a Safety-II pilot in 15 Dutch hospitals.
The blood transfusion chain is also a complex process that should be monitored closely from donor to recipient. Fortunately, many processes in the blood transfusion chain occur without errors, as is shown yet again in this TRIP report. The high level of safety of blood transfusion which we have seen over the last few years in the Netherlands is the reason why now is the time to introduce the Safety-II philosophy in the transfusion chain: look at things that go right, focus on frequent events, look at adverse occurrences that occur often and focus on their frequency, rather than their severity.
Remember that making things run well is an investment in both safety and productivity. I would like to invite you to read this 2018 TRIP report from a Safety-II perspective.
Finally, I would like to pass the TRIP baton to my successor as chairman, Jaap Jan Zwaginga. I am confident that he and the other members of the board, the TRIP office and all the affiliated hospitals in the Netherlands will contribute to a successful TRIP-II future for hemovigilance.

Dr Martin R. Schipperus
President, TRIP Foundation

CHAPTER 1

Main 2018 findings

1.1 Hemovigilance trends in 2018

In 2018, TRIP received a total of 2195 hemovigilance reports. The use of both labile blood components and SD-plasma (Omniplasma®) in 2018 was similar to the use in 2017 (Figure 1 on page 9). Figure 2 (page 9) shows the number of reported reactions per type of blood component in 2018, which is similar to recent years. Over a longer period the number of reported reactions associated with red blood cell transfusions shows a gradual increasing trend. This increase could be related to the fact that transfusions of red blood cell concentrates increasingly only use a single unit per transfusion.

Transfusion reactions

In 2018, the number of reports of transfusion associated circulatory overload (TACO) increased further. As in 2017, this reporting category accounts for the largest number of serious reports. The increase in the number of reports is probably due to an improvement in the recognition of TACO as a transfusion reaction. In 2018, TRIP developed an app based on the pocket reference cards it released earlier in the year. The app is a tool to support nurses and physicians in applying preventive measures for patients who are at a higher risk of TACO.

Additionally, the number of reports categorized as other reaction has increased: this category encompasses all reactions that do not fit the definitions for the standard categories of transfusion reactions. Every year, a considerable number of reactions categorized as other reaction concern cases in which the patient suffered respiratory problems. This begs the question of whether all these cases concern pathology that is not defined in the other TRIP reporting categories, or are in fact cases of TACO or TRALI in which the patient did not show (enough) symptoms to confirm a diagnosis of TACO OR TRALI.

Over the past few years, the number of delayed hemolytic transfusion reactions (4 in 2018) has decreased in comparison to the number of red blood cell concentrates (RBC) transfused. This decrease may likely, in part, be attributed to nationwide recommendations for preventive matching with the selection of blood components, of course in conjunction with safe procedures, quality systems, and the valuable work of the blood transfusion laboratories, reference laboratories and Sanquin. Additionally, the nation-wide database "TRIX" (Transfusion Register of Irregular Antibodies and Cross (X)-match Problems) may have contributed.

Errors and incidents

In 2018, the number and types of events reported were similar to 2017. 11 reports of incorrect blood component transfused (IBCT) concerned patients who received a transfusion with a blood component that was possibly ABO incompatible; the number of reports of this type of incident has been between 10 and 15 for several years. In 2018, TRIP received two reports of issues related to ICT systems. One concerned data migration and the other concerned the programming of selection criteria for units for certain defined at risk groups. In 2019, TRIP, in collaboration with professionals from the field, has been carrying out a project aimed at collecting data about mix-ups that were discovered as a result of discovering blood group discrepancies.

Infectious transfusion complications

TRIP received no reports of viral infections transmitted in 2018.

One report of post-transfusion bacteremia/sepsis (with B hemolytic streptococcus; severity grade 2) possibly resulted from a "Transfusion-Transmitted Bacterial Infection, TTBI. After inquiry from TRIP, several reporting facilities indicated that they did not always contact Sanquin after a positive culture

emerged in an examination of a transfused blood component associated with a transfusion reaction. For safety in general and for the safety of other recipients it is important to inform Sanquin of the results of such cultures.

Based on the registered number of reports, we may conclude that the incidence of transmissions of infections with blood transfusions in the Netherlands is low; in 2018 the incidence was only 1 per over 500.000 administered units

Analysis of reports involving patients under 21 years old

In 2018, TRIP carried out an extensive review of all reports involving patients under 21 years old, in collaboration with hospitals who supply additional data on transfusion with children (see Chapter 2.4). Compared to the number of reports involving patients 21 years old and older, the number of reports with patients under 21 years old is higher in relation to the blood use among these patients.
Most reports concern anaphylactic, other allergic and non-hemolytic febrile reactions. These findings resemble those from other hemovigilance systems, such as SHOT (Serious Hazards of Transfusion, the British hemovigilance system). The data do not show a difference in the number of incidents reported.

1.2 Recommendations

Recommendation	Who?
Transfusion reactions with dyspnea: stimulating proper diagnosis of the type of transfusion reaction.	Hemovigilance professionals in collaboration with clinicians
Register and examine reports of near misses concerning blood group discrepancies: in order to gain insight into the circumstances that contribute to the occurrence of these errors and to establish a (nation-wide) mapping of high-risk situations.	All those involved in the transfusion chain that report relating to hemovigilance and/or patient safety; Hemovigilance professionals in collaboration with hospital patient safety committee, blood transfusion committee
Always contact Sanquin after a positive result of a bacterial culture of a blood component associated with a transfusion reaction. This also applies to transfusion reactions which are strongly suspected to be sepsis related to the administration of a blood component for which the culture results have not been determined (yet).	Hemovigilance professionals, in conjunction with microbiologists and treating physicians.

CHAPTER 2

Overview of 2018 hemovigilance data

2.1 Overview of 2018 hemovigilance data in comparison with previous years

The definitions of categories of incidents, transfusion reactions, severity, imputability etc. can be found on www.tripnet.nl under definitions and in the relevant sections of this report. In 2018, TRIP received 2195 reports. In total, 2055 reactions and 194 incidents (events) were reported: 54 reports concerned a combination of both an incident/event and a reaction. These 54 combined reports are included in both Table 1 (incidents) and Table 2 (reactions).

The reported data are presented in the following tables and figures:

Table 1 Reported incidents, 2010-2018
Table 2 Reported transfusion reactions, 2010-2018
Table 3 Reports per type of blood component in 2018
Table 3a Types of blood component for each type of reaction or incident in 2018*
Tabel 3b Types of reactions and incidents for each type of blood component in 2018*
Figure 1 Distributed units of blood components per year
Figure 2 Transfusion reactions per type of blood component per year
Figure 3 Severity of the transfusion reactions, 2010-2018
Figure 4 Imputability of the transfusion reactions, 2010-2018

** Supplementary tables available as online annexe*

Table 1. Reported incidents, 2010-2018*

Incident	2010	2011	2012	2013	2014	2015	2016	2017	2018*	No. of hospitals with reports in 2018
Incorrect blood component transfused	58	43	51	43	71	53	43	44	40	23
Near miss	71	45	50	39	33	40	52	31	34	11
Other incident	118	138	139	107	120	93	112	72	94	25
Calculated risk situation#	-	-	-	-	-	-	7	6	11	8
Total	**247**	**228**	**240**	**189**	**224**	**186**	**214**	**153**	**179**$	

* *All incidents reported have been included, including those that were registered as an additional category*
\# *The reporting category for calculated risk was introduced in 2016, see also the discussion in chapter 3.1*
$ *Additionally, TRIP received 4 reports of look-back and 11 reports with an additional category of bacterial contamination of product*

Table 2. Reported transfusion reactions, 2010-2018

Reaction	2010	2011	2012	2013	2014	2015	2016	2017	2018*	>2 cpp#	No. of hospitals with reports in 2018
Post-transfusion bacteremia/sepsis	41	61	50	47	56	79	64	73	72$	7	37
Post-transfusion viral infection	1	5	2	5	0	2	3	1	0	0	0
TRALI	17	12	9	9	6	9	6	6	4	4	3
Transfusion-associated circulatory overload (TACO)	47	39	56	69	76	76	87	106	134	40	42
Transfusion-associated dyspnea (TAD)+	-	-	-	-	-	-	8	7	5	2	5
Anaphylactic reaction	73	67	59	70	53	43	62	69	58	13	25
Other allergic reaction	184	191	180	193	153	151	126	127	134	0	34
Acute hemolytische TR	21	17	7	11	17	18	18	16	16	3	10
Delayed hemolytic transfusion reaction (DHTR)	7	9	8	4	5	6	8	5	4	1	4
New allo-antibody formation	814	831	851	849	763	697	649	672	654	0	60
Non-hemolytic transfusion reaction (NHTR)	506	504	456	442	419	448	407	358	359	18	66
Mild non-hemolytic febrile reaction	363	366	383	340	311	336	365	319	326	7	59
Other reaction	164	218	225	221	191	205	215	259	289	26	61
Other small categories of TR¶	4	5	1	5	17	3	4	3	0	0	0
Total TR	**2242**	**2325**	**2287**	**2265**	**2067**	**2073**	**2022**	**2021**	**2055**	**121**	**82**
Total grade 2 of higher#	93	101	100	108	96	112	108	121	121		
Total reports	**2594**	**2630**	**2580**	**2504**	**2318**	**2289**	**2248**	**2131**	**2195**		

* *All transfusion reactions reported have been included, including those that were registered as an additional category*

\# *Imputability definite, probable, or possible; for types of reactions not categorized as severe, grade 2 applies when a reaction led to a (prolonged) hospital admission*

$ *only one of the reports has been categorized as TTBI based on the culture result of the unit, see also chapter 3.3*

\+ *New reporting category introduced in 2016, see discussion in Chapter 3*

¶ *These include reports of post-transfusion purpura, other post-transfusion infection or hemosiderosis.*
Abbreviations: TRALI=Transfusion-associated Acute Lung Injury; TR=transfusion reaction

Table 3. Reports per type of blood component in 2018

Type of blood component (bc)	Units distributed	Units transfused	No. of reports		Reports per 1000 bc distributed	
			All	Serious#	All	Serious#
Red blood cell concentrate	407104	382844	1806	84	4,44	0,21
Platelet concentrate	56274	53900	259	21	4,60	0,37
Fresh frozen plasma	1779	1248	0	0		
SD-plasma[1]	63373	56714	22	5	0,39	0,09
Fitrix® fibrin glue	72	14	0	0		
Blood management techniques[2]			2	0		
Combinations[3]			62	11		
Not stated			42	0		
Total	**528602**	**494720**[4]	**2195**	**121**	**4,14**	**0,23**

\# *Imputability definite, probable or possible*

[1] *SD = solvent-detergent treated plasma; Omniplasma® in the Netherlands*

[2] *See chapter 3.4*

[3] *Including combinations of labile blood components with SD-plasma*

[4] *TRIP received data on the number of units transfused from 84/89 (94%) hospitals*

Table 3a Types of blood component for each type of reaction or incident in 2018

Table 3b Types of reactions and incidents for each type of blood component in 2018

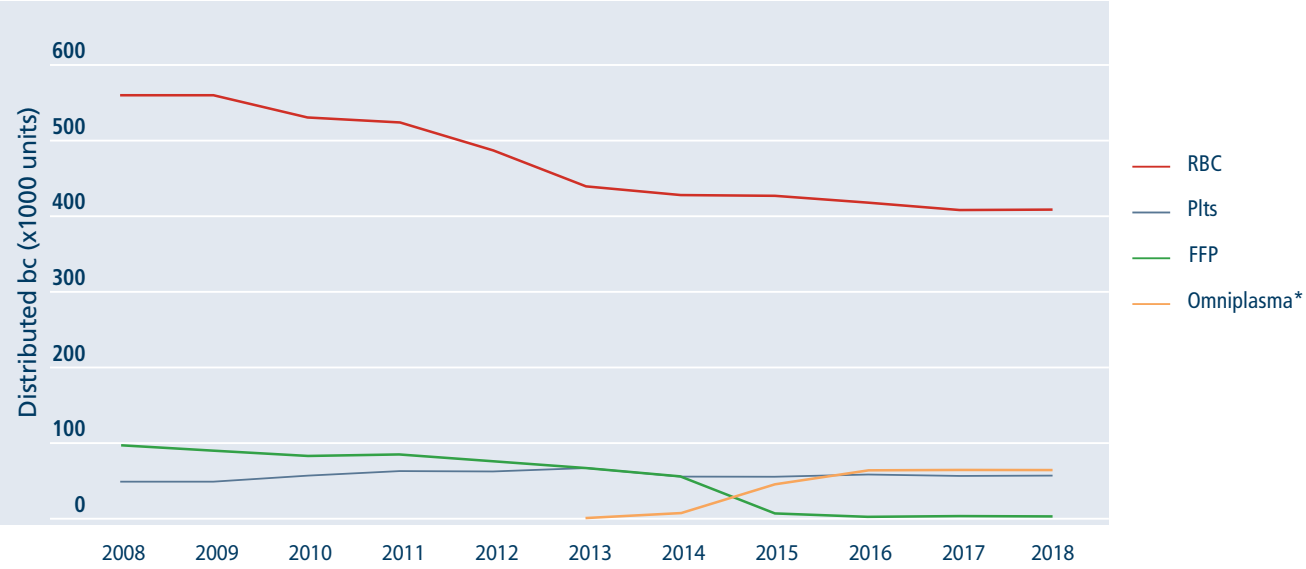

Figure 1. Distributed units of blood components, 2008-2018

* *For SD-plasma (Omniplasma®) the figure for transfused units is shown for 2013-2015 because of the transition (Data from Sanquin for the annual TRIP report)*

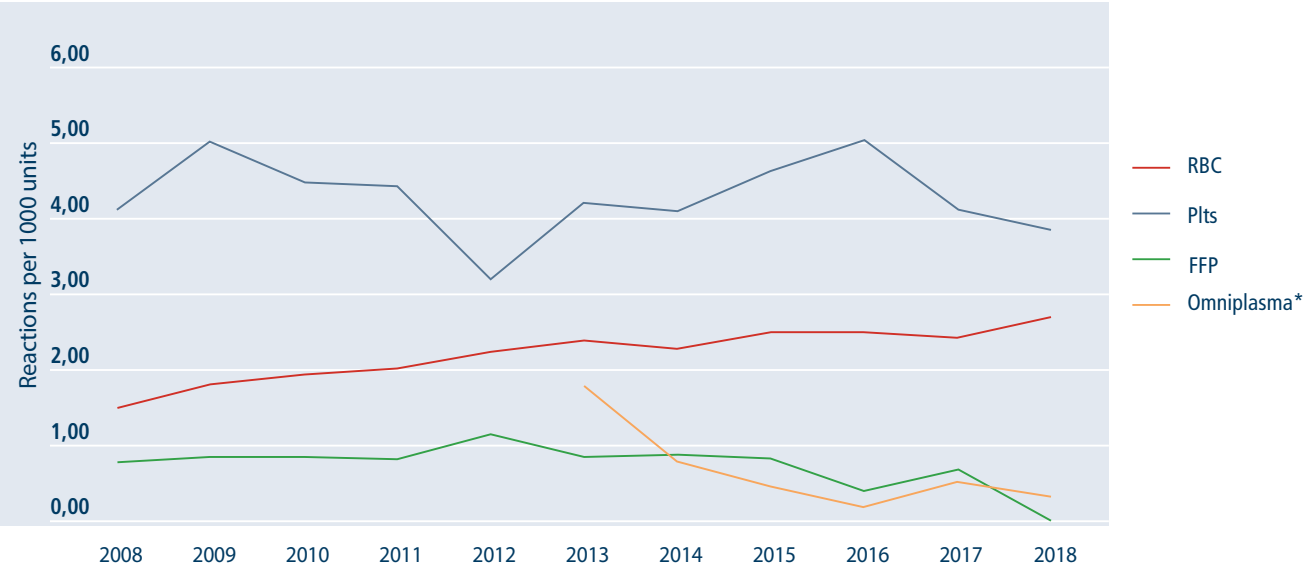

Figure 2. Transfusion reactions excluding new allo-antibodies per type of blood component, 2008-2018

* *Omniplasma® (SD-plasma): in 2013-2015 transfused units used as denominator because of transition*

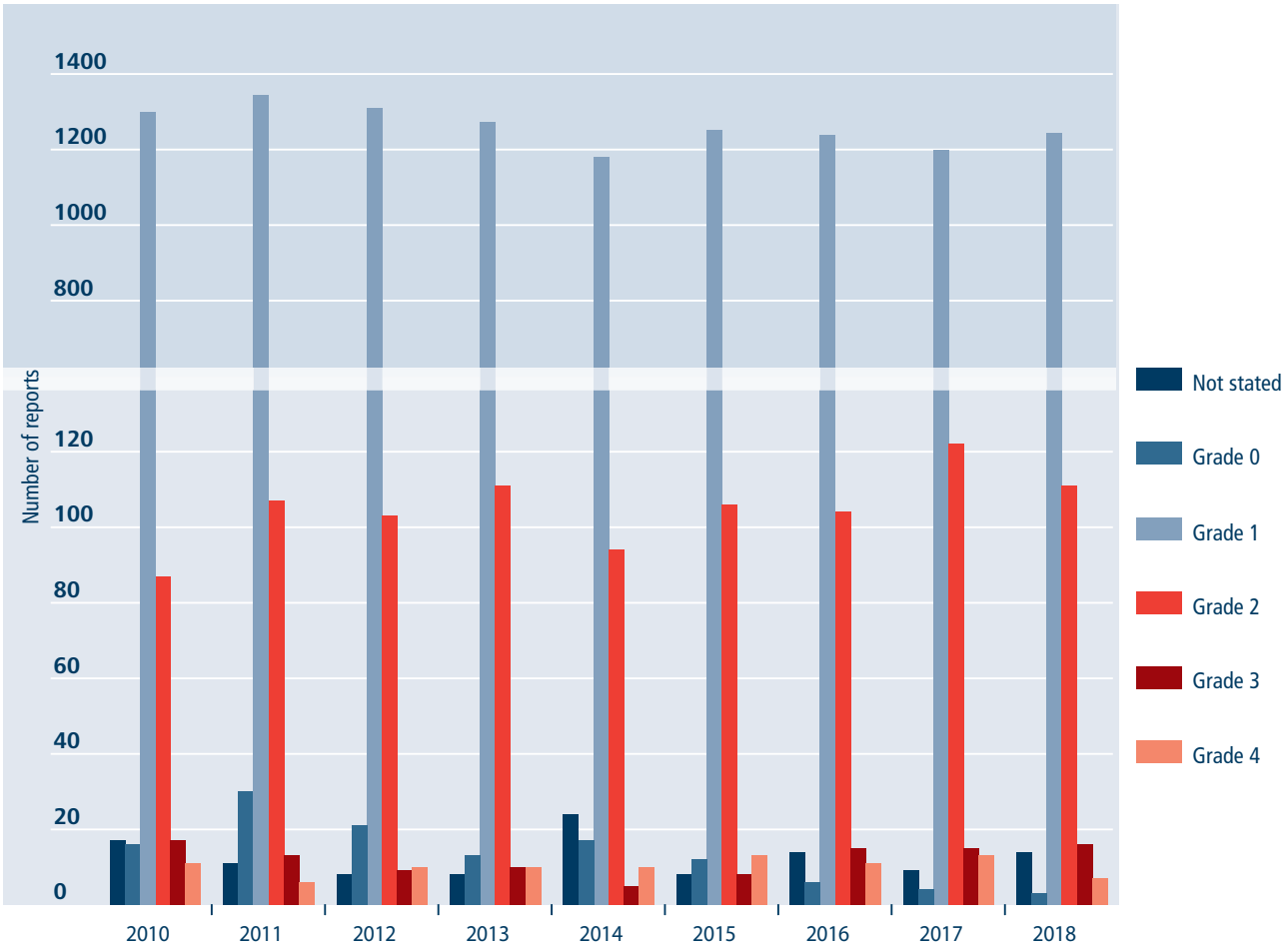

Figure 3. Severity of the transfusion reactions*, 2010-2018

* *All transfusion reactions except new allo-antibody formation are included in this figure*

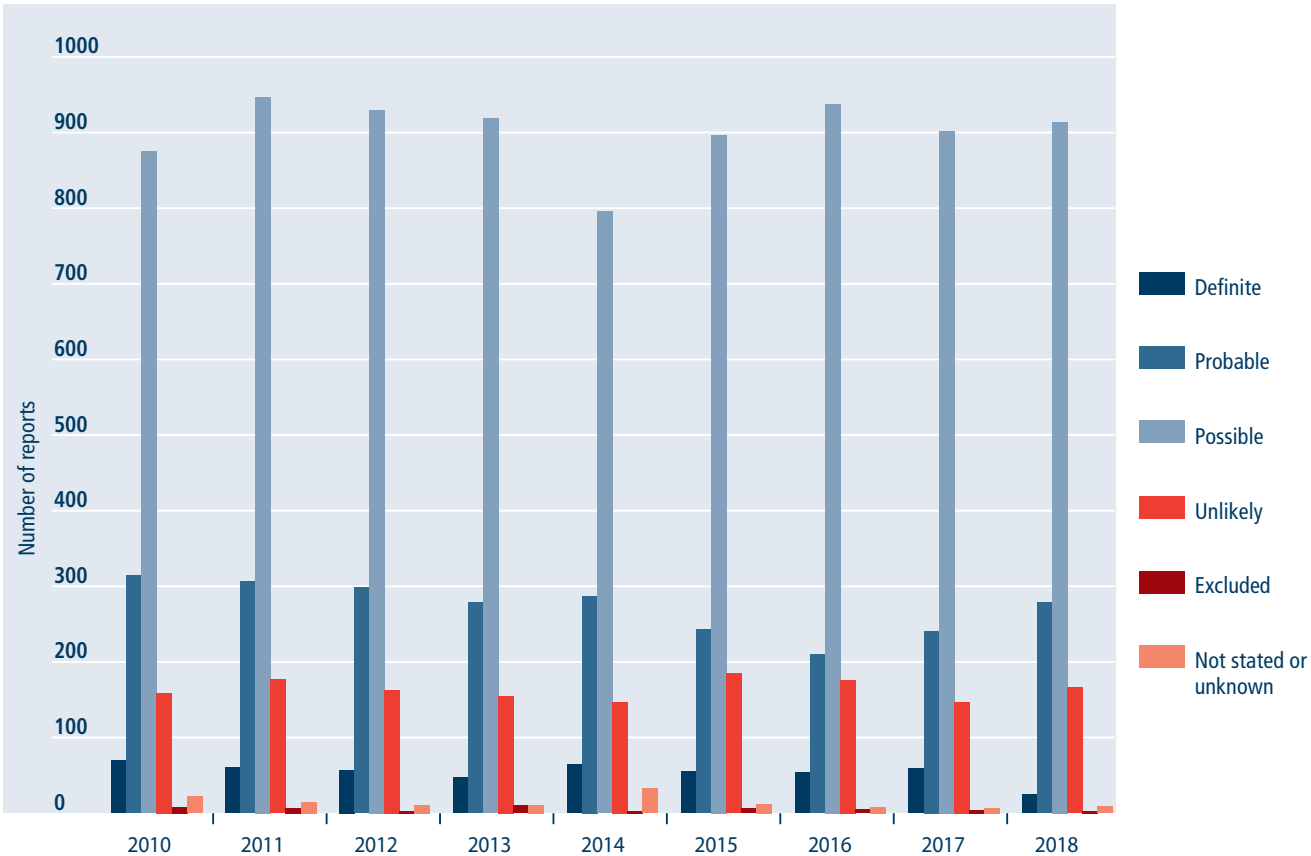

Figure 4. Imputability of the transfusion reactions*, 2010-2018

* *All transfusion reactions except new allo-antibody formation are included in this figure*

2.2 Overview of mandatory reports of serious transfusion reactions

Every year TRIP compiles an overview of serious transfusion reactions (Grade 2 or higher) and incidents in the transfusion chain for the European Commission.

The European Commission gives the following guidance in the "Common Approach" document:

- Reactions with definite, probable and possible imputability are to be reported; late reports from the previous year are to be included
- Reactions following a transfusion of an incorrect blood component and other incidents are included in the appropriate category.
- Hemolytic reactions are subdivided into immunological (ABO), immunological (not ABO) and non-immunological (e.g. infusion together with hypotonic solution).
- Reactions with (only) SD-plasma are not included because of their different legal status and vigilance requirements.
- Reports are subdivided in the form according to the type of blood component administered.

Table 4 shows the serious reactions from 2018 that were included in the overview for the European Commission. The febrile reactions included in the table have been classified as severe due to (prolongation of) hospital admission.

Table 4. Number and imputability of reports of grade 2 and higher in 2018

Severity	2 or 3			4
Imputability	Definite	Probable	Possible	Possible
Hemolytic transfusion reaction (ABO)	1			
Hemolytic transfusion reaction (immunological, not ABO)		2	1	
Allergic reaction		6	4	
Febrile reaction	1	7	17	
Other reaction	5	6	12	2
TAD			2	
Transfusion-transmitted bacterial infection		1		
TRALI		2	1	1
Transfusion-associated circulatory overload (TACO)	1	13	23	2
Total	**8**	**37**	**60**	**5**

2.3 Transfusion reactions with fatal outcome (Grade 4)

In 2018, TRIP received seven reports of transfusion reactions after which the patient did not recover but passed away. These reports are summarized in Table 5, which also includes one late Grade 4 report of a transfusion reaction that occurred in 2017. Table 6 displays all Grade 4 reports with definite, probable or possible imputability that TRIP has received from 2010 onward.

Table 5. Grade 4 reports 2018*

Reaction	Gender, age	Blood component	Imputability	Symptomatology
TRALI	F, 37y	RBC, Plts and SD-plasma	Possible#	Post-partum hemorrhage and retained placenta; Tf while in recovery room. The patient became hypoxic with fluid in the tube, cardiorespiratory arrest; no serological cause found in Sanquin TRALI donor investigation.
Transfusion-associated circulatory overload (TACO)	F, 88y	RBC	Possible	Patient with COPD and heart failure: anemia from gastrointestinal blood loss. After Tf increasing symptoms of circulatory overload, despite good diuresis from furosemide.
Transfusion-associated circulatory overload	M, 84y	RBC	Possible	Cardiac patient with symptoms of angina with chronic anemia; despite temporary break in transfusion and repeated doses of diuretics, worsening pulmonary oedema and death.
Other reaction	M, 85y	Plts, RBC	Possible	Transfusion-dependent patient with terminal systemic mastocytosis. Hypotensive and lowered conscious level during Tf, clinically diagnosed as cerebral hemorrhage.
Other reaction	M, 83y	RBC	Possible	COPD patient on treatment for pneumonia, anemia Hb 4.7mMol/L; cerebral event during transfusion.
Other reaction, additional category TACO	M, 78y	RBC	Unlikely	Hospitalization for venous ulcer in lower extremity, chest infection, chronic anemia with metastatic malignancy; increased dyspnea after Tf, gradual deterioration despite antibiotics and diuretics.
Post-transfusion bacteremia/sepsis	M, 80y	Plts, RBC	Unlikely	Patient with haematological malignancy, on antibiotics because of increased temperature after Tf; rehospitalization 2 days after Tf for sepsis with positive blood culture, antibiotics changed; culture of components was not positive
Post-transfusion bacteremia/sepsis*	M, 56 y/o	RBC	Unlikely	Intravascular hemolysis with sepsis as a result of Clostridium perfringens, most likely from intestines with metastatic colorectal malignancy.

** Includes one late report from 2017*

 # In the TRALI investigation, no HLA-antibodies were found in the donors of the RBC and the platelets; one donor had weakly reactive non-specific granulocyte antibodies

Abbreviations: COPD=chronic obstructive pulmonary disease; Tf=transfusion

Table 6. Grade 4 reports (imputability, definite, probable, possible) 2010-2018

	2010	2011	2012	2013	2014	2015	2016	2017	2018	total
AHTR		1	1			2				4
Other reaction	3	1	1	2		1	1	1	2	12
Post-transfusion bacteremia/sepsis*			1		2					3
Post-transfusion purpura					1					1
TRALI	2		1			2	1	1	1	8
Transfusion-associated circulatory overload (TACO)	2	1	1		3	2	3	6	2	20
Total	**7**	**3**	**5**	**2**	**6**	**7**	**5**	**8**	**5**	**48**

** Only one of the reports (from 2014) confirmed to be TTBI based on the culture result of the unit*

2.4 Late reports from 2017

After the final submission date for reports for 2017, 52 more reports from 2017 were definitively submitted and have now been reviewed (Table 7). This number of reports is similar to that of other years. The late reports include six serious reports, including one report of which the severity was Grade 4 (imputability unlikely). This report is included in Table 5.

Table 7. Late 2017 reports included in the 2018 report

Reporting category	Severity grade					No reaction, severity not applicable
	Not stated or 0	1	2	3	4	
Anaphylactic reaction		4	1			
Other allergic reaction		2				
Mild non-hemolytic febrile reaction		9	2			
Non-hemolytic transfusion reaction		5				
New allo-antibody formation	15					
Other incident						1
Other reaction		9	1			
Post-transfusion bacteremia/sepsis					1	
Transfusion-associated circulatory overload (TACO)		1		1		

2.5 Reports concerning patients under 21 years old

Based on findings in previous years, in 2018 TRIP asked hospitals to supply data on the number of units administered to children, in addition to the annual provision of reports and data on the total number of blood components administered. Out of the 89 Dutch hospitals, 31 (35%) supplied data on pediatric use of blood components; among these were 5 neonatal intensive care units and the national children's cancer centre.

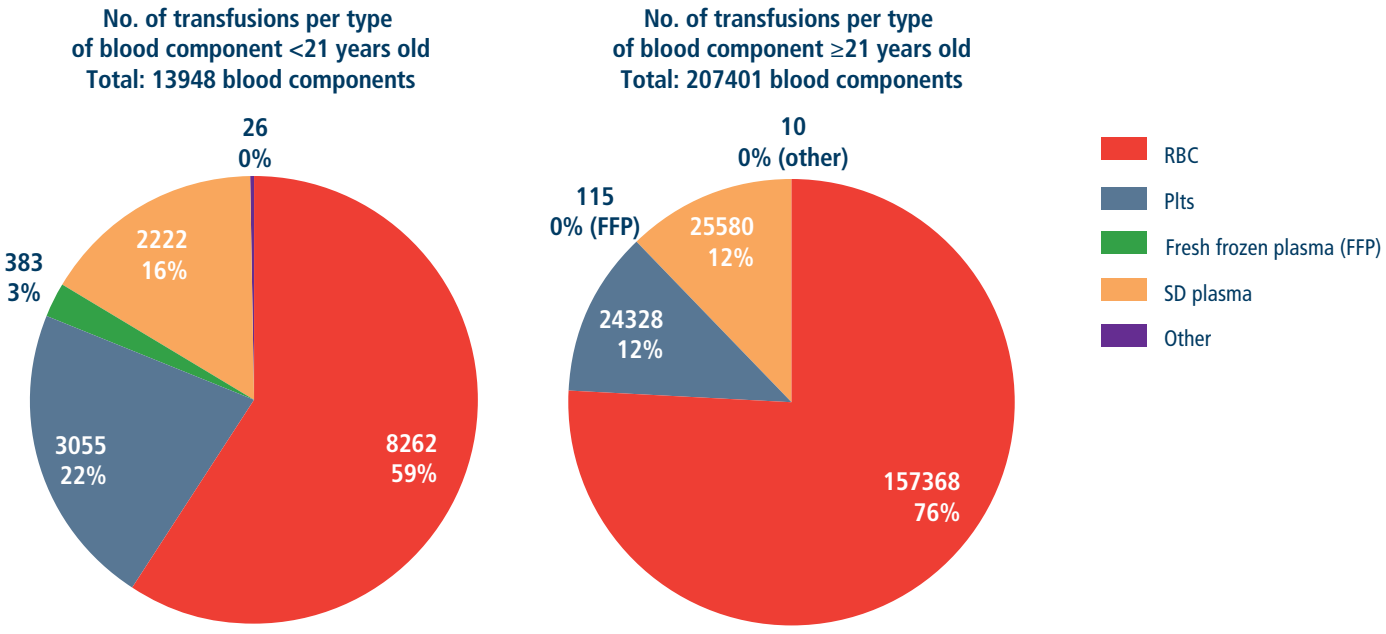

Figure 5. Total no. of transfusions, broken down according to type of blood component and age group

Across the 31 institutions that supplied data on pediatric transfusions (which, combined, account for approximately 53% of the total use of blood components in the Netherlands), over 220,000 blood components were administered. From these institutions, TRIP received 1054 reports, of which 110 concerned patients under 21 years old. After excluding reports of new allo-antibody formation (n=383), mild non-hemolytic febrile reaction (n=116), calculated risk (n=5), and look back by the blood establishment (n=2) (these were excluded because not all hospitals report incidents/reactions in these categories), 548 reports, 84 of which occurred with patients under 21 years old, were included in our analysis.

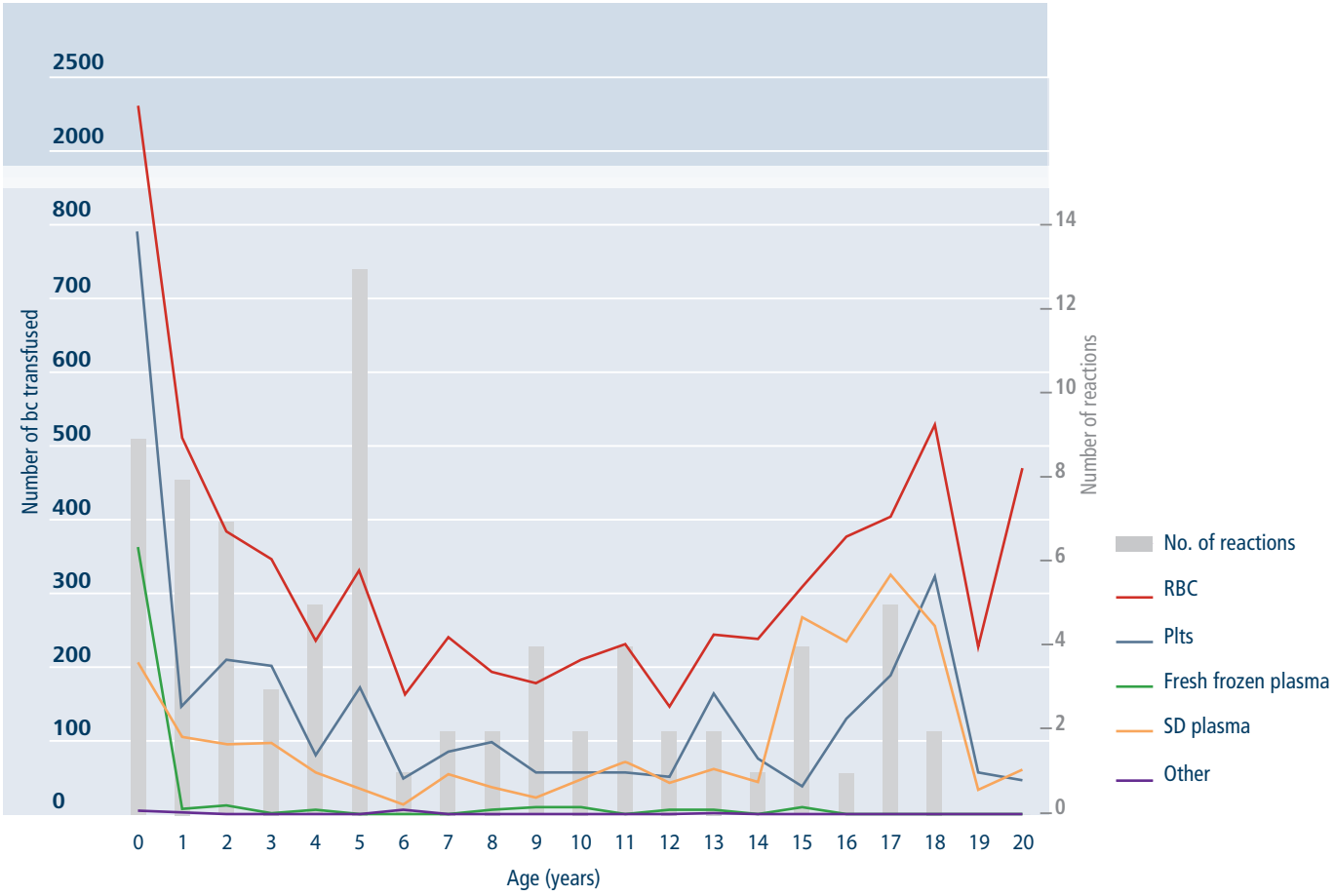

Figure 6. Number of blood components transfused and transfusion reactions reported per age (in years)

Figure 6 shows that fresh frozen plasma was most often administered to 0-1 year olds in accordance with guidelines and its use for pediatric units. For five-year-olds, the data show a noticeable spike in the number of transfusion reactions, as well as in the application of blood components. This spike represents 13 reactions in 9 patients; the reactions were in the main reporting categories.

Table 8. Numbers of reports and of blood components transfused in hospitals that supplied data about pediatric transfusions to TRIP

	Transfusions to patients aged <21y	%	Transfusions to patients aged ≥ 21y	%
Number of blood components transfused	13948		207401	
Transfusion reactions				
Acute hemolytic transfusion reaction	0	0	11	2,8
Anaphylactic reaction	9	11,7	29	7,4
Other allergic reaction	22	28,6	39	9,9
Non-hemolytic transfusion reaction	20	26,0	158	40,2
Other reaction	18	23,4	91	23,2
Post-transfusion bacteremia/sepsis	5	6,5	21	5,3
TAD	0	0	2	0,5
TRALI	1	1,3	3	0,8
Delayed hemolytic transfusion reaction	0	0	2	0,5
Transfusion-associated circulatory overload (TACO)	2	2,6	37	9,4
Total across all reactions	**77**		**393**	
Number of reactions reported per 1000 blood components transfused	5,5		1,9	
Incidents				
Incorrect blood component transfused	3	42,9	15	21,1
Near miss	0	0	19	26,8
Other incident	4	57,1	37	52,1
Total across all incidents	**7**		**71**	
Number of incidents reported per 1000 blood components transfused (incidentieverschil niet significant)	0,50		0,34	

Table 8 shows the number of transfusion reactions in each category per age group. The other reactions that occurred with patients under 21 years old consisted mostly of: febrile reactions with considerable rise in blood pressure (5x), a drop in blood pressure (5x), bacteremia as of before transfusion (4x), pain, and fever with erythema or oedema, and all did not meet the criteria for classification in a more specific category. The imputability for all reactions that occurred in patients under 21 years old is definite, probable or possible. Five of the reports were classified as serious (2x severity grade 2, 3x severity grade 3). The serious reports concerned: 1x TACO (grade 2) in a 17-year-old, 1x TRALI (grade 3) in an 18-year-old, 2 x anaphylactic reaction (grade 3) in a 1-year-old and in a 4-year-old, 1x other reaction (grade 2, decrease in saturation and blood pressure) in a 5-year-old.

In total, 5.5 reactions were reported per 1000 blood components administered to patients under 21 years old and 1.9 reactions were reported per 1000 blood components administered to patients 21 and over. The difference in incidence between the two age groups was 3.6 reactions per 1000 blood components ($p<0,05$; Chi-squared test)

There was no significant difference between the patients under 21 years old and 21 and over in the number of incidents reported per 1000 blood components administered. The incidents involving patients under 21 years old were three reports of incorrect blood component transfused: one report of erroneous use of a non-irradiated blood component and two reports of blood components that were not Rhesus phenotype-compatible or not K-compatible.

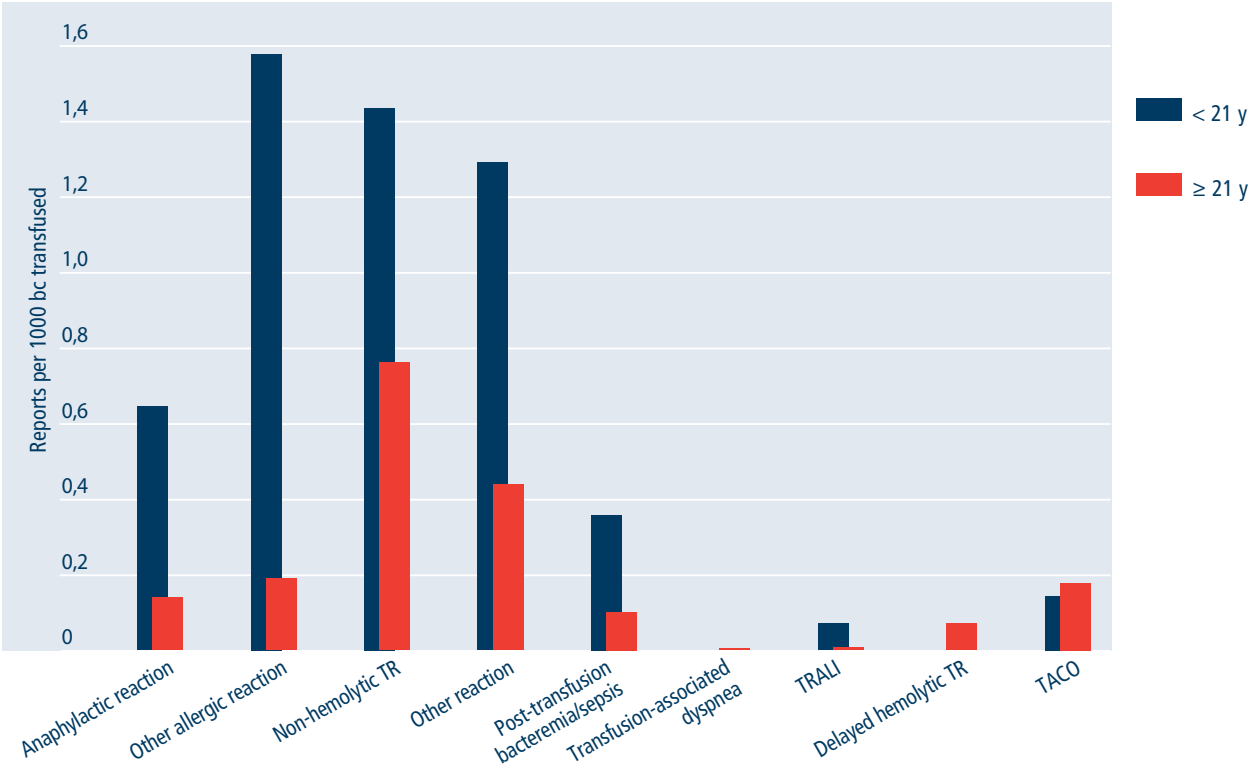

Figure 7. Number of transfusion reactions (TR)* per 1000 blood components administered

** The data include the reports from hospitals that supplied information on transfusions with children, excluding reports of mild non-hemolytic febrile reaction and new allo-antibody formation*

Based on these data, it may be concluded that in the hospitals that supplied information on blood transfusions with children, the number of reports involving patients under 21 years old is higher in relation to the blood use than that involving patients 21 years old and older. Most reports concern anaphylactic, other allergic and non-hemolytic febrile reactions. The difference in the incidence of reactions may be partly due to the fact that patients under 21 years old are administered platelets more often (Figure 5). Other possible explanations may include closer monitoring of patients in this age group, as a result of which a transfusion reaction is more likely to be noticed, or transfusion reactions in children being more likely to be reported back to the laboratory. The higher number of reported reactions in these data is similar to findings from other hemovigilance systems, such as SHOT (Serious Hazards of Transfusion, the British hemovigilance system). The Dutch data do not show a difference in the number of incidents reported.

CHAPTER 3

Discussion of reports per category

3.1 Incidents in the transfusion chain

Incorrect Blood Component Transfused (IBCT)

All cases in which a patient was transfused with a component that did not fulfil all the requirements of a suitable component for that patient, or that was intended for a different patient.

As in previous years, TRIP has assessed all the reports of incorrect blood component transfused to establish which was the worst potential risk to which a patient was exposed through transfusion of an incorrect blood component. For instance in the case of a mix-up of units intended for two patients, if patient X receives the blood which was intended for patient Y the worst risk would be for the unit to be ABO incompatible – regardless of what the two patients' blood groups turned out to be. Before 2013, IBCT cases where the patient could have received an ABO incompatible unit constituted the largest subgroup. In the years after that, the largest subgroup was that of reports of failure to comply to guidelines preventing new allo-antibody formation for patients in defined risk groups. The number of reports in this subgroup has now decreased again, to the number from before 2013. The Irrab subgroup, where there was a risk of not taking into account irregular antibodies demonstrated in a patient, shows a marked increase in 2018 and now forms the largest subgroup of reports alongside that of ABO risk, the number of which has been stable for three years (Figure 8).

The descriptions of the risk groups which TRIP applies in this analysis can be found on www.tripnet.nl (under hemovigilance, tools). Reports are classified according to the first error (in time) which led to the transfusion of an incorrect unit, wherever possible. This first error is classified according to the type of error, such as identification error, communication error, or selection error. The step in the transfusion chain where the first error occurred is also noted; see the TRIP diagram representing the transfusion chain on www.tripnet.nl.

In 2018, TRIP received 2 reports of issues related to ICT. In one of these cases, part of a patient's data (the antigen typing) did not transfer when migrating data from one laboratory information system (LIS) to another. In the other case, a fault in the built-in selection criteria for particular patient groups was discovered, as a result of which the LIS did not take into account the patient's Rhesus phenotype for the selection of blood components. In both cases, the ICT issues created a situation in which there was a risk of repetition for the same patient or for other patients.

40 reports from 22 hospitals (24%), 1-6 reports per hospital.

- 5x a reaction was observed first and it was discovered afterwards that IBCT preceded it (2x AHTR, 1x DHTR, 2x new allo-antibody formation with additional category IBCT), see Table 9.
- 1x the analysis of an IBCT showed that the same error had occurred before and resulted in the same patient receiving an incorrect blood component, of which no report had been made yet. These cases are registered with the additional category IBCT in the past.
- Of the 11 reports classified as ABO risk, 10 cases concern mix-ups of blood bags, donor details, patients, or patient details and 1x a report concerned an emergency situation in which blood group-identical uncrossmatched blood was requested instead of uncrossmatched O-negative.
- 1x it was discovered that a blood component (A pos RBC) that had been issued for a different patient was being administered when the recipient (B pos) had a reaction(worsenings dyspnea; tachycardia;

slight drop in blood pressure) a few minutes after the start of the transfusion. The patient was already receiving 3L O2/min and was additionally treated with saline infusion (NaCL 0.9%). The patient showed a decrease in Hb (3.8 to 3.6 mMol/L) and a slight increase in LDH (to 253 U/L). Bilirubin and haptoglobin remained within normal ranges. The reaction's course was mild and it did not lead to prolonged hospitalization. The other case of AHTR is described in a TRIP Report of the Month.

- 1x a case concerned erroneous administration of O positive red blood cells to a patient (A positive) who did not need transfusion and for whom, logically, there was no transfusion prescription.
- 3 of the 11 cases with irregular antibody risk concern overlooking information in the national Transfusion Register of Irregular Antibodies and X(crossmatch) problems (TRIX) on antibodies previously demonstrated elsewhere when processing the request.
- 1x after an unexpected Hb decrease a patient needed a transfusion again and screened positive for irregular antibodies, which revealed that for a previous transfusion several weeks earlier, previously demonstrated antibodies had erroneously not been taken into account.

IBCT case descriptions (in Dutch) of 2018 reports can be found in the Report of the Month (Melding van de maand) series on www.tripnet.nl, e.g.: Report of the month October 2018: 2x 2RBC → IBCT? (2)
https://www.tripnet.nl/2x-2-ec-%e2%86%92-vbt-2/
Report of the month January 2019: Labelling can be life-threatening
https://www.tripnet.nl/melding-van-de-maand-januari-2019-stickeren-is-levensgevaarlijk/
Report of the Month May 2019: Where has the patient gone?
https://www.tripnet.nl/melding-van-de-maand-april-2019-waar-is-de-patient-gebleven/

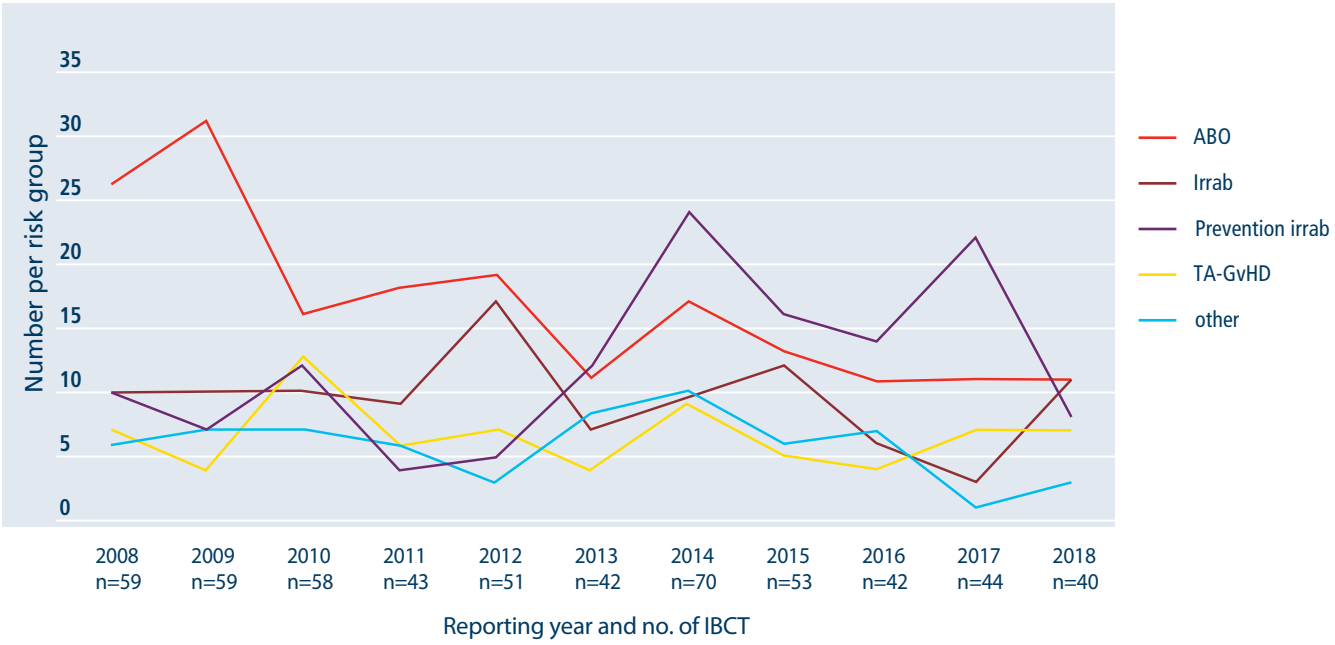

Figure 8. Incorrect blood component transfused broken down according to risk group, 2008-2018
Abbreviations:
ABO=risk of an ABO incompatible blood transfusion
Irras=risk of an irregular antibody incompatible transfusion
Preventie irras=guidelines not followed with regard to prevention of irregular antibody formation
TA-GVHD=risk of transfusion-associated graft versus host disease (after transfusion of a non-irradiated blood component)

Table 9. Incorrect blood component transfused in 2018
Breakdown according to subgroup, administered blood component and observed reaction

Subgroup*	Blood component	N	Blood component happened to be compatible or negative for	Blood component (possibly) incompatible for	N	Reaction or New antibody	N	Imputability%	Severity grade%
ABO	RBC	11		ABO Rhesus D	1	AHTR		definite	3
			Rhesus D	ABO	2	AHTR	1	definite	1
						None$	1		
			ABO	Rhesus D	2	None#			
			ABO Rhesus D		6	None			
Irrab	RBC	10		anti-C; anti-e	1	DHTR		Probable	0
			Antigen K		1	Anti-K			
			Antibody/antibodies previously demonstrated in patient		2	None			
				Antibody/antibodies previously demonstrated in patient	6	None			
	Plts	1		Antibody/antibodies previously demonstrated in patient	1	None			
Prevention Irrab	RBC	7		Rhesus / K	3	Anti-C			
						None#	1		
				Rhesus	4	None#	2		
	Plts	1		Rhesus D	1	None&			
TA-GvHD	RBC	5	Not applicable			None			
	Plts	2							
Other	RBC	3	Not applicable			None			

* *ABO = risk of an ABO incompatible blood transfusion*
Irrab = risk of an irregular antibody incompatible transfusion
Preventie irras = guidelines not followed with regard to prevention of irregular antibody formation
TA-GVHD = risk of transfusion-associated graft versus host disease (after transfusion of a non-irradiated blood component)

% *imputability and severity grade apply to clinical symptoms of a transfusion reaction; new allo-antibody formation is severity grade 0 by definition*

$ *error discovered quickly as a result of which transfusion of the unit was halted before (visually in the IV-tubing) any red blood cells reached the patient*

no new antibodies demonstrated according to most recent information at the time of writing of this report

& *emergency transfusion to F <45 yrs old, patient received anti-D prophylaxis a day later*

Abbreviations: AHTR=acute hemolytic transfusion reaction; DHTR=delayed hemolytic transfusion reaction

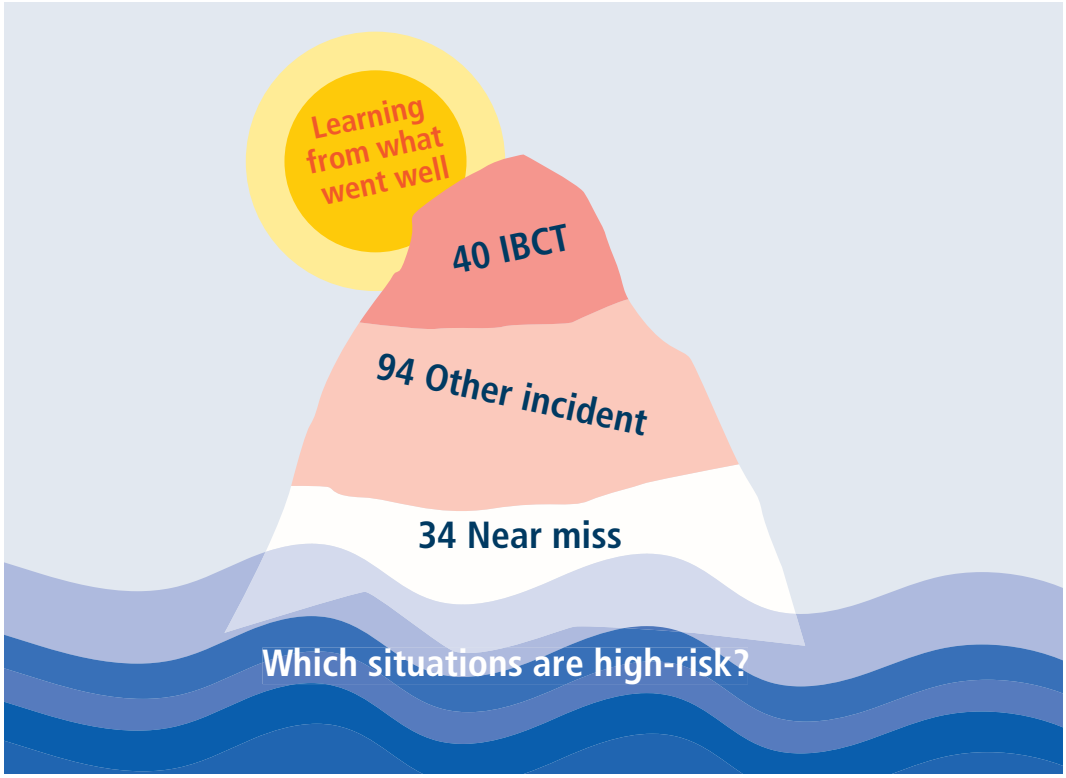

Image: Analysis of near misses provides insight into high-risk situations

Near miss

Any error that, if undetected, could have led to a wrong blood group result or issue or administration of an incorrect blood component, and which was detected before transfusion.

34 reports from 11 hospitals (12%), 1-12 reports per hospital

- In 28 cases, a mix-up of patients or patient identification details (presumably) occurred; for instance a mix-up of labels, blood samples, blood components, testing materials, etcetera.
- In 26 cases there was a potential ABO risk and in 17 of these cases the error was detected through the finding of a blood group discrepancy. One of these cases concerns a situation in which a discrepancy from a previously determined blood group was found, in which the newly determined blood group was found to be correct, but in which the errors that occurred previously could not be established. In one case the discrepancy was probably caused by the presence of many antibodies in the patient's blood, as a result of which the patient now falsely tested Rhesus D positive using certain methods.
- 4 reports describe a potential TA-GvHD risk due to almost administering a non-irradiated blood component. In one of these cases the error was detected at the time of issue, but in two cases the error was detected by a nurse, after the blood component had been issued by the laboratory, when checking the unit before administering it to the patient.

Analyzing regularly occurring types of near miss incidents can be of value for discovering what circumstances lead to these situations. It is a misconception that the analysis of unusual incidents and the registration of exceptional contributing factors are the main ways of contributing to improving the safety of the transfusion chain. In 2018, the hemovigilance advisory board recommended systematic collection of reports of near misses that came to light as a result of blood group discrepancies, to substantiate the importance of introducing certain measures such as (also) using digital identification for the collection

of blood samples. Hospitals were asked to register all cases of blood group discrepancies throughout the 2019 reporting year, analyze these to the extent possible, and report them to TRIP. See also the TRIP Blood Group Discrepancies Project (https://www.tripnet.nl/wp-content/uploads/2019/01/Bloedgroepdiscrepanties-bijlage.pdf) (in Dutch). Regardless of what the cause of a blood group discrepancy turns out to be, further testing must be carried out to definitively determine the patient's blood group (again). For the blood group discrepancies that are judged to be incidents it is relevant to attempt to determine the cause of the discrepancy to the extent possible. It may be expected that situations in which blood group discrepancies were discovered in time are to a large extent comparable to situations which lead to an incorrect blood component being transfused. TRIP has developed a flowchart (https://www.tripnet.nl/wp-content/uploads/2019/01/Bloedgroepdiscrepanties-bijlage.pdf) (in Dutch), which indicates how best to report the different kinds of near misses related to blood group discrepancies.

Descriptions of Near miss cases (in Dutch) can be found in the Report of the Month series on www.tripnet.nl: Report of the month December 2018: Blood group determination and irregular antibody screening. https://www.tripnet.nl/melding-van-de-maand-december-2019-bloedgroepbepaling-en-irregulaire-antistofscreening/

Other incident (OI)

Error or incident in the transfusion chain that does not fit into any of the above categories, for instance patient transfused whereas the intention was to keep the blood component in reserve, or transfusing unnecessarily on the basis of an incorrect Hb result or avoidable wastage of a blood component.

94 reports from 26 hospitals (17%), 1-22 reports per hospital

- 33 reports of incidents with which a reaction was also observed (12x Other reaction; 8x Mild NHFR; 6x TACO; 5x NHTR; and 2x AHTR)

In over 50% of the cases in which other incident was registered as an additional category with a reaction (n=23), this was because the reaction was reported to the laboratory late or not at all, as a result of which the appropriate additional testing was not or only partly carried out. In one case the reaction was reported but the report was not dealt with according to the applicable laboratory procedures.
The reactions reported with the remaining other incidents are listed in Table 10.

In 2018, some of the larger subcategories of OI include cases in which there was a (considerable chance of) delay of transfusion, which caused medical risks for patients due to lack of transfusion (n=14). Most of these delays were caused by the lab not being informed of the transfusion request or because material for pretransfusion testing was not provided. In two cases the saline infusion was not stopped when the transfusion was started. In both cases, no-one noticed that this caused the blood to infuse far too slowly. After the maximum infusion time (6 hours) had passed, the unit turned out to have only partially been administered and the transfusion was stopped.

Another subgroup consists of (nearly) administering unnecessary transfusions (n=14). In one of these cases the error was detected only after the component had already been spiked. In eight of these cases one or more blood components were unnecessarily administered to a patient. The cause in over a third of these cases lay in errors when determining that transfusion was indicated, in particular with the collection of blood samples (e.g. diluted samples). In two cases the laboratory discovered before issuing the components that a transfusion request had been submitted for a different patient than had been intended, and in two more cases request forms for two different patients were processed in the labs requests for a single patient. These types of errors create a risk of a delayed transfusion for the one patient and a risk of overtransfusion for the other.

Wastage of (a large part of) blood components in cases where there was no unintended delay of transfusion or (nearly) unnecessary transfusion again accounted for the largest subgroup of other incidents in 2018 (n=21). In 11 of these cases, the wastage of the blood component should be considered avoidable. Most of these cases concern a situation in which a blood component was collected from the lab but returned when it became clear that the transfusion would not take place (yet). In two of these cases the component had also already been spiked before determining whether or not the transfusion could be initiated at that moment. In one case, four red blood cell concentrates were left in a cool box in the transfer hatch of an operating room throughout the weekend. This also created a risk of these products erroneously being administered to a different patient the next time the operating room was be used. In another case, failing to cancel a request for blood components led to unnecessy thawing of 22 units of SD-plasma. Of the remaining 10 cases, in which the wastage was either judged inevitable or not assessable, the majority concern situations in which the wastage of (part of) the blood component was caused by an IV access problem which arose during administration. In three of these cases an other reaction was also reported because the access issue caused a large and painful haematoma to develop in the patient. Logically, such an incident, in which extravasation goes unnoticed for a long period of time or in which transfusion is still necessary but might be hindered by the access problem, can also cause undertransfusion. In two reports, leakage created when spiking the blood component caused loss of blood components.

TRIP received a further 18 reports in which the blood component was administered to the patient in full, but in errors or failures occurred, such as: transferring a blood component to a new IV against protocol, infusion in combination with an unsuitable IV solution or medication, an infusion time >6 hours or speed of infusion set too high (11x); failing to provide correct information on Rh D/ minor incompatible platelets at the time of issue, failing to link the blood component to the recipient in LIS on issue, or issues in the administrative procedures surrounding issue of blood components for patients outside the hospital or involving O negative uncrossmatched red blood cell concentrates taken from a blood storage cabinet during an emergency situation (7x). One report described a situation in O negative blood components were transfused to a neonate, as described in protocols, but the second blood group determination and screening of the child had not yet been performed.

Further other incident reports concern cases in which information on was missing on request forms for blood components or a newly found antibody was registered prematurely as an allo-antibody.

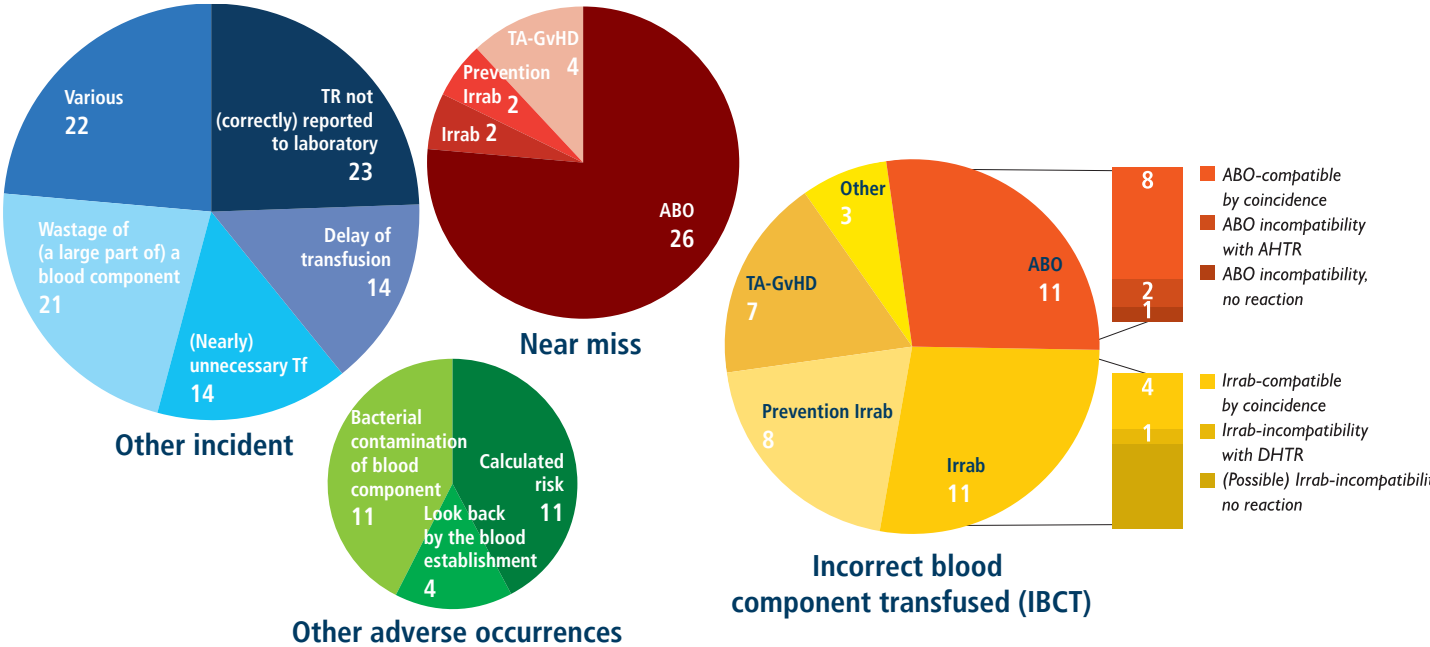

Image: Incidents and adverse occurrences in 2018, divided into subgroups

Table 10. Symptoms (reactions) with other incidents in 2018*

Subgroup	bc	Reaction	Description Analysis following the reaction reveals
Failures in monitoring patients during transfusion	RBC	AHTR	Insufficient documentation of vital signs during transfusion and reaction.
	RBC	Mild NHFR	Maximum infusion time exceeded.
	RBC and Plts	NHTR	Following stem cell apheresis, two blood components were administered in a short time to a patient who was already showing symptoms of an infection prior to the transfusion.
	RBC	Other reaction	Infusion time shorter than prescribed and insufficient documentation of vital signs.
Wastage of (large part of) blood component	RBC	Other reaction	IV tissued, lack of proper checks prior to starting infusion of second blood component, after ten minutes approxi-mately 150ml had infused subcutaneously, after which transfusion was stopped.
	RBC	Other reaction	IV tissued, three blood components infused almost entirely subcutaneously, transfusion of third blood component stopped.
	RBC	Other reaction	IV failed twice, first leaking past the venflon and subcutaneous infusion with a new IV. Transfusion stopped.
	RBC	NHTR	Transfusion erroneously stopped after 15 minutes when temperature went up. Rise in temperature had been predicted for patient and it had been decided to transfuse
	RBC	Mild NHFR	Failure to stop infusion of saline solution during infusion of first blood component, administration stopped after 4 hours' incomplete administration, rise in temperature observed at start of infusion of second blood component.
	RBC	TACO	IV tissued, approximately 145 ml infused subcutaneously, after which transfusion was stopped. With infusion of second blood component dyspnea worsened, transfusion continued after administration of furosemide.

* *Reports of OI in combination with a transfusion reaction are displayed, except for the 23 reports of situations in which a reaction was reported to the laboratory late, insufficiently, or not at all.*
Abbreviations: AHTR=acute hemolytic transfusion reaction; NHFR=non-hemolytic febrile reaction; NHTR=non-hemolytic transfusion reaction; TACO=transfusion associated circulatory overload

A number of 2018 Other incident cases have been described (in Dutch) in the Report of the Month series on www.tripnet.nl:

Report of the month February 2019: Increasing temperature .....
https://www.tripnet.nl/melding-van-de-maand-februari-2019-oplopende-temperatuur/

Report of the month March 2019: Look before you leap.
https://www.tripnet.nl/mvdm-maart-2019-bezint-eer-ge-begint/

Report of the month June 2019: Increasing fever....
https://www.tripnet.nl/melding-van-de-maand-juni-2019-nog-meer-koorts/

Calculated risk situation

A situation where the clinician knowingly decides to proceed with transfusion in the presence of an increased risk or anticipated side effect of the transfusion and where the intended benefit from transfusion is deemed to justify the risk of harm and its possible severity.

11 reports from 5 hospitals (5%), 1-2 reports per hospital

- 1 report with additional category acute hemolytic transfusion reaction
- 4 reports of a reaction with additional category of calculated risk situation: Other reaction (1x) and Post-transfusion bacteremia/sepsis (1x) or with an additional category of calculated risk situation in the past: new allo-antibody formation (2x)

All reports of calculated risk situations from 2018 concern emergency situations in which circumstances did not allow application of preventive transfusion advice for a defined at risk group (n=4), or irregular antibodies that had not previously been demonstrated in the patient were later demonstrated on screening the pre-transfusion sample (n=3). In one case involving concerning a trauma patient, anti-Fya was demonstrated during transfusion of uncrossmatched O-negative blood components. One of the issued red blood cell concentrates was positive for the Fya antigen. The transfusion was stopped immediately, but at that time 1.5 units had already been transfused. There were no clinical symptoms indicating a transfusion reaction, but the laboratory results showed an increase of LDH and bilirubin and a decrease of haptoglobin consistent with hemolysis.

3.2 Non-infectious transfusion reactions

Transfusion-associated circulatory overload, TACO

Dyspnea, orthopnea, cyanosis, tachycardia >100/min. or raised central venous pressure (one or more of these signs) within six hours of transfusion, usually in a patient with compromised cardiac function. Chest X-ray consistent.

134 reports from 43 hospitals (48%), 1-17 reports per hospital

- In 6 reports, other incident was added as an additional category (1x IV site failure; 5x reaction not reported to blood transfusion laboratory)
- Transfusion-associated circulatory overload was reported as an additional category 8 times, 3x with Other reaction, 2x with TRALI, 2x with Post-transfusion bacteremia/sepsis and 1x with a mild NHFR.

In 2018, TRIP received 134 reports of transfusion-associated circulatory overload. The increase in both the total number of reports and the number of reports with a severity grade of 2 or higher (41) that started in 2012 continues unabated (2015: 76; 2016: 87; 2017: 104). For 98% of the reports (n=132) the imputablity was assessed to be possible, probable or definite. As in recent years, the reporting category of TACO encompasses the largest number of reports with a high severity grade. Table 11 shows a break-down of the reports according to severity grade and imputability

Most reports of TACO are related to the administration of one or more red blood cell concentrates (n=120), or the administration of both red blood cell and platelet concentrates (n=6). Some cases are ascribed to the administration of only platelet concentrates (n=6) or plasma (n=1). Only one report concerned a situation of acute major blood loss in which over 15 units of both red blood cells, platelets and plasma were administered.

In six cases TACO occurred in combination with an event classified as other incident, see also Table 10 (section on other incidents). In one case the IV access failed during the administration of a blood component, as a result of which the blood infused subcutaneously for some time, causing a substantial haematoma. This does not appear to have a relation with the patient developing of transfusion-associated circulatory overload during the administration of the previously planned second unit. In the remaining cases, the reaction was not reported to the blood transfusion laboratory. Additionally, in one of the reports of an other incident with an additional category of other reaction, the observed hypertension could have been a symptom of transfusion-associated circulatory overload, but no report of a potential transfusion reaction was made to the blood transfusion lab.

In 2018, TRIP received three reports of other reaction with an additional category of TACO. In one of these cases HPA-1A antibodies were demonstrated in the patient and there was no increment from the administered platelets. However he symptoms observed in this patient, as well as the chest X-ray, could also be interpreted to indicate TACO. Thus the additional category here represents a differential diagnosis and the reaction should most likely be ascribed to the HPA antibodies. The second report details a situation in arrhythmia and cardiac arrest arose during administration of the third successive unit of red blood cell concentrate. Subsequently the patient showed symptoms of circulatory overload, but it was not possible to determine whether the arrhythmia was triggered by TACO. The third case concerns clinical and respiratory deterioration in a patient who had dysrhythmia, heart failure and pneumonia prior to transfusion. The effect of diuretics on this patient is difficult to determine because hypotension occurred after the first dose of furosemide, after which further administration was abandoned. Altogether, the symptoms in this case did not sufficiently fit the criteria for TACO for the reaction to be classified as such. The contribution of the three red blood cell concentrates administered to the deterioration was judged to be minimal, thus the imputability was assessed as unlikely.

An international team, of which TRIP is an active member, has developed a revised definition of TACO and validated it for use in a hemovigilance setting (Wiersum-Osselton JC, Whitaker B, Grey S, et al. Revised international surveillance case definition of Transfusion-associated circulatory overload (TACO): a classification agreement validation study. Lancet Haematology 2019 Jul;6(7):e350-e358. doi: 10.1016/S2352-3026(19)30080-8). With a view to improving the quality of TACO reporting, the Hemovigilance Advisory board at the end of 2018 recommended implementation of the revised international definition of TACO in the Netherlands as of reporting year 2019.

A number of 2018 TACO cases have been described (in Dutch) in the Report of the Month series on www.tripnet.nl: Report of the month November 2018: Acute pain as a result of transfusion? https://www.tripnet.nl/mvdm-november-2018-acute-pijn-ten-gevolge-van-transfusie/

Table 11. Severity and imputability of TACO cases in 2018

Imputability	Total number of reports*	Severity grade			
		1	2	3	4
Definite	7	6	1		
Probable	42	28	11	3	
Possible	83	55	20	3	2
Unlikely	2	1	1		
Total	**134**	**90**	**33**	**6**	**2**

* *For three reports the severity grade was not assessed*

TRALI

Dyspnea and hypoxia within six hours of the transfusion; chest X-ray shows bilateral pulmonary infiltrates. There are negative investigations (biochemical or blood group serological) for hemolysis, bacteriology is negative and no other explanation exists. Depending on the findings of tests of leukocyte serology, report is classified as immune-mediated or unknown cause.

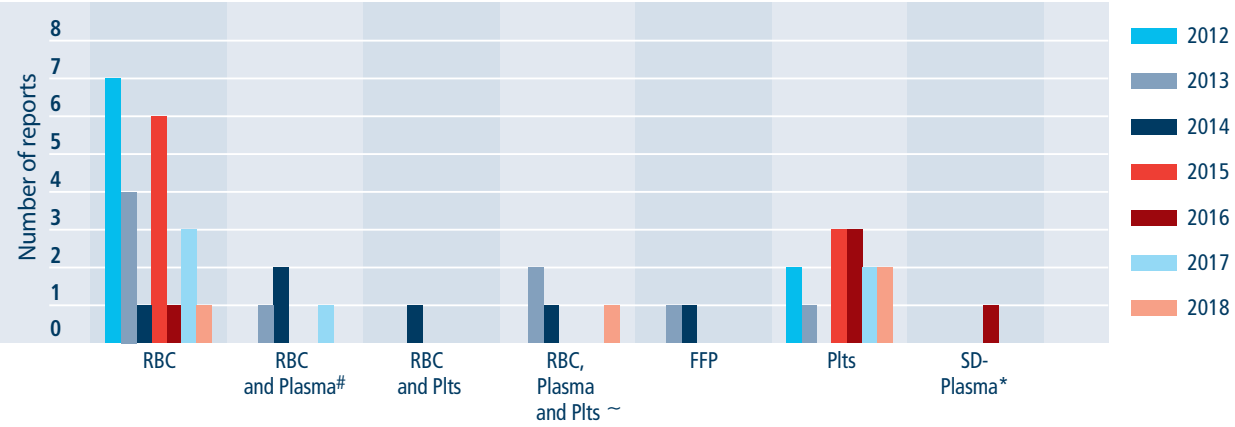

Figure 9. Type of blood component in TRALI reports of definite, probable or possible imputability, 2012-2018

 # concerns RBC + FFP in 2013 and 2014 and RBC + SD Plasma in 2017

~ the plasma concerns FFP up to 2014 and SD-plasma in 2018

** See discussion in 2016 TRIP report: patient with ARDS risk factors and TACO was not fully excluded*

- Four reports from 2018 were registered as TRALI, a number that does not differ significantly from that of other years
- All reports were of severity grade 2 or higher with a definite, probable or possible imputability
- 4x female patients, median age 36 years old
- Figure 9 shows the blood components transfused to patients with reported TRALI from 2012 to 2018.
- For two reports, transfusion-associated circulatory overload was reported as an additional category because features in the patients included findings which could be consistent with transfusion-associated circulatory overload. (In one case there was some improvement after administration of diuretics; the other report described a need for diuresis earlier that day, poor response to diuretics at the time of the reaction and radiology not distinctive.)
- Furthermore, TRALI was reported as an additional category with three reports of transfusion-associated circulatory overload (see section on transfusion-associated circulatory overload). It can be difficult to distinguish between the two types of reactions based on physical examinations, imaging and laboratory investigations. The proposed revised international definition of TRALI also allows for the possibility of a combination both types of complications (Vlaar APJ, Toy P, Looney MR, et al. A consensus redefinition of transfusion-related acute lung injury. Transfusion 2019 Jul;59(7):2465-2476. doi: 10.1111/trf.153).

Transfusion-associated dyspnea, TAD

Shortness of breath or hypoxia during or within 24 hours after a blood transfusion, and the criteria for TRALI, circulatory overload, or anaphylactic reaction are not met. Respiratory problems are the most prominent feature and they cannot be explained by the patient's underlying pathology or other known specific causes.

- 5 reports: 4x with RBC (2x one unit, 2x two units) and 1x with plts (number similar to that of previous years)
- 3x female patients, median age 63 years old, range 28-84 years old
- 2x severity grade 2, 3x severity grade 1, imputability assessed to be possible for all reports
- Interval median 3:04 hours after commencement of administration (range 1:15-4:15)
- In three cases the reaction also involved a rise in temperature and chills
- One serious report was described in the Report of the Month series

Case of TAD: Report of the month July 2019: Is this TAD? https://www.tripnet.nl/is-dat-tad/

Acute hemolytic transfusion reaction (AHTR)

Signs or symptoms of hemolysis occurring within a few minutes of commencement or until 24 hours after a transfusion, such as a drop in systolic and/or diastolic blood pressure of ≥ 20 mmHg, fever/chills, nausea/vomiting, back pain, dark or red urine, no or poor increase of Hb level or an unexpected drop in Hb.

- 16 reports (all with RBC; see Table 12)
- One report of severity grade 3 as a result of transfusion of an ABO-incompatible blood component, transfusion stopped after 5 minutes when symptoms occurred (IBCT registered as additional category)
- Two reports of severity grade 2, in one case because the reaction led to hospitalization from day care unit

Table 12. Acute hemolytic transfusion reaction (AHTR) in 2018

AHTR N=16	No. of reporting hospitals: 10
Age	Median 58 years old, range 26-89 years old
Sex	8 F, 6 M (three reactions occurred in one patient)
Interval	Median interval 2hrs 30 min, range 5 min tot 13 hrs from start of transfusion
Previous Tf and/or pregnancy	Known for 5/6 male patients and 7/8 female patients with AHTR
Severity grade	1x grade 3; 2x grade 2; 11x grade 1; 1x assessment not possible; 1x not stated
Cause	2x (as a result of IBCT) ABO incompatibility (grade 3 and grade 1 respectively) 3x as a result of irregular antibodies (respectively a-Wra, a-Jkb (in an emergency situation), anti-I) 1x possibly as a result of simultaneous infusion of intravenous glucose solution 3x reactions in a transfusion-dependent patient with paroxysmal nocturnal hemoglobinuria; the most pronounced symptoms occurred with the administration of a unit of which the eluate gave a positive crossmatch (no specificity or new antibody demonstrated) The remaining reactions occurred with patients with chronic hemolysis and autologous or nonspecific antibodies.
Imputability	3x definite; 6x probable; 5x possible; 1x assessment not possible; 1x not stated

Delayed hemolytic transfusion reaction (DHTR)

Signs or symptoms of hemolysis occurring from 24 hours to a maximum of 28 days after transfusion, such as: unexplained drop in hemoglobin, dark urine, fever or chills, or laboratory findings indicating hemolysis.

- Four reports of DHTR, all following administration of red blood cell concentrates
- 1x additional category DHTR with report of new allo-antibody
- Median age 58 years old, range 50-81 years old; four out of five DHTR with female patients
- 1x severity grade 2 as a result of (prolongation of) hospitalization; 1x severity grade 1 and 3x severity grade 0.
- Interval after administration: median 9 days, range 7-30 days
- Clinical symptoms (in patients that experienced symptoms): dizziness, shortness of breath/dyspnea, decrease in saturation, increased pulse rate/tachycardia, rise in temperature <1 oC, variable BP, low back ache, pink/red urine
- In all cases irregular antibodies (1x specificity not demonstrated)
- Continued decline in number of reports of DHTR (Figure 10)

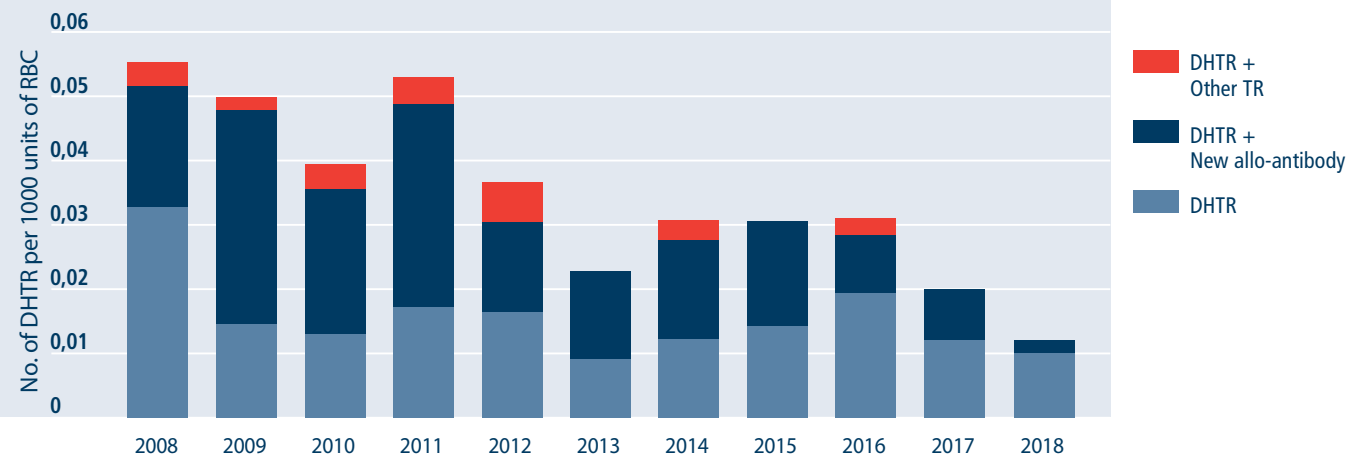

Figure 10. Delayed hemolytic transfusion reaction, 2008-2018

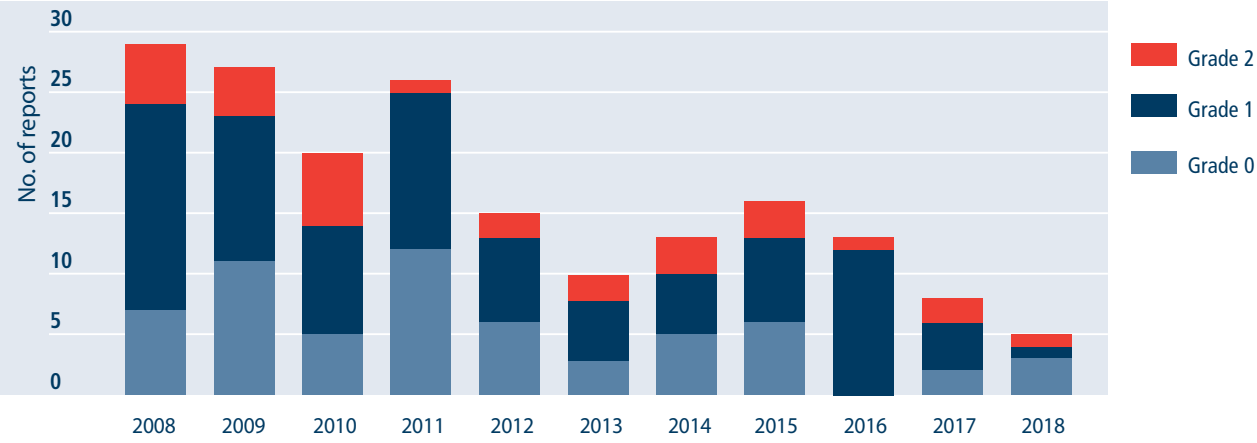

Figure 11. Severity of reports of delayed hemolytic transfusion reactions (main/additional category, excluding IBCT; imputability definite, probable, possible), 2008-2018

Anaphylactic reaction and other allergic reaction 2018

Anaphylactic reaction

Rapidly developing allergic reaction occurring within a few seconds after the start of transfusion or up till a short time after transfusion with features such as stridor, fall in systolic and/or diastolic blood pressure ≥ 20mm Hg, nausea/vomiting, diarrhoea, back pain, skin rash.

Other allergic reaction

Allergic phenomena such as itching, redness or urticaria without objective respiratory, cardio-vascular or gastrointestinal features, arising from a few minutes of starting transfusion until a few hours after its completion.

Information on these reports is summarized in Table 13.

IgA and anti-IgA

In 2018 one anaphylactic reaction was reported in a patient with reduced IgA (to 0.21 g/L, i.e. not IgA-deficient) and the presence of anti-IgA. The national "CBO" transfusion guidelines recommend investigating whether the presence of anti-IgA in an IgA-deficient patient (<0.05mg/dl) could have caused an anaphylactic reaction. In 2018, 21 reports recorded determination of IgA levels as part of investigation of a transfusion reaction (10x with an anaphylactic or other allergic reaction) and in four of these reports low levels of IgA were found (1x non-hemolytic transfusion reaction, 1x other reaction, 2x anaphylactic reaction). Not all patients with an IgA deficiency develop antibodies against IgA and not all patients with anti-IgA have transfusion reactions.

From 2003 to 2018, TRIP has received 5 reports of anaphylactic reactions in which both an IgA-deficiency and the presence of anti-IgA were demonstrated (0.7%); for these patients, blood components donated by IgA-deficient donors may be prescribed for future transfusions.

Table 13. Overview of reports of anaphylactic reaction and other allergic reaction in 2018

	Anaphylactic reaction		Other allergic reaction	
No. of reports	58		135	
Average age, median age (IQR))	51 years old, median 61 (IQR 27-72)		48 years old, median 53 (IQR 17-66)	
Sex	29 F (50%)		64 F (47%)	
Serious reports	15 serious, of which 12 imputability definite, probable or possible		-	
Blood component	Number (% of total)	Reports per 1000 units	Number (% of total)	Reports per 1000 units
Red blood cell concentrate Platelet concentrate FFP SD-plasma Multiple types of blood components (labile and possibly SD-plasma)	20 (34%) 28 (48%) 0 7 (12%) 3 (5%)	0,05 0,50 0,11 	47 (35%) 72 (53%) 0 12 (9%) 4 (3%)	0,12 1,28 0,19
Symptoms (no. of reports) Skin symptoms Itching, urticaria, redness	28		133	
Rise in temperature 1-2 oC ≥2 oC Chills	7 2 6		6 1 3	
Reduced responsiveness/unresponsive	3		-	
Dyspnea/decrease in saturation	27		1	
Decreased blood pressure	20 (12x ≥20 mmHg syst. and/or diast.)		-	
Increased blood pressure	2 (2x ≥20 mmHg syst. and/or diast.)		2 (1x ≥20 mmHg syst. and/or diast.)	
Nausea/vomiting/diarrhoea	9		2	

New allo-antibody formation

After receiving a transfusion, demonstration of clinically relevant antibodies against blood cells (irregular antibodies, HLA or HPA antibodies) that were not present previously (as far as is known in that hospital).

- 654 reports (668 including reports with new allo-antibody formation as an additional category), 796 new allo-antibodies
- 61 reporting hospitals (69%), range of 1-62 reports per hospital
- 292 M and 376 F
- 45 new allo-antibodies in women <45 years old at the time of transfusion
- specificities shown in Table 14.
- formation of anti-D, anti-c, anti-E, or anti-K in 15 women <45 years old: Table 15. No reports of incorrect selection of blood components in this group.

Table 14. New allo-antibodies 2018: most frequent specificities in women and men

New antibody	F <45y/o*	F total	M	Ratio F/M	Percentage (TRIP 2018)	TRIX#
anti-E	8	129	110	1,2	30%	16,7%
anti-K	3	80	72	1,1	19,1%	12,9%
anti-Jka	2	40	21	1,9	7,7%	3,2%
anti-c	4	39	21	1,9	7,5%	5,3%
anti-Fya	10	40	19	2,1	7,4%	4,9%
anti-C	3	20	16	1,3	4,5%	6,2%
anti-Wra	2	16	13	1,2	3,6%	6%
anti-Cw	2	11	11	1,0	2,8%	3,1%
anti-S	1	11	8	1,4	2,4%	2,0%
anti-Lua	-	8	9	0,9	2,1%	-
anti-Kpa	1	9	6	1,5	1,9%	-
anti-D	1	9	5	1,8	1,8%	11,4%
anti-e	2	8	5	1,6	1,6%	0,9%
anti-Jkb	1	7	6	1,2	1,6%	0,8%
anti-Fyb	1	5	5	1,0	1,3%	0,5%
anti-M	2	6	4	1,5	1,3%	9,6%

* *Total: 43; 2 other reports of antibodies concern 1x anti-P1, 1x nonspecific auto-antibodies.*

\# *From: van Gammeren et al. A national Transfusion Register of Irregular Antibodies and Cross (X)-match Problems: TRIX, a 10-year analysis. TRANSFUSION 2019;59;2559–2566*

Table 15. Reports of formation of anti-D, anti-c, anti-E and anti-K in women <45 years old in 2018

Antibody	2017	2018
Anti-D		1 1x emergency Tf of D pos. platelets (2002)
Anti-c		4 1x emergency Tf of c pos. RBC, calculated risk 1x Tf of c pos. RBC in 2007 1x after Tf of 2 units of RBC in 1996, phenotype unknown (also formation of anti-E) 1x previous pregnancy, no c pos RBC
Anti-E	3 1x Tf 2014 (at the time K negative policy only in the hospital) 1x calculated risk in emergency situation 1x Tf in 2002	8 3x Tf 2004 or earlier, typing for E antigen unknown 1x Tf E pos. RBC in 2004 1x Tf of 2 units of RBC in 1996, antigen typing unknown (also formation of anti-c) 1x Tf with platelets 1x after Tf of D pos. RBC to recipient with Rh variant 1x previous pregnancy, no E pos. RBC
Anti-K	5 5x Tf ≤ 2002	3 2x RBC ≤ 2002, typing for K antigen unknown 1x Tf of RBC abroad, typing for E antigen unknown

Other reaction

Transfusion reaction which does not fit into the categories above.

- As in previous years, the category of other reaction represents the fourth largest number of reports of transfusion reactions (289, including two other reactions registered in combination with an other incident)
- Since 2010, other reactions are one of the three categories with the largest number of reports of transfusion reactions of severity grade 2 or higher and with definite, probable or possible imputability (26 in 2018).
- The category includes many reports in which a patient suffered symptoms that do not fit any of the standard categories, and that may (partly) be explained by the patient's illness. Although the patient's underlying conditions may an important differential diagnosis for these reactions, the imputability of a quarter of these reactions was still assessed to be definite or probable, based on the temporal association with the transfusion.

Some reports of other reactions lacking in information

It remains an issue that in 2018 some of the transfusion reactions cannot be registered as anything but other reaction because of a lack of clinical information. In 2018, for instance, the descriptions in some reports resembled transfusion-associated circulatory overload. Yet, because no information was available on the results of physical examination or the effect of the administration of diuretics, the report had to be classified as other reaction.

Other reaction case descriptions (in Dutch) of 2018 reports can be found in the Report of the Month (Melding van de maand) series on www.tripnet.nl, e.g.:
Report of the month August 2019: "Critters" in the blood?
https://www.tripnet.nl/melding-van-de-maand-augustus-2019-beestjes-in-het-bloed/
Report of the month September 2019: Other reaction: the best possible diagnosis?
https://www.tripnet.nl/mvdm-september-overige-reactie-meest-passende-diagnose/

Table 16. Types of reactions that are registered as other reaction (broken down as in previous reports)

Type of reaction	2017	2018	2018 Def., Prob.	2018 Poss.	2018 ≥ severity grade 2*
Reactions with hypotension	52	53	4	46	3
Subgroup: hypotensive transfusion reaction (ISBT)	6	9	1	8	-
Reactions with dyspnea	37	27	3	20	-
Increased blood pressure	13	31	3	22	-
(Possible) cardiac symptoms	12	12	1	8	-
Did not completely fit TRIP definition for standard category	45	55	11	26	5
Unproven sepsis	5	1	1	0	1
Other symptoms	78	110	21	64	17
Total	**249**	**289**	**442**	**186**	**26**

* *Imputability definite, probable or possible*
Abbreviations: Def., Prob.=Imputability definite or probable; Poss.=Imputablity possible

Conclusion other reaction

In 2018, the number of reports classified as other reaction continued to increase. The analysis of all reports of other reactions showed (as in the past) that some reports of other reactions are not well investigated and/or substantiated. Every year, a considerable number of reactions categorized as other reaction concern reactions in which the patient had dyspnea or oxygen desaturation. Adequate clinical review is required in order to provide optimal treatment for a patient.

3.3 Infectious transfusion complications

Bacterial problems associated with blood transfusions

Post-transfusion bacteremia/sepsis

Clinical symptoms of bacteremia/sepsis arising during, directly after or some time subsequent to a blood transfusion, for which there is a relevant positive blood culture of the patient with or without a causal relation to the administered blood component.

- 72 reports from 37 hospitals (41%), 1-9 reports per hospital
- 2 reports with bacterial contamination of blood component as an additional category, see Table 18

Bacterial contamination of blood component

Relevant numbers of bacteria in a (remnant of) blood component or in the bacterial screen bottle of a platelet component, or in material from the same donation, demonstrated by approved laboratory techniques, preferably including typing of the bacterial strain or strains.

- TRIP did not receive any reports concerning receiving a notification from Sanquin of a positive bacterial screening result with consequences for a patient
- 11 reports (4x other reaction, 4x NHR, 1x anaphylactic reaction, and 2x post-transfusion bacteremia/sepsis) with an additional category of bacterial contamination of blood component (Figure 12, Tables 17, 18 and 19).

If post-transfusion symptoms lead to blood cultures being performed and the presence of bacteria in the patient's blood is confirmed, a post-transfusion bacteremia/sepsis is said to have occurred (providing the bacterial species has not previously been cultured from the patient's blood). If the same bacteria are cultured from the administered blood component, the possibility of transfusion-transmitted bacterial infection (TTBI) should be considered (bacterial contamination of product reported as an additional category).

A report is registered the reporting category of bacterial contamination of product (main category) if Sanquin registers a positive culture result at its screening of a platelet concentrate and the patient suffers some form of consequences. Hospitals are requested to report those cases where (sometimes only with hindsight) a patient had symptoms during or after the transfusion or the notification of a (probably) contaminated transfusion had medical consequences for the patient who received the unit. For instance, the patient may need to receive prophylactic antibiotics or undergo additional investigations. TRIP receives overall figures on the screening results from Sanquin (Table 20 on page 36). The additional category of bacterial contamination of a blood component is registered if a (relevant) positive bacterial culture result is returned on a component which has (partly) been transfused and which was tested because of a suspected transfusion reaction (typically performed in the hospital). Remarkably, hospitals sometimes respond to queries from TRIP indicating that Sanquin is not always contacted in these cases. For the safety of other recipients it is important that Sanquin is informed if there is a serious suspicion of transfusion-associated bacteremia/sepsis in a recipient or a microbiologically relevant positive culture of a blood component.

Case descriptions on reports concerning bacterial problems associated with blood transfusions (in Dutch) in 2018 can be found in the Report of the Month (Melding van de maand) series on www.tripnet.nl, e.g.:
Report of the month August 2019: "Critters" in the blood?
https://www.tripnet.nl/melding-van-de-maand-augustus-2019-beestjes-in-het-bloed/

Table 17 shows the number of reports of bacterial problems associated with blood transfusion in the years 2010-2018. The use of the different reporting categories and additional categories relating to bacterial problems is further explained in a diagram on www.tripnet.nl under hemovigilance, additional materials. These materials also include information on how the results of the investigations are used to assess whether a report might represent a case of TTBI. Figure 12 illustrates this process of assessment using the numbers of reports in 2018. For one report of post-transfusion bacteremia/sepsis the same micro-organism was detected in the patient's post-transfusion blood culture as in the culture of the administered blood component. This report was reviewed by the Expert Committee and judged to be a possible case of transfusion-transmitted bacterial infection (TTBI; Table 18).

Table 17. Overview of reports from hospitals relating to bacterial problems 2010-2018

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Post-transfusion bacteremia/sepsis	41	61	50	47	55	79	64	72	72
(cases of TTBI, as assessed by experts)	(3)	(2)	(1)	(2)	(2)	(2)	(3)	(2)	(1)
Post-transfusion bacteremia/sepsis as an additional category (not TTBI)	17	13	14	6	10	4	2	5	1
Bacterial contamination of blood component* (including positive bacterial screening)	44	43	42	25	12	15	10	4	-
Bacterial contamination of blood component (including reports of positive bacterial screening) as an additional category	17	19	16	10	14	7	16	19	11

* *The cases in which bacterial screening by the blood establishment results in a positive culture are provided to TRIP by Sanquin as an overall total, and since 2017 have only been registered for TRIP reporting as an individual report by a hospital if a patient showed symptoms or experienced negative consequences, such as postponement of surgery or the administration of prophylactic medication.*

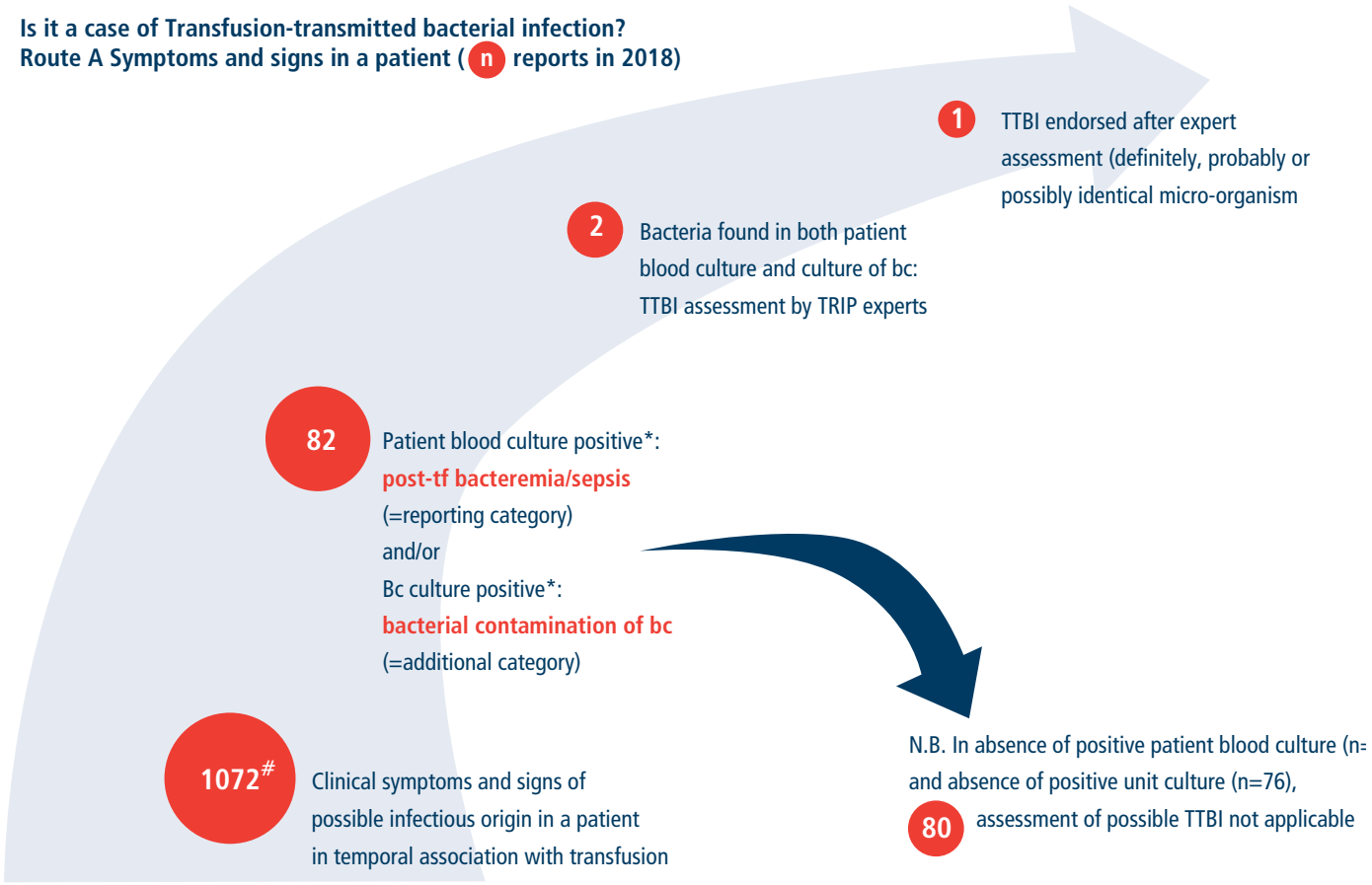

Figure 12. Assessment of TTBI 2018

\# *Number of reports in 2017 concerning reactions with rise/drop in temperature and/or chills*

* *Culture result should be deemed relevant*

Abbreviations: bc=blood component; pt=patient; Tf=transfusion; TTBI=transfusion-transmitted bacterial infection

Table 18. Overview of TTBI assessment in 2018 (Expert meeting April 2019))

Patient blood culture	Unit (culture result in hospital)	BacTalert / Culture by Sanquin	Reporting category	Severity grade	Severity grade Imputability of reaction	bp	TTBI assessment
Group B beta-hemolytic streptococcus	Group B streptococcus	Not stated	Post-transfusion bacteremia/sepsis	2	Probable	TC	Possible
Klebsiella oxytoca	Micrococcus luteus	Not stated	Post-transfusion bacteremia/sepsis	1	Probable	TC	Not applicable

Table 19. Overview of reactions (excluding post-transfusion bacteremia/sepsis) reported with additional category bacterial contamination of product

	Remarks about patient	bp	Remarks about transfusion reaction	Blood component culture[$] (culture performed in hospital) In none of the cases the component screened positively at Sanquin	Patient blood culture	Reporting category
Oncology patients without pre-existing infection	Acute myeloid leukemia	Plts	Rise in temperature <1 °C, unresponsive, urticaria and redness (generalized)	*Arthrobacter* species	not performed	Anaphylactic reaction
	Cervical cancer	RBC	Rise in temperature ≥1 <2 °C	*Staphylococcus warneri* (CNS)	negative	Mild non-hemolytic febrile reaction
	Metastased colorectal cancer	RBC	Rise in temperature ≥1 <2 °C	Aerobic: *Staphylococcus hominis* (CNS) Anaerobic: No growth	negative	Mild non-hemolytic febrile reaction
	Acute lymphatic leukemia	RBC	Rise in temperature ≥2 °C	*Propionibacterium acnes*	not performed	Non-hemolytic transfusion reaction
	Multiple myeloma	Plts	Chills, itching (topical) on head and arms	*Micrococcus luteus*	negative	Other reaction
	Acute myeloid leukemia	Plts*	Rise in temperature ≥2 °C (to 41.7 °C), chills, decrease in saturation, tachypnea, dyspnea, drop in bp (to 95/60), pain in loin and flank, nausea, diarrhoea, warm, clammy/sweaty	*Escherichia coli* (positive culture < 24 hrs after sending to laboratory. The associated units of RBC were recalled and cultured; all cultures remained negative for 7 days)	negative	Other reaction
Oncology patient with pre-existing infection and/or already receiving antibiotics	Non-Hodgkin lymphoma, 6 days postautologous stem cell transplant, febrile neutropenia, had beenon Vancomycin/ Ceftazidim for 1 day	Plts	Chills, drop in bp, nausea	*Micrococcus luteus*	negative	Other reaction
Oncology patient without pre-existing infection	Patient with haemorrhage with fractured femur	RBC	Rise in temperature ≥1 <2 °C	*Aerococcus viridans*	not performed	Mild non-hemolytic febrile reaction
	Patient in emergency department with dyspnea and anemia	RBC	Rise in temperature ≥2 °C	*Staphylococcus aureus*	negative	Other reaction
Total		9				

* *Plts distributed on day 2 (negative to date), administered on day 5*

Abbreviations: bp=blood pressure; Plts=platelet concentrate; RBC=red blood cell concentrate p

Table 20. Overview of bacteriological screening of platelet concentrates by Sanquin

Annual total number (Sanquin)	2010	2011	2012	2013	2014	2015	2016	2017	2018
Platelet concentrates with initial positive result	332	321	238	165	214	190	218	188	185
Units already transfused (platelet concentrates and associated RBC units)	106	125	90	83	80	82	79	96	100*

* *information supplied to Sanquin by hospitals: in two cases a mild reaction was reported, in two cases Sanquin did not receive any response from the hospital*

Post-transfusion viral infection

A viral infection that can be attributed to a transfused blood component as demonstrated by identical viral strains in donor and recipient and where infection by another route is deemed unlikely.

Information from hospitals

In 2018, TRIP did not receive any reports concerning post-transfusion viral infection.

Look-back by the blood establishment

Retrospective notification of a possibly infectious donation, leading to investigation of the recipient for that infection

In 2018, TRIP received four reports from hospitals that were connected to either look-back investigations or recalls (for reasons other than a positive bacterial screening) by Sanquin. One of the cases was concerned a look-back investigation by Sanquin related to a prior donation of a donor of whom a HEV-positive unit was reported. Three cases concerned recalls by Sanquin after a donor contacted the blood establishment about developing symptoms of infection in the days after donation (post-donation information): nothing untoward was reported in the recipients of blood components donated by these donors (3x platelet concentrate).

The Hemovigilance advisory board recommends only reporting a look-back or recall to TRIP if there were consequences for the patient, such as a reaction, prolonged hospitalization, additional treatment, etcetera.

Information from Sanquin

In 2018, 6 seroconversions occurred. As prescribed by the protocol, look-back investigations were performed, but no transmissions were found.

Conclusion infectious transfusion complications

TRIP received no reports of viral infections transmitted in 2018. One report of post-transfusion bacteremia/sepsis (with Group B hemolytic streptococcus; severity grade 2) after administration of a red blood cell concentrate has been assessed as TTBI with possible imputability.

This once again shows that patients in the Netherlands are at a very low risk of contracting an infection through blood transfusion: in 2018, 1 infection occurred from more than 500,000 units transfused.

3.4 Blood management techniques (BMT)

In 2018, one hospital reported two non-hemolytic transfusion reactions, observed with administration of unwashed drain blood after knee joint replacement.

3.5 Reports with SD-plasma (Omniplasma®) in 2018

Use of SD-plasma in The Netherlands

SD stands for solvent-detergent, a pharmaceutical virus reduction method which is applied to pools of donor plasma units. In 2014-2016, Omniplasma®, which is an SD-plasma produced from Dutch plasma donations collected by Sanquin, was progressively introduced as the standard plasma product for transfusion. Sanquin continues to distribute FFP for pediatric use and other special indications.

Because SD-plasma is covered by legislation on pharmaceutical products, hospitals draw up contracts between the hospital pharmacy and the blood transfusion laboratory. In accordance with arrangements made between TRIP and Lareb, the Dutch pharmacovigilance agency, reports of transfusion reactions and/or transfusion incidents are made in the TRIP system. In 2018 the arrangements between TRIP and Lareb were updated such that TRIP has submitted anonymized data on all reactions related to the administration of Omniplasma® to the Lareb pharmacovigilance system since May 2018 (including reports where labile blood components were also administered). After the reports have been coded according to pharmacovigilance practices, the reports are transferred to the European database Eudravigilance. At the same time, the TRIP annual hemovigilance reports continue to provide a complete picture of the transfusion chain.

Figure 1 on page 9 shows the course of the use of SD-plasma. The reports with SD-plasma from 2018 are summarized in Table 21. The categories which represent the largest numbers of reactions are the allergic reactions (anaphylactic and other allergic reactions), as was previously the case for FFP. The general picture, including the number of units administered is compared to the general picture in years when FFP was still the standard component used.

Table 21. Reports associated with SD-plasma in 2018

	2018			
Units distributed	63,373			
Units transfused	56,#14			
	Non-serious reactions		Serious reactions	
Type of reaction	SD only	With SD	SD only	With SD
Anaphylactic reaction	3	2	4	1
Other allergic reaction	12			
Non-hemolytic transfusion reaction (NHTR)	1	2		
New allo-antibody formation		1		
Other reaction		1	1	
TRALI[$]				1
Transfusion-associated circulatory overload (TACO)			1	1
Incidents				
Other incident*	2			

 # Units transfused provided by 84/89 hospitals

$ See discussion in Table 5

** 1x communication error after deciding not to transfuse, 1x unnecessary transfusion based on incorrectly collected blood sample*

Conclusion SD-plasma

The side effects of the use of SD-plasma (Omniplasma®) are similar to the reactions previously reported to TRIP with the use of quarantine fresh frozen plasma.

CHAPTER 4

General information

4.1 TRIP working methods and participation in TRIP reporting

A central registration system for blood transfusion reactions and incidents makes it possible to monitor the transfusion chain, detect weak links and make recommendations for improving transfusion safety. The incidence of known side effects of blood transfusions is tracked and previously unknown reactions to transfusion of current or new blood products can be detected in timely fashion.

TRIP foundation (originally: Transfusion Reactions In Patients) was created in 2001 by representatives of the various professional societies involved in blood transfusion. The national TRIP Hemovigilance and Biovigilance Office has operated a registry for transfusion reactions and incidents since 2003 in collaboration with the contact persons in the hospitals and the national blood service, Sanquin. Since August 2006 TRIP has also run a national reporting system for serious adverse reactions and events in the chain of clinical application of human tissues and cells. When the biovigilance activities were structurally assigned to TRIP the foundation's statutes were changed (2012) and its name became Transfusion and Transplantation Reactions in Patients. The tissue and cell vigilance findings are reported in a separate annual biovigilance report which is also available on www.tripnet.nl under publications/reports.

Reporting to TRIP is anonymous. Though voluntary in principle, it is regarded as the professional standard by the Healthcare Inspectorate (Inspectie voor Gezondheidszorg en Jeugd, IGJ) and the national "CBO" transfusion guidelines (2004 and 2011 versions; the guidelines are under revision as of 2017-2019). Reporting to TRIP is separate from the hospitals' responsibility to provide care.

Over 95% of the reports have been submitted to TRIP digitally since 2012. Since 2016, when a new secure reporting system was taken into use, all reports have been submitted online. Reporters of transfusion reactions and incidents are asked to provide results of relevant investigations and grade the clinical severity of the reaction. The imputability, i.e. the likelihood that the reaction can be ascribed to the administered transfusion, is also assessed. If necessary TRIP requests further explanation or details from the reporter. All reports are reviewed by the TRIP physicians, who assess their coherence and verify the reporting category of (potentially) serious reports. Each year TRIP checks for duplicate reports and merges them in consultation with the reporting hospitals.

An Expert Committee, consisting of experts in the different professional groups who are appointed by the TRIP Board, advises TRIP on the serious and complex reports and on the recommendations based on the data. Only after this review process are the reports included in the annual report. The expert committee is composed of representatives of professional societies and of experts who are appointed for their specialized knowledge in a particular domain; the members are also members of TRIP's Hemovigilance advisory board.

Under the requirements of European Directive 2002/98/EC it is mandatory to report serious adverse reactions and incidents which could have a relation to quality and/or safety of blood components. TRIP provides the analysis of these serious reports (severity grade 2 or higher) and prepares the annual overview for the competent authority, the Ministry of Health, Welfare and Sports (MoH), and the healthcare inspectorate. The hospitals can send the serious reports to the healthcare inspectorate and Sanquin using the TRIP online reporting system.

At the end of each reporting year TRIP receives a copy of Sanquin's annual overview of serious adverse reactions and serious adverse events as reported to the healthcare inspectorate, as well as numbers of distributed blood components. Each year TRIP and Sanquin match up relevant serious reports which have been reported through different routes using anonymous details (date of transfusion, age, sex, type of blood component and general type of reaction), the intention being to ensure that the information in the TRIP database is as complete as possible. If all reports to Sanquin are sent through the TRIP reporting system (even if this might be a duplicate report of a reaction which has already been reported by telephone) this will ensure that they can be matched and that Sanquin always has access to the final classification (diagnosis) of each reaction in the TRIP system.

The value of reporting and collecting transfusion reactions and incidents at the national level depends on the participation of all the reporting establishments. In 2018, TRIP received reports from 81 hospitals. Five hospitals indicated that there had been no reports of incidents or reactions in the TRIP reporting categories. Three hospitals had not provided any information about reports or administered transfusions to TRIP at the time of compiling this report. In 2018, two Dutch hospitals were declared bankrupt; both hospitals had already submitted reports, one of them also submitted data on the number of blood components administered in 2018. The level of participation among hospitals is 87/89=97% for submitting reports and 84/89=94% for submitting data on the number of blood components transfused.

Besides the hospitals, TRIP is in contact with four private clinics which have been licensed by the ministry of health to receive and transfuse blood components (these clinics have contracts with Sanquin or other hospitals for the provision of component selection and crossmatching services). One of the four licensed clinics will start up again in 2019 and has not responded to TRIP's inquiries about whether any units were transfused in 2018. A second has indicated that reports of any reactions would be made through the hospital with which they have a contract for component selection. The other two clinics informed TRIP that no units were transfused in 2018.

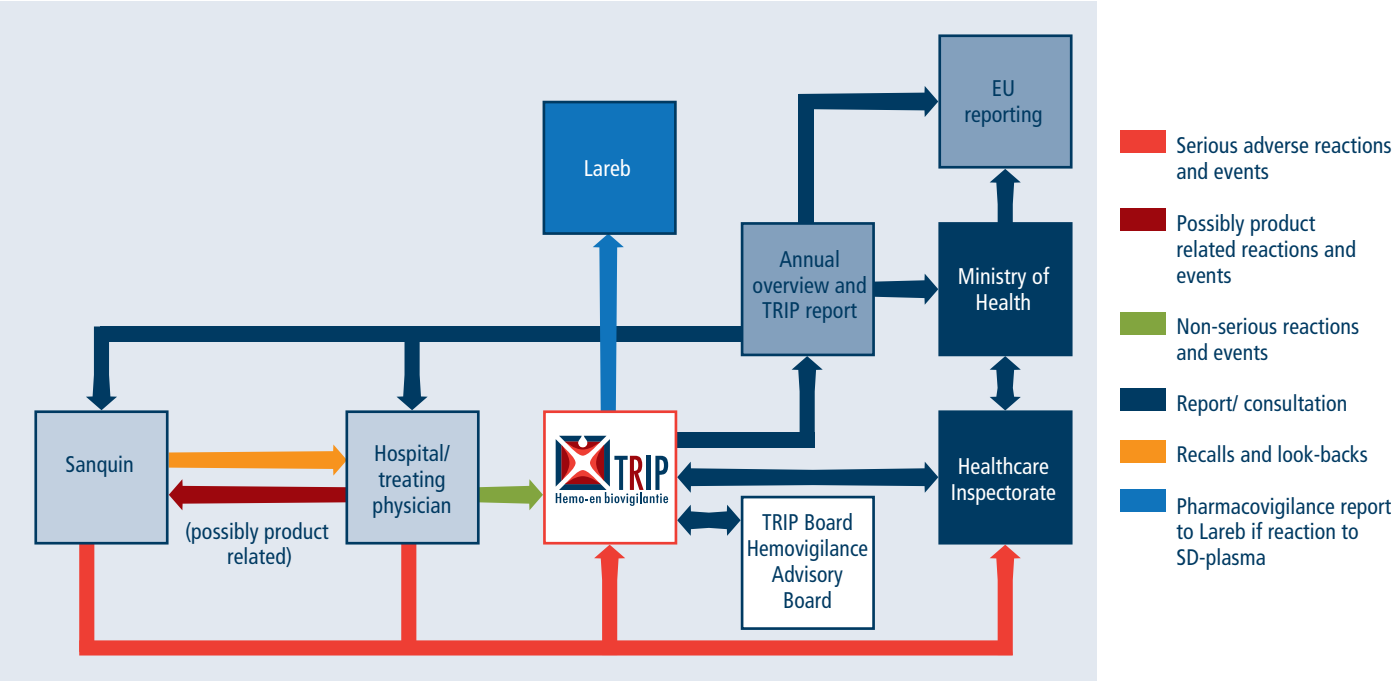

Figure 13. Flow of hemovigilance information and outputs in The Netherlands

List of terms and abbreviations

AHTR	acute hemolytic transfusion reaction
Bc	blood component
BMT	blood management techniques
CBO	CBO quality organisation in healthcare
DHTR	delayed hemolytic transfusion reaction
EU	European Union
FFP	fresh frozen plasma
IBCT	incorrect blood component transfused
Irrab	irregular antibodies
Mild NHFR	mild non-hemolytic febrile reaction
New allo-ab	new allo-antibody formation
NHTR	non-hemolytic transfusion reaction
NM	near miss
OI	other incident
Plts	Platelet concentrate
Post-Tf bact/sepsis	post-transfusion bacteremia/sepsis
Pt	patient
PTP	post-transfusion purpura
RBC	red blood cell concentrate
Sanquin	Sanquin (Dutch national blood establishment)
SD	solvent detergent (a pathogen reduction method)
Sp.	species
TACO	transfusion-associated circulatory overload
TAD	transfusion-associated dyspnea
TA-GvHD	Transfusion-associated graft versus host disease
Tf	transfusion
TR	transfusion reaction
TRALI	transfusion-related acute lung injury
TRIP	TRIP Foundation (Transfusion and Transplantation Reactions In Patients)
TRIX	Transfusion Register of irregular antibodies and X(crossmatch) problems
TTBI	transfusion-transmitted bacterial infection

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TRIP
Hemo- en biovigilantie