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ORIGINAL PAPER

Putting the spotlight on donation-related risks and donor safety – are we succeeding in protecting donors?

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Abstract

Background and objective The European consortium project TRANSPOSE (TRANSfusion and transplantation: PrOtection and SElection of donors) aimed to assess and evaluate the risks to donors of Substances of Human Origin (SoHO), and to identify gaps between current donor vigilance systems and perceived risks.

Materials and methods National and local data from participating organizations on serious and non-serious adverse reactions in donors were collected from 2014 to 2017. Following this, a survey was performed among participants to identify risks not included in the data sets. Finally, participants rated the risks according to severity, level of evidence and prevalence.

Results Significant discrepancies between anticipated donor risks and the collected data were found. Furthermore, many participants reported that national

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data on adverse reactions in donors of stem cells, gametes, embryos and tissues were not routinely collected and/or available.

Conclusions These findings indicate that there is a need to further develop and standardize donor vigilance in Europe and to include long-term risks to donors, which are currently underreported, ensuring donor health and securing the future supply of SoHO.

Key words: blood safety, donors, donor health, hemovigilance.

Introduction

Since the spread of human immunodeficiency virus (HIV) and hepatitis C virus through transfusions and transplantations in the 1980s, both blood and tissue establishments have successfully reduced the risk of transmission of infections [1,2] resulting in very low numbers of transmissions being reported [3–5]. After the introduction of nucleic acid testing (NAT), the risk of transmitting viruses in the transfusion and transplantation chain has further declined, but the concern of transmission to recipients remains [6]. As a consequence, the precautionary principle has been widely applied when establishing eligibility criteria for donors of substances of human origin (SoHO) [7].

Recently, there has been increasing scientific focus on the safety and the well-being of donors. This includes possible adverse reactions in repeat donors, for example long-term effects of frequent donations such as iron deficiency in whole blood donors [8,9] and possible citrate-related osteoporosis in plasma donors [10,11]. Frequent plasma donation, in combination with poor knowledge of nutrition, has now been shown to result in low IgG levels within 3 weeks after beginning plasma donation [12–15] as well as reducing product yield [16].

Donor management in haematopoietic stem cell (HSC) donation poses different issues as donors can be both unrelated (UD) and related (RD). Focus has been on donor management and awareness of the risks to donor health has increased in general, and improving the care of RDs is an area of specific interest. Research in this field has shown that changing accreditation standards may also improve donor safety [17].

In gamete donors, there has been increasing focus on the ethical aspects of donor care. This includes careful information regarding donation-related risks, improving communication and follow-up [18–20] as well as paying attention to the psychosocial aspects of donation [21,22]. For oocyte donors specifically, the long-term risk of cancer following hormone treatment is of concern [23–25].

Post-mortem tissue donation poses other challenges; not only must donation be respectful to the donor but equally to the relatives, who must approve donation. Research in donor care within this field of donation is therefore centred around understanding the ethical dilemmas and supporting the families in their decision-making [26].

In European Union (EU), member states must comply with the relevant Directives concerning blood and tissues. The specific requirements for blood donation are contained in the various annexes in Directive 2004/33/EC and in Directives 2005/62/EC and the associated Good Practice Guidelines contained in Directive 2016/1214. The relevant requirements are also identified in The European Directorate for the Quality of Medicines and Healthcare (EDQM) Guide to the preparation, use and quality of blood components products along with other non-mandatory recommendations.

In 2002, the surveillance of adverse reactions in transfusion recipients (haemovigilance) was first introduced in the Directive 2002/98/EC. Biovigilance (including adverse reactions to cell and tissue transplants) was later incorporated into legislation in Directive 2004/23/EC. Since then, many European countries have implemented donor vigilance systems, although reporting of donor complications is currently only voluntary.

Complications in haemo- and biovigilance are traditionally divided into adverse reactions and adverse events as defined in Directive 2002/98/EC. The first is an unintended response in the donor or recipient related to the donation or transfusion/transplantation. The latter includes accidents and errors related to the collection, testing, processing, storage and distribution of the products, and complications observed during or after donation. Adverse reactions are predominantly described by severity and imputability. Imputability describes the likelihood of a complication being a result of the donation/transplantation/transfusion, as defined in Directive 2005/61/EC. This is rated on a scale from zero (excluded/unlikely) to three (certain). In 2010 the NOTIFY project (https://www.notifylibrary.org/) developed a database which compiles scientific references of complications in haemo- and biovigilance and also vigilance and surveillance reports.

TRANSPOSE aimed to critically evaluate donation-related risks and to identify risks currently not (or insufficiently) included in donor vigilance as well as discrepancies between reported and anticipated donation-related risks.

Methods

TRANSPOSE was initiated in September 2017 and involved 25 associated partners from 15 European countries (https://www.transposeproject.eu) who were directly part of the project and 14 collaborating stakeholders, who could be consulted for external reviews of the project outputs. The participants and stakeholders covered the following domains; blood, plasma, haematopoietic stem cells, gametes, embryos and tissues in the field of donor management. As part of the project, an investigation of current donation-related risks was launched for all SoHO (i.e. whole blood [WB], plasma for fractionation [PFF], HSC and Bone marrow [BM], medically assisted reproduction [MAR, including gametes and embryos] and tissues) excluding solid organs.

Participants working in one of these fields were invited. Relevant disciplines were represented at an academic level, such as transfusion medicine, laboratory testing, public health, epidemiology, risk assessment, behavioural sciences, marketing, economics and project management. Furthermore, the project was built on existing relationships, for example the DOMAINE project and the Erasmus Lifelong Learning Programme 'Donor Health Care'. In addition, stakeholders from both European and global bodies and organizations within the field of transfusion, transplantation and donor health were also invited.

Reported risks to donors

The data collection is illustrated in Fig. 1 and took place in the spring of 2018. All TRANSPOSE participants were asked to provide donor vigilance data and to include data on both serious and non-serious adverse reactions, regardless of severity. Data provided for tissue donors included both living (bone) and deceased donors (ligaments, tendon, ocular tissue, heart valves and other). Furthermore, participants were asked to send data from the previous 3 years and, if data for 2017 were not accessible at the time, then to provide data for 2014–2016.

Data from the European Commission (EC) annual reporting on serious adverse reactions for blood, blood products, cells and tissue were not included, since they neither include non-serious adverse reactions nor the total number of donations. Furthermore, reporting donor adverse reactions is not mandatory and many countries are currently not providing data. The EC reports of serious adverse reactions (SAR) could therefore not be used for statistical purposes. Also, including these data, which are largely anonymized by state, would give the risk of including the same data twice, when pooling them with the provided national data. We therefore chose to exclude the reports from this analysis.

From the data received, reported adverse reactions were included regardless of level of imputability. Furthermore, only data that stated the denominators were included. For whole blood and plasmapheresis, the data were compiled according to the International Society of Blood Transfusion's (ISBT)/International Haemovigilance Network (IHN) 2014 definitions of categories of adverse reactions in donors [27]. The analysis of complications rates and most common risks were subsequently performed on the compiled data.

Anticipated risks to donors

First, a database of risks to donors was compiled using the original risk categories from the donor vigilance reports.

Then, methodological triangulation was used to complete the list of known and anticipated donor risks. We took advantage of expert knowledge within the TRANSPOSE collaboration to identify donor risks currently not included in donor vigilance. This included risks described in literature and theoretical risks. The process is shown in Fig. 2. Based on this work, the final list of risks to donors was compiled. A method for classification was then developed that would allow participants to rate each risk. It was agreed that this should include an estimate of prevalence, available scientific evidence and an assessment of the impact of the risk to the donor.

Statistics

For each SoHO, all donor vigilance data were pooled and the numbers presented are total numbers from the combined reports. Proportions were calculated using the combined data. Confidence intervals were calculated using the Wilson procedure without correction for continuity.

Results

Donor vigilance data

The overall results of the data collection are presented in Table 1. Three stakeholders provided national reports where the data on adverse reactions in whole blood donation and plasmapheresis had been combined. These results have been presented separately in Table 1, as it was not possible to access raw data and further subcategorize according to type of donation.

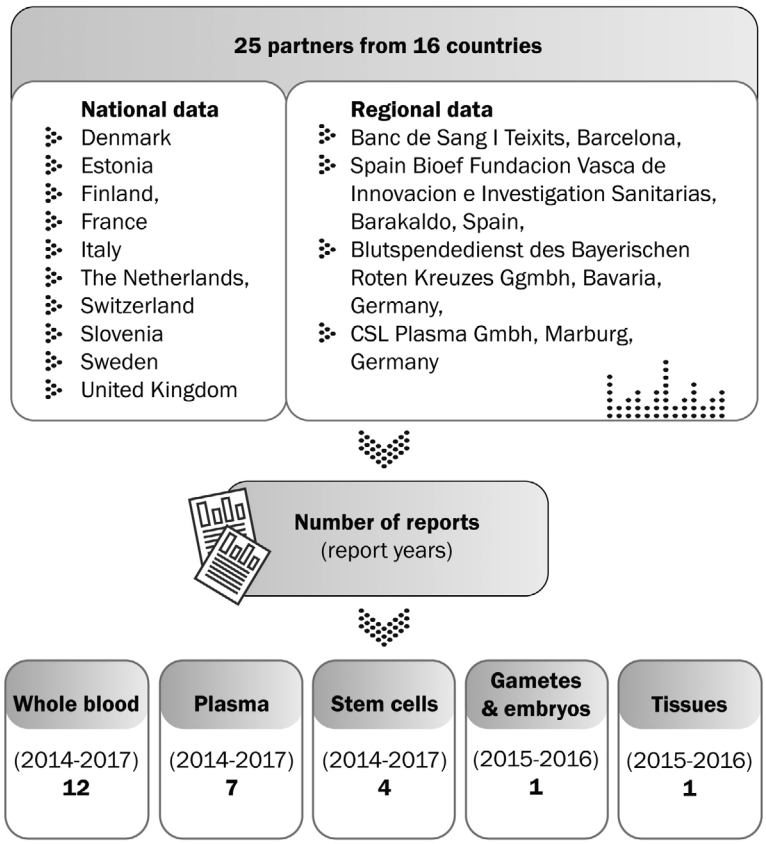

Fig. 1 TRANSPOSE collection of donor vigilance data.

Whole blood (WB) and plasma for fractionation (PfF)

Characteristics of the data collection are shown in Table 2. Two organizations adhered completely to ISBT definitions of adverse reactions in donors and three organizations included the total number of complications divided by gender and first-time vs. repeat donor, with one organization also stratifying by age and donation site. The results of the data collection according to ISBT definitions are shown in Table 3, and the data from the three organizations that had combined their data for whole blood and plasmapheresis are presented in a separate column. The plasmapheresis results were dominated by one organization where the adverse reactions were defined by severity and not by categories of complications, and therefore these have all been labelled as 'other'. Overall, most organizations subdivided vasovagal reactions by timing of reaction (on-site/off-site) and did not include details on loss of consciousness (LOC). Only one organizations had subcategorized LOC into duration of < or >60 s. There were a total of 33 and 27 categories describing donor adverse reactions across all the received data, for WB and PFF respectively.

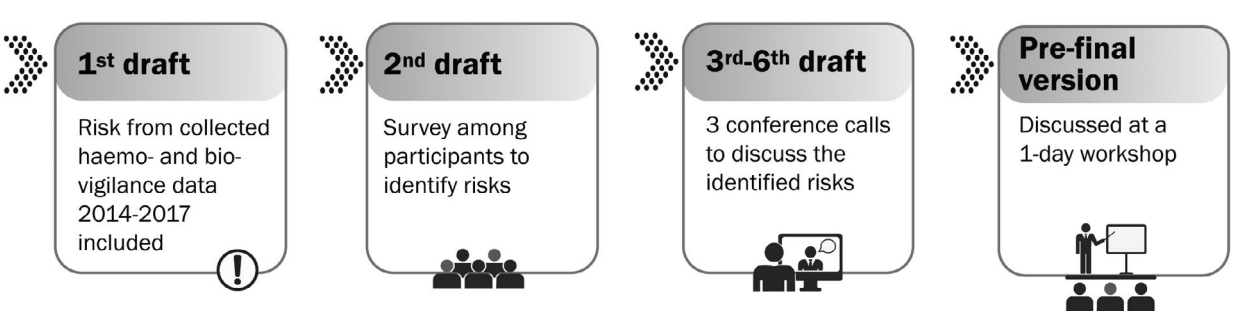

Fig. 2 The TRANSPOSE work process to identify risk to donors of SoHO.

Table 1 Complications in the donation of SoHO reported by TRANSPOSE participants

Donors	Report years	Total number of donations	Total number of complications	Complication rate
Whole blood	2014–2017	19 721 150	95 871	0·0049 (0·0049–0·0049)
Plasma	2014–2017	1 979 972	12 577	0·0064 (0·0063–0·0065)
Unspecified type of blood donation	2014–2017	15 848 803	37 012	0·0023 (0·0023–0·0023)
Haematopoietic stem cells	2014–2017	10 744	135	0·0126 (0·0107–0·0149)
Medically assisted reproduction	2015–2016	378 078	17	0·00004 (0·0–0·0)
Tissues	2015–2016	42 405	0	0

The complication rates are presented as proportions (95% CI) of the total number of complications. Three countries provided the combined data for whole blood and plasmapheresis. These are presented in the third row as 'unspecified type of blood donation'.

Haematopoietic stem cells (HSC), medically assisted reproduction (MAR) and tissues

Characteristics of the data collection for these categories are shown in Table 4. Table 5 details the results for HSC and tissues; only few of the participating organizations could provide data for these SoHO. For MAR, it was noted that the vast majority of donations were sperm donations without any registered adverse events/reactions.

Anticipated risks to donors

The assessment of anticipated risks is presented in Table 6. Each risk was rated according to the level of evidence, severity and prevalence. Prevalence was defined as the participant's personal estimate of the prevalence among all the donors who were available for donation. For comparison of the ratings by the different participants, a total score based on each individual rating was calculated for each risk. This score was the product of the severity, level of evidence and prevalence ratings. To rank the risks from unlikely to highly likely, the individual total scores for each risk was compiled and a mean total score was calculated. The highest rated risks were then compared to the risks reported in the vigilance data to identify discrepancies.

TRANSPOSE participants identified 40 risks in total across all types of SoHO that they believed should be part of donor vigilance. Thirty-three of these risks were commonly known risks directly related to the donation procedure. Seven risks concerned long-term health issues as a result of donation, some that are currently not part of the reported donor vigilance. They included induced cancer, autoimmune disease, osteoporosis, cytopaenia(s), psychosocial complications, and low levels of iron, protein and immunoglobulin. Due to the different nature of the SoHOs, some risks were not equally relevant to all donors.

For WB, the long-term risk of iron deficiency was the highest rated anticipated risk to donors followed by adverse reactions directly associated with the donation procedure: vasovagal reactions, haematomas and nerve damage. The highest rated risk to plasma donors was vasovagal reaction. This was directly linked to the concern of volume overdraws in plasma donors when the donation volume is solely estimated based on body weight especially in those donors who have an uneven balance in body weight and plasma volume, for instance, due to obesity. The highest rated long-term risks for plasma donors was iron deficiency (rated fourth) and low protein and/or Immunoglobulin levels which was the seventh highest rated risk to plasma donors.

For haematopoietic stem cell donation, the highest rated risks were directly associated with the donation procedure. However, a potential long-term risk of autoimmune disease and cytopenia was a concern despite being rated as having a low level of evidence and prevalence. For all SoHOs, the risk of psychosocial complications to donation, for example anxiety, donation stress and the loss of working capacity following donation, was mentioned as risks that should be included in future donor vigilance.

Discussion

Data from 12 countries over 4 years and for four types of SoHO showed that reported donor complications rates are low even when including non-serious reactions. However, as reporting is not mandatory a significant degree of underreporting is likely. Even so, the total number of complications in blood, plasma and stem cells were substantially higher than the combined numbers of the 2015–2017 EC reports (19 177 SAR on blood donors and 163 SAR in HSC donors.

There is already international consensus on the need for a standardized donor vigilance system [28] and work has been done to harmonize current systems [29]. However, our results for WB and PFF show that despite consensus there is still variation in the categories included in donor vigilance. Furthermore, there is a significant variation in how these adverse events/reactions are recorded

Table 2 Characteristics of whole blood and apheresis data collection in the participating organizations

Organization	Taxonomy used for adverse reactions	Severity criteria used	Minimum severity in the data	Imputability criteria used	Minimum level of imputability in the data
1	Local definition	Grade 1–3	None	No	None
2	ISBT/IHN 2014 definitions with additional categories	Grade 1–3	≥2	Yes	≥2
3	ISBT/IHN 2014 definitions	Mild/Moderate/Severe	None	Yes	≥1
4	Local definition	Non-severe/Severe	Only for citrate reactions (min. severe)	No	None
5	Local definition	Mild/Moderate/Severe (SHOT* definition for severe)	None	No	None
6	ISBT/IHN 2014 definitions with additional categories	Grade 1–4	None	Yes	≥1 and including NE**
7	None	No	None	No	None
8	ISBT/IHN 2014 definitions with additional categories	Mild/Moderate/Severe	None	No	None
9	ISBT/IHN 2014 definitions	Grade 1–3	≥1	Yes	≥1
10	ISBT/IHN 2014 definitions	IHN*** criteria	≥2	Yes	None
11	ISBT/IHN 2014 definitions	Mild/Moderate/Severe (SHOT definition for severe)	Severe	Yes	≥1
12	Common Approach for SARE reporting to the European Commission	Grade 1–4	≥2	Yes	None
13	Local definition	Mild/Moderate/Severe	None	No	None
14	Local definition	Mild/Moderate/Severe	None	No information	No information

*Serious Hazards of Transfusion. **Not able to evaluate.

according to imputability and/or severity as well as donor demographics. This continues to make international comparison complicated and affects the overall collective quality of data being collected.

TRANSPOSE participants agreed that adverse reactions which transform healthy donors to patients should be reported. This also includes reactions that have a negative influence on quality of life. The majority of the potential long-term effects of donation are risks that can be mitigated through clinical tests including routine monitoring of ferritin, immunoglobulin, protein levels and a bone density scan. Psychosocial complications can be addressed through validated donor questionnaires including the 12-item Short Form Survey. Assessment of the risk of cancer and autoimmune disease in donors relies on a valid clinical monitoring of the general population in order to identify an increased risk among donors. Within the field of HSC, long-term adverse reactions such as iatrogenic malignancy, is already part of donor vigilance. Collaboration and exchange of experience across SoHOs could improve follow-up in all types of donors.

Importantly, the risk of iron deficiency in WB donors, deemed the most important risk by the participating stakeholders, was only included in one haemovigilance report. This despite current literature supporting that iron deficiency in WB donors is considered a relevant risk that should be addressed to improve both donor care and donor health [30,31]. However, this would require both ferritin monitoring by the blood collecting facilities and consensus on how non-anaemic iron deficiency should be defined and mitigated.

Only limited data for HSC, MAR and tissue donation were received. The participants commented that this was probably due to the fact that collecting donor complication data is not mandatory on a European level. However, the WMDA do collect mandatory data from registered member countries, predominantly European, on SARs in HSC donors. In their 2018 report, 62% of SARs in donors occurred >30 days after donation and 52% were non-haematological malignancy and autoimmune disease, which are to be reported by Worldwide Network for Blood and Marrow Transplantation standards regardless if causal connection to donation is established [32]. Our data for HSC donors suffered from being both very heterogenic in terms of adverse reaction categories and also included non-

Table 3 Adverse reactions to whole blood and plasma donation

	Whole blood		Plasmapheresis		Unspecified type of blood donation	
	Total number	Proportion of total adverse reactions (95% CI)	Total number	Proportion of total adverse reactions (95% CI)	Total number	Proportion of total adverse reactions (95% CI)
A. Complications mainly with local symptoms						
A 1. Complications mainly characterized by the occurrence of blood outside the vessels.						
A1.1 Haematoma	17 064	0·178 (0·1756–0·1804)	3155	0·2509 (0·2434–0·2586)	5797	0·1566 (0·1529–0·1604)
A1.2 Arterial puncture	599	0·0062 (0·0057–0·0067)	32	0·0025 (0·0017–0·0036)	102	0·0028 (0·0023–0·0034)
A1.3 Delayed bleeding	215	0·0022 (0·0019–0·0025)	11	0·0009 (0·0005–0·0016)	0	0·00 (0·00–0·00)
Complications mainly characterized by pain						
A2.1 Nerve injury/irritation	396	0.0041 (0·0037–0·0045)	38	0·003 (0·0022–0·0042)	193	0·0052 (0·0045–0·006)
A2.2 Other Painful arm	568	0·0059 (0·0054–0·0064)	88	0·007 (0·0057–0·0087)	147	0·004 (0·0034–0·0047)
A3. Local inflammation/infection	68	0·009 (0·0005–0·0009)	13	0·001 (0·0006–0·0018)	82	0·0022 (0·0018–0·0027)
A 4. Other major blood vessel injury						
A4.1 Deep Venous Thrombosis	7	0·0001 (0·0001–0·0002)	1	0·0001 (0·00–0·0005)	0	0·00 (0·00–0·00)
A4.2 AV fistula	0	0·00(0·00–0·00)	0	0·00(0·00–0·00)	4	0·0001 (0–0·003)
A4.3 Compartment syndrome	0	0·00(0·00–0·00)	0	0·00(0·00–0·00)	0	0·00 (0·00–0·00)
A4.5 Brachial pseudoaneurysm	0	0·00(0·00–0·00)	0	0·00(0·00–0·00)	0	0·00 (0·00–0·00)
B. Complications mainly with generalized symptoms: vasovagal reactions						
B1.1 Vasovagal reaction with loss of consciousness	0	0·00(0·00–0·00)	0	0·00(0·00–0·00)	747	0·0202 (0·0188–0·0217)
B1.2 with injury	99	0·001 (0·0008–0·00012)	1	0·0001 (0–0·0005)	69	0·0019 (0·0015–0·0024)
B1.3. without injury	531	0·0055 (0·005–0·006)	20	0·0016 (0·001–0·0025)	0	0·00 (0·00–0·00)
B2.1 Vasovagal reaction without loss of consciousness	3229	0·0337 (0·0326–0·0349)	120	0·0095 (0·0079–0·0114)	7648	0·2066 (0·2025–0·2108)
B2.2 with injury	0	0·00(0·00–0·00)	0	0·00(0·00–0·00)	0	0·00 (0·00–0·00)
B2.3 without injury	0	0·00(0·00–0·00)	0	0·00(0·00–0·00)	0	0·00 (0·00–0·00)
C. Complications related to apheresis						
C.1 Citrate reactions	-	-	1404	0·1116 (0·1062–0·1173)	833	0·0225 (0·021–0·0241)
C.2 Haemolysis	-	-	0	0·00(0·00–0·00)	0	0·00 (0·00–0·00)

Table 3 (Continued)

	Whole blood		Plasmapheresis		Unspecified type of blood donation	
	Total number	Proportion of total adverse reactions (95% CI)	Total number	Proportion of total adverse reactions (95% CI)	Total number	Proportion of total adverse reactions (95% CI)
C.3 Air embolism	-	-	0	0·00(0·00–0·00)	0	0·00 (0·00–0·00)
C.4 Infiltration	-	-	45	0·0036 (0·0027–0·0049)	0	0·00 (0·00–0·00)
D. Allergic reactions						
D.1 Allergy (local)	51	0·0005 (0·0004–0·0007)	8	0·0006 (0·0003–0·0013)	13	0·0004 (0·0002–0·0007)
D.2 Generalized allergic reaction (anaphylactic reaction)	1	0·00(0·00–0·00)	8	0·0006 (0·0003–0·0013)	13	0·0004 (0·0002–0·0007)
E. Other serious complications related to blood donation						
E.1 Major cardiovascular event	25	0·0003 (0·0002–0·0004)	10	0·0008 (0·0004–0·0015)	13	0·0004 (0·0002–0·0007)
F. Other complications						
F.1 Other	27 891	0·2909 (0·288–0·2938)	4715	0·3749 (0·3664–0·3834)	923	0·0249 (0·0233–0·0266)
Other vasovagal reactions categories						
VVR unspecified	9229	0·0963 (0·0944–0·0982)	147	0·0117 (0·0099–0·0138)	0	0·00 (0·00–0·00)
VVR onsite	32 793	0·3421 (0·3391–0·3451)	2561	0·2036 (0·1966–0.2108)	17 447	0.4714 (0.4663–0·4765)
	143	0·0015 (0·0013–0·0018)	13	0·001 (0.0006–0·0018)	0	0·00 (0·00–0·00)
-with injury						
	0	0·00(0·00–0·00)	0	0.00(0·00–0·00)	0	0·00 (0·00–0·00)
-without injury						
VVR off site	2870	0·0299 (0·0288–0·031)	187	0·0149 (0·0129–0·0172)	2981	0·0805 (0·0778–0·0833)
	105	0·0011 (0·0009–0·0013)	0	0·00(0·00–0·00)	0	0·00 (0·00–0·00)
-with injury						
	56	0·0006 (0·0005–0·0008)	0	0·00(0·00–0·00)	0	0·00 (0·00–0·00)
-without injury						
Total	95 871	1	12 577	1	37 012	1

Three countries provided the combined numbers for whole blood and plasma donations, and these are presented in the last column as 'unspecified type of blood donation'.

Table 4 Characteristics of haematopoietic stem cells, medically assisted reproduction and tissues data collection in the participating organizations

Organization	Taxonomy used for adverse reactions	Follow-up time after donation	Severity criteria used	Minimum severity in the data	Imputability criteria used	Minimum level of imputability in the data
Haematopoietic stem cells						
1	Common Approach for SARE reporting to the European Commission	Related: No standardized requirements but up to 1 year Unrelated: 5 years	Grade 1–4	≥2	Yes	None
2	Vigilance and Surveillance of Substances of Human Origin (SOHO VℰtS) Guidance for Competent Authorities	Unrelated: 10 years recommended	Vigilance and Surveillance of Substances of Human Origin (SOHO VℰtS) Guidance for Competent Authorities	≥2	Yes	≥1
3	WMDA S(P)EAR*	Unrelated: 10 years	WMDA S(P)EAR	None	Yes	None
4	Unspecified	1 year	Non-severe/severe	Severe	No	None
5	NOTIFY	Minimum 6 months	Grade 1–4	None	Yes	≥1
Medically assisted reproduction and tissues						
1	Common Approach for SARE reporting to the EC	-	Grade 1–4	≥2	Yes	None
2	Vigilance and Surveillance of Substances of Human Origin (SOHO VℰtS) Guidance f or Competent Authorities	-	Vigilance and Surveillance of Substances of Human Origin (SOHO VℰtS) Guidance for Competent Authorities	≥2	Yes	≥1

*World Marrow Donor Association Serious (Product) Events and Adverse Reactions.

Table 5 Most frequent adverse reactions in stem cell and gamete donors reported by TRANSPOSE participants

	Total number of complications	Proportion of the total number of complications
Haematopoietic stem cells		
Citrate reactions	58	0·4296 (0·3449–0·5139)
Adverse reactions to granulocyte-colony stimulating factor	8	0·0593 (0·0304–0·1126)
Medically Assisted reproduction		
Ovarian hyperstimulation syndrome	8	0·4706 (0·2617–0·6904)
Pelvic inflammatory disease	3	0·1765 (0·0619–0·4103)
Bladder lesion	3	0·1765 (0·0619–0·4103)

The complication rates are presented as proportions (95% CI) of the total number of complications.

Table 6 Classification of donor risks; all risks and categories were rated according to descriptions

Score	Estimated level of evidence	Estimated severity	Estimated prevalence
1	Not accessible	Minor injuries or discomfort. No medical treatment or measureable physical effects.	<0·001%
2	Theoretical: no cases described	Injuries or illness requiring medical treatment. Temporary impairment	0·001%–0·01%
3	Possible: few cases described not confirmed	Injuries or illness requiring hospitalization	0·01%–1%
4	Likely: few cases described and confirmed	Injury or illness resulting in permanent impairment	1%–10%
5	Definite: frequently described and confirmed	Fatal	>10%

serious adverse reactions. This may account for the differences between our data and the WMDA report. However, a general concern for both data collections was the underreporting of adverse reactions in related allogenic donors in comparison with unrelated donors [33].

Conclusion

In Europe, donor complications are rare but probably underreported. The reporting is very heterogenic and non-standardized despite international consensus. In order to ensure the health of donors, we should first collaborate to implement a standardized donor vigilance system. An international focus on donor vigilance is strongly needed and should be a key priority for all stakeholders including regulatory bodies and national competent authorities.

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Conflicts of interest

The authors declare no conflicts of interest.

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