

# The 'Donor of the Future Project' — first results and further research domains

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## Vox Sanguinis

**Background** The Alliance of Blood Operators initiated a project labelled 'Donor of the Future'. This study gives an overview of the project results, in particular with regard to country differences.

**Study Design and Methods** A large survey ( $N = 7663$ ) among blood donors in six countries was conducted to analyse the effects of five global areas of change: (1) demographic change; (2) technological developments; (3) health innovations; (4) public, behavioural and attitudinal aspects; and (5) political, economic and environmental issues.

**Results** The main results exhibited similarities and differences between blood donors of the participating countries. Greater differences were found, for example, regarding technological developments. Whereas only blood donors from the UK and Australia would like to be informed via SMS, blood donors from all countries would like to be informed via email.

**Conclusion** Different priorities of donors have been uncovered. These differences give suggestions to improve the country-specific donor management. Furthermore, the key findings provide a comprehensive overview of major future research domains.

**Key words:** blood donors, blood management, future changes, international survey.

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## Introduction

During recent decades, blood services were confronted with a steadily shrinking donor base and a varying blood demand [1]. Reasons are manifold, such as ageing populations, medical innovations and stricter deferral criteria [2, 3]. Consequently, learning more about trends influencing the future blood donor behaviour is important for blood donor services worldwide. Therefore, the Alliance of Blood Operators (ABO) [4, 5] instructed the Donor Engagement and Relationship Group (DERG) to analyse the 'Donor of the Future' in six different countries. Hence, internal workshops discussing future developments from an organizational perspective were realized. As a result,

the experts of DERG identified the following five main areas of change: (1) demographic change; (2) technological developments; (3) health innovations; (4) public, behavioural and attitudinal aspects; and (5) political, economic and environmental issues.

Keeping this ABO project background in mind, the purpose of this article is twofold: first, this study presents the empirical results of the 'Donor of the Future Project' and discusses relevant differences between countries. Therewith, the nature of the article is rather practical than theoretical oriented. Nevertheless, we aim to integrate the topic in recent research and theory on blood donor management and try to create awareness for a deeper knowledge on donor behaviour issues. Second, we aim to identify future research topics for each area of change, and consequently, to provide new ideas for the blood donor management research community.

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Against this background, our study makes three key contributions to blood donor management research. First, in contrast to previous studies that have examined individual present age factors relevant to blood donations, this study focuses on societal changes and future trends in blood donation behaviour. Second, in contrast to previous studies on societal megatrends mostly focusing on one country or context [6–9], this study analyses and discusses five areas of change among six countries. Third, by learning about changes influencing blood donors, this study also contributes to the discussion on how to incentivize [10, 11], recruit and retain blood donors best [12–15].

### Five areas of change

Blood services accepted the need to recognize changing circumstances in society and try to react to new patterns influencing blood donation behaviours. Therefore, we explain the five areas of change identified by DERG experts in a short overview and therewith frame our study:

#### Demographic change

The demographic change is characterized by declining birth rates and an increasing life expectancy [16]. The shifting age structure of the population is followed by a decreasing number of donors [1, 17]. Additionally, the ethnical diversity of the population grows due to increasing migration [18]. However, many members of minority groups do not donate in their host country and most ethnic groups do not share the same blood characteristics [19], resulting in a shortage of minority blood types [20, 21]. Consequently, the need for a more ethnically diverse blood donor pool grows [19].

#### Technological developments

Technological developments ultimately change and improve the communication between donors and blood services [9]. Furthermore, the donation process can be simplified, as the predonation health history questionnaire can be completed online, and more donor health data can be stored [22]. Similarly, these technologies can be used to promote donation events online. Hence, it is important for blood services to know which technologies donors prefer.

#### Health innovations

Health innovations create possibilities for blood services to offer diversified products and special health services, including health-protecting solutions [1, 23, 24]. In contrast, these health innovations have the potential to expand donor requirements. The increasing mobility of

individuals contains new risks for patients, such as new infections or identification of new pathogens [17]. The donation process may become stricter, resulting in increasing donor loss [23]. Donors need to comply with more requirements, but expect to donate without side-effects [25]. An evaluation of how innovations affect donors is needed.

#### Public, behavioural and attitudinal aspects

Individualization is a process experienced by a population due to changing circumstances [1] and is defined with regard to personal identity, individual needs and cultural norms [26]. Even if the general donation motives, such as awareness, reciprocity and altruism [27], stay the same, other factors may change. Thus, a greater diversity of donors occurs. For instance, prior studies have shown the influence of family and peers on younger donors to donate for the first time [2, 28, 29]. Blood services want to know which special groups are important. In addition, a multicultural population [20] also results in a developing community. Migration leads to an intermixing of cultural norms and motives through the various population subgroups [30]. Blood services need to be aware of how the community's blood donation reasons change.

#### Political, economic and environmental issues

The World Health Organization (WHO) supports and promotes globally voluntary non-remunerated donations [31]. But prior studies show the stimulating effect of incentives [32] due to compensating effects [10, 24]. On the other hand, previous studies provide evidence that incentives do not affect the quantity of blood donations [13]. Thus, various incentives are used, which provide a non-monetary allowance [23, 33]. However, not all incentives are positively perceived [34], and withdraw from using incentives may even cause negative consequences [13]. Blood services need to understand which incentives should be used or avoided in the future. Furthermore, incentives may not be the right tool to meet the blood product demand. A solution could be sharing blood products across borders [9], but blood services have to be aware of consequences for their donor bases.

## Materials and methods

### Participants and procedure

In July 2014, the DERG co-operated with the University of Amsterdam and the University of Hamburg to conduct a survey to assess the identified changes from a blood donor perspective. Donors from eight blood services in six countries co-operated (Table 1).

All blood services sent out the questionnaire to blood donors of their donor base aged between 17 and 50 years (identical for all blood services), whereby the required size was between 1500 and 2000 blood donors. Blood services were asked to send out as many questionnaires as needed to generate comparable sample sizes per country. The upper age limit guarantees a participant pool of donors who were able to donate at least the next 10 years.

The questionnaire was mailed to about 47 000 donors, who received a reminder after 2–3 weeks. Participants were not offered an incentive, leading to a return rate of 16.3% (or 7663 questionnaires). However, response rates differ between countries. Reasons might be the relationship of donors to the organizations or if donors are used to getting survey invitations. For example, in the Netherlands and Germany, where regularly surveys take place, invited blood donors show the highest response rates. Anyhow, participating donors may have a generally higher possibility to keep donating in the future.

As 493 respondents only answered an initial question and did not answer the questions regarding the five areas of change, the final sample consisted of 7170 questionnaires. The sample's mean age was 36.3 years. More female donors (53.7%;  $n = 3848$ ) participated. The majority (95.4%;  $n = 6843$ ) were active donors. Of those, 81.7% ( $n = 5855$ ) donate whole blood, 8.7% ( $n = 624$ ) double red cells, 5.3% ( $n = 378$ ) platelets and 10.0% ( $n = 719$ ) plasma. The majority, 53.6% ( $n = 3845$ ), stated to have donated up to three times, and 24.5% ( $n = 1756$ ) donated six or more times. The sample characteristics can be found in Table 2, whereby the reader should keep in mind that the sample is not representative for the general population in each country (see limitations).

## Measurement

The questionnaire was developed based on the insights the DERG gained from analysing the five areas of change [5]. To increase the validity and to assess the effect of the

five areas of change on blood donation behaviour, the questionnaire was discussed and adjusted due to the feedback of DERG experts. The questionnaire started with an introduction, followed by the changing areas. (1) Demographic change was measured with three items related to age or ethnic background. (2) Technological developments were measured with twelve questions, focusing on information source, communication devices or other developments. (3) Seven questions measured health innovations. Three questions covered the patients' perspective; four questions covered the donors' situation. (4) Nine questions covered the public, behavioural and attitudinal aspects, containing donors' perspectives and expectations. (5) Political, economic and environmental issues were measured with ten questions including various incentives and one question about sharing blood products across countries (see Table 3).

## Statistical analysis

To analyse the data, we used statistical software (SPSS, version 21). All variables were descriptively analysed. To compare the countries, we used univariate analyses of variance (ANOVA), since the data shows variance homogeneity (significant Levene test results) and an approximate normal distribution (skewness and kurtosis values =  $|\pm 3|$  and  $z$ -values =  $|\pm 2.58|$ ). Answers with a score of 7–5 were considered to be positive, of 4.99–3 neutral and of 2.99–1 negative. In addition, we adjusted for gender and age effects using  $t$ -test for independent samples (Table 3). Using a median split approach, age was divided into two groups (younger: 17–36 years; older: 37–50 years).

## Results

The ANOVA results of the different countries illustrate significant differences. Due to the large sample size, these differences are only small prompting cautious interpretations.

**Table 1** Participating countries and organizations

Country	Blood service	Participants	Response rate
Australia (AU)	Australian Red Cross Blood Service	1522	14.94
Canada (CA)	Canadian Blood Services	851	17.02
Germany (GER)	German Red Cross Blood Donor Service North-East German Red Cross Blood Donor Service Baden-Wuerttemberg-Hessen	1412	30.11
The Netherlands (NL)	Sanquin Blood Supply	1351	33.80
United Kingdom (UK)	NHS Blood and Transplant	305	15.25
United States of America (USA)	American Red Cross America's Blood Centers	2221	10.58

**Table 2** Sample characteristics

	Total	AU	CA	GER	NL	UK	USA
<b>Number (%)</b>	<b>7170 (100)</b>	<b>1432 (20.0)</b>	<b>814 (11.4)</b>	<b>1289 (18.0)</b>	<b>1264 (17.6)</b>	<b>288 (4.0)</b>	<b>2083 (29.1)</b>
Gender							
Male	2878	606	308	527	561	98	778
Female	3848	767	461	662	643	117	1138
Not stated	444	59	45	85	60	13	167
Age							
17–24	996	182	164	280	188	27	155
25–34	1855	236	199	456	361	83	520
35–44	1958	205	205	415	359	91	683
45–50	1764	606	199	32	298	74	555
Not stated	597	203	47	106	58	13	170
Country of birth							
Same as organizational location	6255	1105	675	1106	1164	252	1813
Other	362	253	86	33	35	21	95
Not stated	553	74	53	150	65	36	175
Do you (still) donate blood?							
Yes	6843	1389	778	1216	1191	277	1992
No	217	27	16	66	60	8	40
Not stated	110	16	20	7	13	3	51
What do (did) you usually donate? (multiple answers possible)							
Whole blood	5855	1195	726	1140	965	260	1569
Double red cells or red cells	624	–	10	7	4	1	602
Platelets	378	53	15	8	18	5	279
Plasma	719	302	16	58	200	0	143
Don't know or unsure	487	39	91	136	132	29	60
How many times did you donate in 2013?							
0 times	727	165	110	156	153	33	110
Once	909	139	106	277	150	45	192
2 times	1378	185	161	329	220	49	424
3 times	1558	302	121	206	239	80	610
4 times	962	292	105	183	118	27	237
5 times	362	44	73	44	114	5	82
6 or more times	432	124	56	33	101	6	112
Don't know or unsure	838	178	82	61	169	33	315
Not stated	4	3	0	0	0	0	1

## Demographic change

The results show that all donors would appreciate a permissible age higher than the limit of 69 years. Donors from Australia ( $M = 2.65$ ), Canada ( $M = 2.62$ ) and the UK ( $M = 2.61$ ) would not approve a maximum age limit, whereas donors from Germany ( $M = 3.09$ ), the Netherlands ( $M = 3.17$ ) and the USA ( $M = 3.58$ ) rated this as neutral. For donors in the USA, this result is not surprising, because there is no upper age limit [35]. Overall, younger donors ( $M = 3.28$ ) evaluated a maximum age limit more positive than older donors ( $M = 2.90$ ). Regarding the registration of ethnic background, five countries rated this change positive. Only Germany indicated this registration neutral ( $M = 4.51$ ). Altogether, female donors

( $M = 5.96$ ) were more positive regarding the ethnic registration than male donors ( $M = 5.60$ ).

## Technological developments

Concerning the information source, five countries rated receiving information and support online neutral, whereas the Netherlands evaluated this as rather negative ( $M = 2.91$ ). Donors in the USA ( $M = 5.02$ ) and the UK ( $M = 5.01$ ) would like to be informed online at the website. Donors in the Netherlands ( $M = 2.96$ ) liked to be informed by social media less. Donors from the UK ( $M = 5.04$ ) and Australia ( $M = 5.19$ ) preferred receiving information via SMS. The possibility to be informed via email was rated positively by all countries. Moreover, this

Table 3 Five areas of change – mean values, standard deviations and ANOVA results

	Total M (SD)	AU M (SD)	CA M (SD)	GER M (SD)	NL M (SD)	UK M (SD)	USA M (SD)	Gender Male vs. female	Age Younger vs. older
<b>Demographic change</b>									
If I can, I'd be happy to continue donating when I am over 69	5.99 (1.499)	6.30 <sup>b</sup> (1.220)	6.16 <sup>b</sup> (1.359)	5.66 <sup>c</sup> (1.670)	5.81 <sup>d</sup> (1.529)	6.30 <sup>b</sup> (1.404)	5.96 <sup>c</sup> (1.522)	5.99 < 6.00 n.s.	5.90 < 6.09***
I would approve a maximum age limit to donate blood <sup>f</sup>	3.09 (1.935)	2.65 <sup>b</sup> (1.776)	2.62 <sup>b</sup> (1.674)	3.09 <sup>c</sup> (1.994)	3.17 <sup>c</sup> (1.882)	2.61 <sup>b</sup> (1.764)	3.58 <sup>d</sup> (2.025)	3.00 < 3.11*	3.28 > 2.90***
I have no objection when my ethnic background is recorded, which may better meet future patient needs for specific ethnicity-related blood products	5.78 (1.797)	6.24 <sup>c</sup> (1.427)	6.18 <sup>abc</sup> (1.466)	4.51 <sup>d</sup> (2.284)	5.72 <sup>c</sup> (1.729)	6.53 <sup>b</sup> (1.164)	6.04 <sup>a</sup> (1.520)	5.60 < 5.96*	5.68 < 5.90***
<b>Technological developments</b>									
I am likely to donate more in the future because of more online information and support being available	3.95 (1.803)	4.02 <sup>b</sup> (1.664)	4.13 <sup>b</sup> (1.683)	3.52 <sup>c</sup> (1.760)	2.91 <sup>d</sup> (1.637)	4.23 <sup>b</sup> (1.634)	4.67 <sup>a</sup> (1.722)	3.90 < 3.98 n.s.	3.97 > 3.93 n.s.
I would prefer to be informed about blood donation events in the future	4.61 (1.944)	4.32 <sup>b</sup> (1.894)	4.89 <sup>a</sup> (1.810)	4.31 <sup>b</sup> (2.117)	4.24 <sup>b</sup> (1.909)	5.01 <sup>a</sup> (1.844)	5.02 <sup>a</sup> (1.839)	4.45 < 4.72***	4.68 > 4.54**
Online at the website of the blood service	3.59 (2.141)	3.46 <sup>b</sup> (2.024)	4.01 <sup>a</sup> (2.181)	3.18 <sup>c</sup> (2.208)	2.96 <sup>d</sup> (1.856)	3.96 <sup>a</sup> (2.163)	4.09 <sup>a</sup> (2.150)	3.37 < 3.73***	3.91 > 3.27***
By social media (e.g. Facebook, Twitter)	4.11 (2.228)	5.19 <sup>b</sup> (1.853)	3.79 <sup>c</sup> (2.188)	3.43 <sup>d</sup> (2.294)	3.39 <sup>d</sup> (2.101)	5.04 <sup>b</sup> (1.939)	4.27 <sup>a</sup> (2.194)	4.10 < 4.13 n.s.	3.97 > 4.24***
By SMS/text messaging	5.63 (1.663)	5.86 <sup>b</sup> (1.387)	5.87 <sup>b</sup> (1.517)	5.65 <sup>b</sup> (1.872)	5.15 <sup>c</sup> (1.793)	6.02 <sup>b</sup> (1.380)	5.61 <sup>a</sup> (1.639)	5.66 > 5.65 n.s.	5.51 < 5.78***
By e-mail	5.35 (1.721)	5.56 <sup>ab</sup> (1.506)	5.67 <sup>b</sup> (1.516)	5.09 <sup>c</sup> (2.045)	4.98 <sup>c</sup> (1.767)	5.64 <sup>ab</sup> (1.534)	5.44 <sup>a</sup> (1.647)	5.35 < 5.39 n.s.	5.30 < 5.43**
Through computer or laptop	4.89 (2.031)	5.24 <sup>ab</sup> (1.881)	5.03 <sup>ab</sup> (1.995)	4.37 <sup>c</sup> (2.352)	4.50 <sup>c</sup> (2.076)	5.53 <sup>b</sup> (1.748)	5.07 <sup>a</sup> (1.972)	4.96 > 4.85*	5.02 > 4.79***
Through smartphone	4.20 (2.131)	4.36 <sup>a</sup> (2.008)	4.50 <sup>a</sup> (2.065)	3.38 <sup>c</sup> (2.292)	4.13 <sup>d</sup> (2.060)	4.97 <sup>b</sup> (1.916)	4.43 <sup>a</sup> (2.057)	4.29 > 4.14**	4.22 > 4.21 n.s.
Through other new technologies (e.g. google glasses)	3.15 (1.993)	3.20 <sup>b</sup> (1.884)	3.44 <sup>b</sup> (1.832)	2.34 <sup>b</sup> (1.832)	3.04 <sup>c</sup> (1.872)	3.68 <sup>a</sup> (1.987)	3.51 <sup>a</sup> (2.087)	3.28 > 3.04***	3.19 > 3.11 n.s.
I would prefer to complete the predonation health history questionnaire online in the future	4.76 (2.014)	4.61 <sup>b</sup> (1.919)	5.19 <sup>a</sup> (1.867)	4.20 <sup>c</sup> (2.200)	4.84 <sup>d</sup> (1.960)	5.26 <sup>a</sup> (1.685)	5.50 <sup>a</sup> (1.734)	4.74 < 4.78 n.s.	4.64 < 4.91***
I would donate blood less in the future if blood services promoted donation online (e.g. tweets, games, postings) <sup>R</sup>	2.41 (1.613)	2.89 <sup>c</sup> (1.689)	2.54 <sup>b</sup> (1.599)	2.21 <sup>a,d</sup> (1.653)	2.16 <sup>d</sup> (1.411)	2.35 <sup>ab</sup> (1.502)	2.32 <sup>a</sup> (1.599)	2.49 > 2.35***	2.23 < 2.55***
Required more health data about me <sup>R</sup>	2.52 (1.632)	2.26 <sup>b</sup> (1.530)	2.26 <sup>b</sup> (1.498)	2.89 <sup>a</sup> (1.773)	2.26 <sup>b</sup> (1.394)	2.05 <sup>b</sup> (1.395)	2.79 <sup>a</sup> (1.733)	2.61 > 2.43***	2.53 > 2.49 n.s.
<b>Health innovations</b>									
I would donate blood more often in the future if									

Table 3 (Continued)

	Total M (SD)	AU M (SD)	CA M (SD)	GER M (SD)	NL M (SD)	UK M (SD)	USA M (SD)	Gender Male vs. female	Age Younger vs. older
The blood needs of patients increased	5.01 (1.781)	4.79 <sup>b</sup> (1.840)	4.80 <sup>b</sup> (1.864)	4.54 <sup>c</sup> (1.928)	5.30 <sup>a</sup> (1.551)	4.96 <sup>b</sup> (1.834)	5.36 <sup>a</sup> (1.629)	4.89 < 5.10***	5.17 > 4.87***
It was made clear that more donations were needed to support medical advances	4.86 (1.773)	4.82 <sup>b</sup> (1.791)	4.74 <sup>b</sup> (1.816)	4.22 <sup>c</sup> (1.891)	5.15 <sup>a</sup> (1.584)	4.92 <sup>b</sup> (1.743)	5.13 <sup>a</sup> (1.676)	4.77 < 4.92**	4.97 > 4.76***
I would be disappointed if I could not donate in the future because of stricter requirements for blood donation	5.15 (1.837)	5.15 <sup>c</sup> (1.822)	5.16 <sup>a,c</sup> (1.842)	5.05 <sup>c</sup> (1.942)	4.83 <sup>d</sup> (1.789)	5.66 <sup>b</sup> (1.597)	5.33 <sup>a</sup> (1.804)	5.02 < 5.25***	5.22 > 5.09**
I would donate more in the future if blood services offer health checks	4.78 (1.779)	4.59 <sup>a,b</sup> (1.736)	4.38 <sup>b</sup> (1.681)	5.21 <sup>c</sup> (1.804)	5.00 <sup>d</sup> (1.689)	4.53 <sup>a,b</sup> (1.791)	4.72 <sup>a</sup> (1.815)	4.85 > 4.74*	5.01 > 4.60***
It would have a great positive influence on my future blood donation behaviour if									
Donating was less time-consuming	3.93 (2.071)	3.71 <sup>c</sup> (2.010)	4.50 <sup>a</sup> (2.049)	3.51 <sup>d</sup> (2.115)	3.38 <sup>d</sup> (1.945)	4.06 <sup>b</sup> (2.317)	4.43 <sup>a</sup> (1.990)	4.02 > 3.87**	3.91 < 3.98 n.s.
A needle-free method was invented	3.60 (2.061)	3.72 <sup>b</sup> (2.007)	3.95 <sup>b,b</sup> (2.015)	3.08 <sup>c</sup> (2.101)	2.89 <sup>c</sup> (1.851)	3.85 <sup>a,b</sup> (2.057)	4.10 <sup>a</sup> (2.024)	3.54 < 3.64 n.s.	3.61 > 3.59 n.s.
I was told how my blood was used	4.20 (2.004)	4.09 <sup>b</sup> (1.905)	4.57 <sup>a</sup> (1.989)	4.40 <sup>a</sup> (2.105)	3.47 <sup>c</sup> (1.879)	4.22 <sup>a,b</sup> (2.053)	4.47 <sup>a</sup> (1.960)	4.11 < 4.28**	4.60 > 3.86***
Public, behavioural and attitudinal aspects									
Who would have a great influence on your future blood donation behaviour?									
My family	4.22 (2.201)	4.02 <sup>d</sup> (2.219)	4.42 <sup>c</sup> (2.186)	4.17 <sup>d</sup> (2.309)	3.58 <sup>b</sup> (2.052)	3.68 <sup>b</sup> (2.255)	4.80 <sup>a</sup> (2.054)	4.20 < 4.23 n.s.	4.34 > 4.13***
My friends	3.58 (2.062)	3.36 <sup>d</sup> (1.988)	3.63 <sup>c</sup> (2.097)	3.58 <sup>c</sup> (2.142)	2.97 <sup>b</sup> (1.830)	2.96 <sup>b</sup> (1.863)	4.18 <sup>a</sup> (2.050)	3.58 > 3.57 n.s.	3.82 > 3.37***
My colleagues	3.05 (1.897)	2.99 <sup>d</sup> (1.812)	3.19 <sup>c</sup> (1.955)	2.74 <sup>b</sup> (1.853)	2.39 <sup>c</sup> (1.532)	2.53 <sup>b,c</sup> (1.652)	3.71 <sup>a</sup> (1.983)	3.11 > 2.99*	3.11 > 3.00*
Celebrities/public figures	1.99 (1.456)	2.07 <sup>d</sup> (1.368)	1.94 <sup>d</sup> (1.448)	1.61 <sup>b</sup> (1.226)	1.83 <sup>d</sup> (1.256)	1.80 <sup>b,d</sup> (1.253)	2.32 <sup>a</sup> (1.697)	2.07 > 1.92***	1.96 < 2.02 n.s.
I believe more people will donate blood in the future because									
Of better awareness of the need	5.56 (1.400)	5.58 <sup>b</sup> (1.323)	5.60 <sup>b</sup> (1.366)	5.05 <sup>c</sup> (1.709)	5.79 <sup>a</sup> (1.141)	5.55 <sup>b</sup> (1.352)	5.69 <sup>a,b</sup> (1.335)	5.41 < 5.66***	5.55 < 5.57 n.s.
Of greater connection with the community	4.89 (1.636)	5.13 <sup>c</sup> (1.494)	5.16 <sup>c</sup> (1.537)	4.17 <sup>d</sup> (1.796)	4.42 <sup>b</sup> (1.564)	4.62 <sup>b</sup> (1.543)	5.39 <sup>a</sup> (1.475)	4.86 < 4.91 n.s.	4.81 < 4.97***
Of more medical advances, which require blood to extend patients' lives	4.95 (1.588)	5.11 <sup>c</sup> (1.478)	5.00 <sup>c</sup> (1.530)	4.24 <sup>d</sup> (1.733)	4.68 <sup>b</sup> (1.529)	4.90 <sup>b,c</sup> (1.486)	5.43 <sup>a</sup> (1.441)	4.84 5.03 ***	4.89 5.01**
They want to make a difference in patients' lives.	5.50 (1.421)	5.59 <sup>b,c</sup> (1.327)	5.71 <sup>a,c</sup> (1.309)	4.90 <sup>c</sup> (1.726)	5.40 <sup>d</sup> (1.298)	5.44 <sup>b,d</sup> (1.410)	5.81 <sup>a</sup> (1.268)	5.33 < 5.62***	5.51 > 5.49 n.s.
They want to feel better about themselves	5.19 (1.519)	5.25 <sup>b,c</sup> (1.458)	5.40 <sup>b,c</sup> (1.447)	5.02 <sup>d</sup> (1.626)	4.80 <sup>c</sup> (1.518)	5.09 <sup>b,d</sup> (1.453)	5.42 <sup>a</sup> (1.469)	5.15 < 5.22*	5.25 > 5.14**
Political, economic and environmental issues									
I believe donors in the future should be rewarded	3.80 (2.041)	3.02 <sup>b</sup> (1.885)	3.22 <sup>b,c</sup> (1.931)	4.35 <sup>d</sup> (2.014)	3.27 <sup>c</sup> (1.885)	3.07 <sup>b,c</sup> (1.866)	4.60 <sup>a</sup> (1.920)	3.92 > 3.72***	4.01 > 3.62***
I would donate in the future if I received Payment	3.22 (2.222)	2.51 <sup>b</sup> (1.940)	3.05 <sup>c</sup> (2.220)	3.62 <sup>d</sup> (2.261)	2.93 <sup>c</sup> (2.072)	2.66 <sup>b,c</sup> (2.041)	(2.298)	3.36 > 3.11***	3.66 > 2.86***

Table 3 (Continued)

	Total	AU	CA	GER	NL	UK	USA	Gender	Age
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	Male vs. female	Younger vs. older
Time off work	3.81 (2.226)	3.23 <sup>b</sup> (2.109)	3.76 <sup>c</sup> (2.238)	4.07 <sup>a</sup> (2.271)	3.76 <sup>c</sup> (2.184)	3.44 <sup>b,c</sup> (2.173)	4.14 <sup>a</sup> (2.217)	3.87 > 3.75*	4.18 > 3.51***
Discounts	3.57 (2.158)	2.92 <sup>b</sup> (2.002)	3.50 <sup>d</sup> (2.196)	3.65 <sup>d</sup> (2.147)	3.16 <sup>c</sup> (2.033)	3.07 <sup>b,c</sup> (2.000)	4.35 <sup>a</sup> (2.113)	3.66 > 3.51**	3.94 > 3.28***
Certificates	3.33 (2.122)	2.70 <sup>d</sup> (1.878)	3.35 <sup>b</sup> (2.150)	2.87 <sup>c,d</sup> (1.999)	3.17 <sup>b</sup> (2.033)	3.12 <sup>b,c</sup> (2.017)	4.19 <sup>a</sup> (2.144)	3.45 > 3.24***	3.63 > 3.10***
Voucher	3.59 (2.139)	2.93 <sup>b</sup> (1.994)	3.38 <sup>c</sup> (2.151)	3.81 <sup>d</sup> (2.074)	3.07 <sup>b</sup> (1.991)	3.01 <sup>b</sup> (1.940)	4.43 <sup>a</sup> (2.093)	3.64 > 3.56 n.s.	3.95 > 3.32***
Small gifts at the time of donation	3.49 (2.108)	2.73 <sup>b</sup> (1.890)	3.16 <sup>c</sup> (2.043)	4.04 <sup>a</sup> (2.081)	3.09 <sup>c</sup> (1.983)	2.76 <sup>b</sup> (1.927)	4.16 <sup>a</sup> (2.107)	3.55 > 3.43*	3.87 > 3.17***
Public recognition	2.87 (1.960)	2.58 (1.802)	2.73 <sup>b,c</sup> (1.881)	3.24 <sup>d</sup> (2.089)	2.81 <sup>a,b</sup> (1.921)	2.75 <sup>a,b,c</sup> (1.908)	2.95 <sup>a</sup> (2.009)	3.07 > 2.72***	3.14 > 2.65***
No reward	5.11 (1.978)	5.59 <sup>b</sup> (1.774)	5.58 <sup>b</sup> (1.775)	4.13 (2.211)	5.25 <sup>d</sup> (1.817)	5.68 <sup>b</sup> (1.675)	5.01 <sup>a</sup> (1.949)	4.90 < 5.26***	5.07 < 5.13 n.s.
I would continue to donate in the future even if blood components were shared across borders to help patients in other countries	5.39 (1.918)	5.69 <sup>c</sup> (1.758)	5.51 <sup>b,c</sup> (1.952)	5.69 <sup>c</sup> (1.865)	5.22 <sup>a</sup> (1.720)	5.33 <sup>a,b</sup> (1.980)	5.08 <sup>a</sup> (2.087)	5.39 < 5.40 n.s.	5.58 > 5.21***

Significant differences ( $P < 0.001$ ) using ANOVA and REGWF post hoc test ( $P < 0.05$ ). Controls: Age differences were detected by using median split. Significant differences using t-test for independent samples:  $P < 0.001$ \*\*\*;  $P < 0.01$ \*\*;  $P < 0.05$ \*; n.s. = not significant. Measured on a seven-point Likert scale from 1 = strongly disagree to 7 = strongly agree.

<sup>a,b,c,d,e</sup>Means that shared superscripts are not significantly different ( $P > 0.05$ ).

<sup>R</sup>Reverse-coded items.

item showed the highest mean values among all other sources. Clearly, younger donors showed preferences to be informed via website ( $M = 4.68$ ) and social media ( $M = 3.91$ ).

Regarding the communication device, all countries were positive towards a computer or laptop, whereas smartphones were rated positively by Australia ( $M = 5.24$ ), Canada ( $M = 5.03$ ), the UK ( $M = 5.53$ ) and the USA ( $M = 5.07$ ). Other new technologies were perceived neutrally by the countries, except for Germany, which evaluated this negatively ( $M = 2.34$ ). Overall, younger donors showed a higher mean value regarding smartphone ( $M = 5.02$ ) and male donors were more open for new technologies ( $M = 3.28$ ).

Regarding other technological innovations, three countries evaluated the completion of the predonation questionnaire neutral, whereas Canada ( $M = 5.19$ ), the UK ( $M = 5.26$ ) and the USA ( $M = 5.50$ ) assessed this as positive. The need for more health data and the promotion of donation events online would not affect the future behaviour. Regarding age, older donors preferred to complete the predonation questionnaire online ( $M = 4.91$ ) and were more sceptical regarding online promotion ( $M = 2.55$ ).

### Health innovations

The country-specific 'health innovation' results were more diversified. While four countries stated to be neutral about donating more if the need of patients increases, the Netherlands stated to be neutral towards stricter requirements ( $M = 4.83$ ). We found female donors to be more upset if requirements increase ( $M = 5.25$ ). However female ( $M = 5.10$ ) and younger donors ( $M = 5.17$ ) showed higher mean values for 'need of patients increases'. Donors from the Netherlands ( $M = 5.15$ ) and the USA ( $M = 5.13$ ) would support medical advances. This is also true for younger donors ( $M = 4.97$ ). Offering a health check stimulates donations in Germany ( $M = 5.21$ ), the Netherlands ( $M = 5.00$ ) and of younger donors ( $M = 5.01$ ). Donors from the Netherlands were sceptical about the invention of a needle-free donation method ( $M = 2.89$ ). However, younger donors would like to know how their blood was used ( $M = 4.60$ ).

### Public, behavioural and attitudinal aspects

All countries evaluated the influence of family and celebrities as neutral. Regarding friends and colleagues, small but statistically significant differences were found. Donors in the Netherlands ( $M = 2.97$ ) and the UK ( $M = 2.96$ ) stated that friends have no influence. In Australia ( $M = 2.99$ ), Germany ( $M = 2.74$ ), the Netherlands ( $M = 2.39$ ) and the UK ( $M = 2.53$ ) colleagues had no

influence. However, younger blood donors showed higher mean values for family ( $M = 4.34$ ) and friends ( $M = 3.82$ ).

All countries expected a 'better awareness of need' and to 'feel better about themselves' as positively stimulating the population to donate. Donors in Canada, the UK and the USA rated the 'communal connection' and 'medical advances' as positive. German donors evaluated 'to make a difference in patients' lives' as neutral ( $M = 4.90$ ), and donors in the Netherlands assessed to 'feel better about themselves' as neutral ( $M = 4.80$ ). Overall, female donors evaluated a 'better awareness of need' ( $M = 5.66$ ), 'medical advances' ( $M = 5.03$ ) and 'to make a difference in patients' lives' ( $M = 5.62$ ) as stronger reasons, while younger donors stated 'make a difference in patients' lives' ( $M = 5.51$ ) and 'feel better about themselves' ( $M = 5.25$ ).

### Political, economic and environmental issues

Blood donors in Canada and the USA generally have the same neutral opinion regarding incentives. Only 'public recognition' was rated negatively, whereas 'no reward' was rated positively. Australian donors assessed 'payments' ( $M = 2.51$ ), 'discounts' ( $M = 2.92$ ), 'certificates' ( $M = 2.70$ ), 'vouchers' ( $M = 2.93$ ) and 'small gifts' ( $M = 2.73$ ) as negative. Obtaining 'certificates' ( $M = 2.87$ ) was stated as negative by German donors, whereas 'public recognition' ( $M = 3.24$ ) had a neutral influence and 'no reward' ( $M = 4.13$ ) a positive one. Donors in the Netherlands valued 'payment' ( $M = 2.93$ ) negatively. A 'paid blood donation' ( $M = 2.66$ ) and 'small gifts' ( $M = 2.76$ ) were negatively evaluated by the UK. Sharing blood across borders was evaluated positively by all countries. Younger donors evaluated rewards ( $M = 4.01$ ) and sharing blood products ( $M = 5.58$ ) as more positive. Female donors were more positive towards no reward ( $M = 5.26$ ).

### Discussion

Our study helps understanding better how global changes affect blood donations in Western countries. By elaborating the five areas, we present a theoretical background of future changes and shed light on current donors' reactions to volatile conditions. Donors differ in some aspects regarding the influence of the identified areas. Thus, a universal approach to improve donor management worldwide would not be applicable. Instead, different priorities between countries were uncovered. Here, the wide standard deviations of all results stress the need for a diversified approach.

The 'demographic change' leads to an increasing proportion of older people, resulting in a decreasing potential

to cover blood demands, because healthy donors of a certain age will leave the blood donation system [36]. Therefore, the upper age limit for donors was discussed earlier [37], but no uniform age restriction worldwide exists [38]. A first research stream should focus on the consequences for blood donors after reaching the maximum age and consequences for patients receiving blood from elderly donors. Because no upper age limit in the USA exists, other countries could learn from those experiences [35]. A second research stream should focus on the expectations of minority donors regarding the registration pattern and extrapolate the future demand for even more tailored products.

'Technological developments' are ubiquitous, and communication is developing continuously [9]. The implementation of new technologies always influences the service a blood service offers, and future research should focus on consequences of adopting innovations. A more diversified look at subgroups of donors, especially in a country-specific context, taking different levels of expertise and innovativeness into account, is needed. This is even more relevant since younger donors are more open regarding smartphone, tablet and social media. The second research domain should focus on how implementing innovative technologies is experienced by donors to improve the service and to influence donor recruitment positively. As some blood services already have several existing new technologies – such as social media – in use, blood services which donors evaluated these technologies less preferable (e.g. from the Netherlands) should try to learn from more successful blood services. Surprisingly, the possibility to complete the predonation questionnaire online shows the smallest value for Australian donors, although blood donors have the opportunity to check out sample questions online. However, older blood donors are in general more open to this service. Thus, before implementing this technology, it needs to be evaluated in detail.

'Health innovations' offer possibilities in securing the future blood need. Although previous research mainly focused on improving marketing tools [7, 11], an understanding of how changing requirements should be communicated is important. As in other studies, donors are willing to donate blood to meet patients' needs [15], but they would be disappointed if they were no longer able to donate, and this is even stronger for female donors. Further research should evaluate different communication forms to counteract negative donors' reactions. Second, the results are clear about the benefits for donors resulting from health innovations. Future research should focus on the needs and values of specific subgroups [12]. Integrating clearly defined benefits for donors in recruitment tools may increase donations.

Regarding 'public, behavioural and attitudinal aspects', previous research suggests that social pressure from friends and peers and using celebrities in campaigns can trigger blood donations [12, 26, 28]. Our results do not allow for such overall conclusion. Only younger blood donors are more likely to be influenced by family and friends, which is in line with prior studies [2]. Future research should analyse how the influence of acquaintances changes during the donor's career. There are indicators of a greater influence at the beginning of the donation career, which decreases over time. Additionally, previous research suggests that generational motives may influence donations [28]. Thus, future research needs to understand generational differences.

Related to 'political, economic and environmental issues', research should evaluate the country-specific influence of incentives. For example, donors from Germany and the USA, where there are partially paid blood donations, rated 'rewards' and 'payment' higher. Although the participating blood services do not reveal any payment for donations, the acceptance of monetary rewards in these countries seems to be higher, which was also documented for other countries [34]. Furthermore, male and younger donors are in general more open to rewards, which is also in line with results of other studies [2, 10, 13]. Analysing whether a subgroup of donors tends to shorten its donation interval in order to obtain an incentive would be interesting. In the case of a confirmation, blood services could use this to alleviate shortages in the blood supply. Another approach to avoid shortages is sharing blood products across borders, especially since many European countries are still unable to collect enough plasma to be self-sufficient [39]. Because there is still reluctance regarding blood products from other countries, researchers should deal with such views in two ways. First, knowledge about existing country-specific biases is needed. Second, an understanding of the consequences of trading blood products is important.

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Our results suggest that blood services need to be flexible to integrate new service strategy and to meet the donors' high requirements. Although this study was based on active blood donors, sufficient approaches to secure the future blood supply with the help of loyal, regular donors are provided. However, future studies should evaluate non-donors to enhance recruitment strategies.

Our study has some limitations. The number of changes was limited. Since literature reveals many possible changes, which are not always independent, an influence of 'side trends' cannot be precluded [6]. Further research should derive cross-relationships and their effect on blood donor management. The number of respondents per country differed greatly. In addition, our sample is not representative regarding age, gender and donation number. Although the sample size is large, this cannot compensate the representative issue. Furthermore, the self-selected sample consists only of donors aged 17–50 years to gain a future perspective. For a thorough comparison, a similar and representative number of participants should be ensured. The DERG survey considered the effect from a practical perspective. Further research should assess actual effects on the donor base.

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## Conflict of interests

The authors declare no conflict of interests.

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