Blood Donation by Elderly Repeat Blood Donors

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Keywords

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Summary

Background: Upper age limits for blood donors are intended to protect elderly blood donors from donor reactions. However, due to a lack of data about adverse reactions in elderly blood donors, upper age limits are arbitrary and vary considerably between different countries. **Methods:** Here we present data from 171,231 voluntary repeat whole blood donors beyond the age of 68 years. **Results:** Blood donations from repeat blood donors beyond the age of 68 years increased from 2,114 in 2005 to 38,432 in 2012 (from 0.2% to 4.2% of all whole blood donations). Adverse donor reactions in repeat donors decreased with age and were lower than in the whole group (0.26%), even in donors older than 71 years (0.16%). However, from the age of 68 years, the time to complete recovery after donor reactions increased. Donor deferrals were highest in young blood donors (21.4%), but increased again in elderly blood donors beyond 71 years (12.6%). **Conclusion:** Blood donation by regular repeat blood donors older than 71 years may be safely continued. However, due to a lack of data for donors older than 75 years, blood donation in these donors should be handled with great caution.

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Introduction

To ensure the safety of both blood donors and future recipients, donors may be asked to temporarily or permanently refrain from giving blood. Whilst the definition of criteria for the protection of the potential recipient is straightforward (e.g. exclusion in case of specific infectious diseases), the reasons for deferral to protect the donor are sometimes arbitrary due to the lack of objective data [1, 2]. This applies in particular to donors reaching the upper age limit which does not only differ from nation to nation but also within individual countries [3]. The various aspects of the eligibility of older donors have been discussed previously [4–7]. However, the critical debate about the upper age limit is now revived by the demographic development towards an older population which may lead to a shortage in blood supplies [8]. Germany raised the upper age limit from 65 to 68 years of age already in 1996 [9]. Since 2005 repeat blood donors over the age of 68 years may donate blood with the permission of the physician-in-charge [10] which means that a fixed upper age limit has been abolished.

Due to a lack of data on donation incidents in the 68+ age group, a prospective study was carried out in 2006 to record the risk of incidents during donation of repeat donors between the age of 68 and 71 years [11]. The result emphasized that it was rather lower compared to that of the overall donor group. Therefore, the German Red Cross Blood Service West routinely admitted blood donors with no upper age limit as of January 1, 2010 under the prerequisite that they are experienced and active repeat donors who will be assessed prior to each new donation event by the attending physician-in-charge. Donations by older donors as well as deferrals and donor reactions were monitored closely. We are now able to present data on the effects of the raising of the age limit during routine blood donations in Germany particularly with regard to the following aspects:

Table 1. Blood donations, deferral rates and donor reactions of blood donors at the age of 72 years and older in the year 2012

	Age, years													
	72	73	74	75	76	77	78	79	80	81	82	83	>75	72 – 83
Number of donations														
Male	4,766	2,791	1,663	600	187	78	62	9	22	2	1	0	361	10,181
Female	1,774	805	506	99	42	18	8	2	1	0	0	4	75	3,259
Total	6,540	3,596	2,169	699	229	96	70	11	23	2	1	4	436	13,440
Deferrals, %														
Male	10.6	10.9	12.6	12.0	24.0	29.1	23.5	50.0	31.3	50.0	0.0	none	26.6	11.8
Female	10.9	13.5	12.2	26.7	27.6	30.8	20.0	0.0	0.0	none	none	0.0	25.7	12.7
Total	10.7	11.5	12.5	14.4	24.7	29.4	23.1	45.0	30.3	50.0	0.0	0.0	26.5	12.0
Donor reactions, %														
Male	0.10	0.04	0.06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	none	0.0	0.07
Female	0.45	0.37	0.40	1.01	0.0	5.56	0.0	0.0	0.0	none	none	0.0	1.33	0.46
Total	0.20	0.11	0.14	0.14	0.0	1.04	0.0	0.0	0.0	0.0	0.0	0.0	0.23	0.16

- The development of blood donation by elderly blood donors and the amount of blood donations given by elderly blood donors
- Deferral rates in elderly blood donors
- The rate of adverse reactions occurring during blood donation in elderly blood donors.

The study was performed at the German Red Cross Blood Service West (GRCBS-West) which is located in the western part of Germany. About 23 million inhabitants are living in the countries North Rhine Westfalia, Rhineland-Palatinate and Saarland, all served by the GRCBS-West. The area covers large urban regions (e.g. Cologne, Bonn, and the Ruhr area) as well as rural regions (e.g. Eifel, Münsterland, and Siegerland). Mobile blood drives are undertaken daily from the five centers of the GRCBS-West which are located in Münster, Breitscheid, Hagen, Bad Salzuflen and Bad Kreuznach, collecting about one million whole blood donations annually from non-remunerated voluntary blood donors.

Material and Methods

At the GRCBS-West, blood collections are announced in newspapers, by poster advertising, bulk mail, and loudspeaker van. Registered donors are regularly and individually invited to donate blood by mail or by e-mail. The last individual invitation by mail is sent to each donor who finished his 71st year of life. Besides the expression of thanks for giving blood, this letter explains that the donor will no longer be automatically invited by mail or by e-mail, but that he can continue to donate blood if he wants and if he is accepted for donation by the attending physician.

Whole blood donations are performed predominantly on mobile blood drives. The total volume of each blood donation is 500 ml with an additional 40 ml for laboratory tests. Admission of donors is done according to the German national guidelines for blood donation [12]. Further detailed instructions for admission and deferral of blood donors, performance of blood donation, and documentation are given in the Standard Operating Procedures (SOP) of the GRCBS-West which are identical and obligatory for all donation sites of the GRCBS-West.

All data are entered in the automated electronic data base and data processing system of the GRCBS-West (BAS 400), either directly on site via mobile laptop applications or on a standard paper form with subse-

quent data acquisition by trained secretarial staff in the centers. All adverse acute blood donor reactions as well as deferrals are registered in standardized codes, thus allowing statistical analysis and monitoring.

Donor reactions were classified identical to our previous study [11] as mild, moderate, or severe following a modified version of the definitions published by the Canadian Blood Services [13] and others [3, 14] including systemic reactions as well as donor injuries and continued medical treatment:

- *Mild reactions:* bruising, painful phlebotomy, re-bleeding, local allergic reactions and systemic symptoms (without loss of consciousness) of pallor, diaphoresis, sweating, nausea, hyperventilation, weakness and fainting that resolved within 15 min.
- *Moderate reactions:* hematoma, massive re-bleeding, arterial puncture, a loss of consciousness for less than 30 s, and/or bradycardia and hypotension with a full recovery within 30 min.
- *Severe reactions:* comprised chest pain, loss of consciousness for more than 30 s and/or convulsions, vomiting, incontinence or tetany, arrhythmia, and a reaction where the duration of recovery lasted more than 30 min; any reactions or injuries requiring intravenous fluids, medication or further medical treatment by another physician than the responsible physician of the blood donation service (outside medical care).

Statistical Methods

All data were extracted from the electronic data base and data processing system of the GRCBS-West (BAS 400 – iSeries version 6 release 1) via Jeff Viewer (version 2013.114) and entered into MS Excel (version 14). All donors with at least one previous documented blood donation in our blood donation service were considered as repeat donors.

Calculations and graphs were performed using MS Excel. Donors were classified in different age groups covering 10 years each. A smaller range was selected for the youngest donors (18–20 years) due to the well-known high number of deferral rates and adverse reactions in this small age group [15]. The elderly blood donors were also categorized in smaller age groups. The group of 65–68 years covered the increase of the upper age limit in Germany in 1996 [9] and the group of 69–71 years covered the age group of our previous study [11]. All donors older than 71 years were integrated in the last age group. Calculations of deferral rates and adverse reactions always relate to the corresponding age group. An additional and more detailed description of the donors over the age of 71 years on annual basis was done with respect to the fact that data for these age groups are not published in Germany so far. The chi-squared (χ^2) test was applied to compare differences in blood donation, donor deferral, and adverse reaction frequencies between donor age groups. P values were calculated using Fisher's exact test, and values less than 0.05 were considered as statistically significant.

Fig. 1. Development of the absolute numbers of blood donations of blood donors beyond the age of 68 years from 2006 to 2012.

Fig. 2. Percentage of whole blood donations given by blood donors of different age in 2005 (black columns) and 2012 (grey columns).

Results

Numbers of Blood Donations by Elderly Blood Donors

Complete data of all whole blood donations collected by the GRCBS-West in the years from 2006 to 2012 were included in the study, thus enclosing about 7 million whole blood donations, including 171,231 blood donations from donors over the age of 68. Data from 2006 were included to cover blood donation before increasing the upper age limit at the GRCBS-West.

Following the information about the lifting of the upper age limit, provided to our donors in 2010, several blood donors, previously excluded due to age, resumed their blood donation. This explains the 436 blood donations by donors over the age of 75 years during 2012. The oldest blood donor documented in 2012 was 83 years old. In 2012 a total of 13,440 blood donations were done by blood donors beyond the age of 71 years (table 1).

Since the start of our prospective study in 2006, the absolute numbers of blood donations by male and female donors

Fig. 3. Donor deferral rates in elderly blood donors from 2006 till 2012.

Fig. 4. Donor deferral rates of male and female blood donors in 2012 in different age groups.

over the age of 68 years has increased steadily. However, whereas donation by male donors over the age of 68 years increased only until 2010, the number of blood donations by female donors is still increasing in 2012 (fig. 1).

Since the start of our prospective study in 2006 there has been a steadily increasing number of blood donations by donors over the age of 68 years. The percentage of blood donations provided by blood donors over the age of 68 years steadily increased from 0.2% ($n = 2,114$) in 2005 to 3.9% ($n = 37,478$) in 2011. In 2012 already 4.2% ($n = 38,432$) of all whole blood donations were done by donors older than 68 years. General demographic changes in the donor population since

2005 are evident and demonstrate a distinct age shift. The loss of blood donations from donors younger than 68 years is compensated by blood donation of the elderly donors (fig. 2).

Donor Deferrals

Donor deferral rates of donors in the age group 69–71 years were constantly lower than the average deferral rates ($p < 0.001$), whereas the deferral rates for donors older than 71 years initially were 50% in 2006. Deferral rates of donors in the age group > 71 years fell sharply in 2008 when the first results of our prospective study were communicated and published. A second decrease of donor deferral rates in this age

Fig. 5. a Classification of donor deferrals (in the year 2012) in different age groups. Donor deferral rates are given for the corresponding age groups. For the sake of clarity, only the ‘top ten’ deferrals (covering 85% of all deferrals) are shown. **b** Classification of all donor deferrals due to donor safety reasons and recipient safety reasons (in the year 2012) in different age groups. Donor deferral rates are given for the corresponding age groups.

group can be seen in 2010, when we officially informed our staff and donors about the results of the study and the admission of blood donors older than 71 years (fig. 3). Deferral rates of the donors beyond the age of 71 years were calculated separately for each year age group. They increased significantly ($p < 0.001$) beyond the age of 72 years (table 1).

Since donor deferral rates in the elderly changed during the study period towards lower deferral rates in elderly donors, a more detailed analysis is performed only for 2012. Detailed data for 2012 demonstrate that the donor deferrals of young donors were the highest, then decreased with increasing age, but then increased again at donors older than

65 years. Differences in donor deferral rates between male and female donors were highly significant in younger and middle aged donors ($p < 0.001$) and diminished with age (fig. 4).

A detailed analysis of the reasons for donor deferrals in 2012 revealed that a substantial part of deferrals in elderly donors was due to high blood pressure or cardiac diseases, whereas low hemoglobin and – surprisingly – drugs caused less deferrals in elderly blood donors than in younger blood donors. Since in all age groups the same ‘top ten’ reasons covered about 85% of all deferrals, here we present only data about these ‘top ten’ deferrals as pointed out in (fig. 5a). Fur-

Fig. 6. Adverse donor reactions (given in % of donations in the corresponding age group) in first-time donors and repeat donors.

Fig. 7. Adverse donor reactions of repeat donors (given in % of donors in the corresponding age group) classified as mild, moderate or severe.

ther analysis revealed that, with increasing age of the blood donors, the aim of donor deferrals shifted from recipient safety reasons to donor safety reasons (fig. 5b).

Adverse Donor Reactions

Since the structure for the recording of adverse donor reactions was changed at the GRCBS-West in 2011, we did not perform a sequential detailed comparison of donor reactions from 2005 to 2012. The following analysis is based on data from 2012, covering data from 38,432 blood donations from donors older than 68 years. Adverse donor reactions were higher in first-time donors than in repeat donors in all age

groups. Donor reactions in repeat donors decreased constantly with age up to the age of 71 years and then increased again, if subtly, in donors older than 71 years. Also donor reactions in first-time donors decreased with age but only until the age group 51–60 years and increased again in the first-time donor age group 61–65 years. Donors older than 65 years were only exceptionally accepted as first-time donors. Donor reactions in donors beyond 68 years were significantly lower ($p < 0.001$) than in the donor population as a whole (fig. 6). Calculations for donors over the age of 75 years are not sound due to very low number of blood donations in these age groups.

Fig. 8. Distribution of adverse donor reactions of blood donors with respect to the time to complete recovery in the corresponding age group.

A more detailed classification of donor reactions as mild, moderate, and severe revealed a slight increase of severe reactions in older repeat donors; however, this effect already started in donors older than 65 years and was very discrete ($p < 0.05$ in donors older than 71 years). Due to the small numbers of donations and adverse donor reactions in the age groups 69–71 years ($n = 35$) and >71 years ($n = 22$) this effect needs further observation (fig. 7).

The investigation of the period to complete recovery from adverse donor reactions revealed that complete recovery in older blood donors does take longer. However, like the slight increase of severe donor reactions, this effect already started in blood donors older than 65 years. Due to the small number of cases, the obvious effect in donors older than 71 years may be due to the small number of cases and needs further observation (fig. 8).

Discussion

Since the upper age limit for donors was not based on scientifically proven data but rather on a strategy of prevention and extreme caution – criteria to which we still adhere to – the decision of GRCBS-West to raise the upper age limit at the end of 2006 was also viewed with some skepticism. At that time data published on the incidence rate did comprise donors up to the age of 71 years [13], and it was only later that records on donors over the age of 71 years became available [3]. This is why, when we raised the upper age limit up to the completed age of 71 years, it was only within the scope of a prospective study. Furthermore, we timely and closely recorded and monitored the reaction of the donors on a monthly basis. Results showed that the rate of donor reactions among the

older repeat donors up to the completed age of 71 years was well below the average [11]. Based on these data, we revoked restrictions on the upper age limit for repeat donors in the year 2010. These data enabled us to judge which share the older blood donors do have in the total number of donors during routine operation. In addition we were able to record the practice of deferral as well as the rate of donor reactions during routine situations.

Up to the point of evaluating this report, there has been a constant increase in blood donations by older donors. At the end of 2012, the GRCBS-West recorded that the share of donations by donors over the age of 68 years amounted to 4.2 %, i.e. in the meantime these donors contribute to a large extent to the volume of blood donations. Taking into account that not only in the GRCBS-West but throughout Germany a stagnating development with a downward trend could be noted between 2011 and 2012, the raising of the upper age limit has contributed significantly to a secured supply with blood components. Considering that the annual admission rate to donation rises with increasing age (1.5 for the 18- to 20-year-old age group up to 2.5 for the >71-year-old age group) and in view of the fact that rates of infection for relevant transfusion-associated viral diseases among repeat donors decreases with age [16], it can be stated that the donation of aged donors also contributes to the safety of blood products. The influence of senescence of hematopoietic stem cells on the quality of donated blood was not in the focus of the study and deserves further studies. However, recently published data could not detect an influence of the age of donors on the quality of stored red blood cells [17] and no clinically relevant changes in fresh frozen plasma [18]. A reduced hematopoietic regenerative capacity in aged donors should be recognized by the regular determination of the donor's hemoglobin value before each donation.

Fear of an increased risk of donor reactions was unfounded. All in all, the oldest donors' reactions were even lower compared with the younger group of donors. This may be partially due to donor deferrals based on donor safety reasons that increased with age and constituted about 80% of all deferrals in donors older than 71 years. However, an appropriate evaluation of this study is limited to a donor age up to 75 years as the numbers of donations beyond that age are too low to provide reliable data. In addition, compared to the total number of donors, older donors do not show a negative trend regarding the severity of donor reactions. Although it may appear that there is a tendency towards severe reactions, it has to be considered that they are below average, whereas mild and moderate reactions, which can frequently be found among young donors, do rarely occur among aged repeat donors. This is primarily due to the guidelines to admit only older repeat donors, i.e. through years of experience as a blood donor a positive selection process has taken place. Donors who have suffered from severe or repeated reactions are often excluded from blood donation or they voluntarily refrain from giving blood. These results may by no means be transferred to first-time donors.

In this context the authors recommend caution. This view is supported by the monitoring of a small number of older first-time donors which were admitted to donate blood at the start of this study. The monthly monitoring recorded an increased rate in donor reactions which led to an immediate exclusion of first-time donors over the age of 68 years from giving blood. Special consideration should also be given to the longer recovery time elderly blood donors require after donor reactions. A precautionary measure that could be taken in this context is to avoid that older donors give blood at the end of a donation appointment.

In Germany, repeat donors will be assessed prior to each new donation event by the attending physician-in-charge. We did not ask for an additional written recommendation by the family doctor as requested by some other blood donation services [19]. We do not consider this recommendation by the family doctor as necessary as long as each single donation is preceded by a consultation with the attending donor center physician. This is in line with the assessment of Goldman et al. [3] who got the approval of the family doctors of 98% of contacted donors belonging to the age group of the 70- to 74-year-olds.

The removal of the upper age limit for blood donors was widely approved by our repeat donors which is reflected in the high number of older blood donors who appear at dona-

tion events without having received a special written invitation. Although donors over the age of 71 years do no longer receive an actual invitation, blood donation by this age group amounted to 13,440 in 2012! The attending physician is responsible for donor safety and, as demonstrated in this study, the share of donor deferrals due to donor safety reasons increases with age. However, it has become more and more difficult for donor center physicians to defer aged donors during a donation appointment since elderly donors tend to regard the admittance to donate blood as a proof of their health and performance, whereas a donor deferral is often considered a personal insult particularly with respect to diminishing understanding and self-assessment.

In the meantime there have been various studies on the safety of blood donations with regard to aged donors [3, 5–7, 13, 19]. However, up to now these studies – including our own preceding study [11] – were carried out at selected or limited donation appointments.

Data of the present analysis are now based on the routine donation services covering several years and comprising 171,231 donations of donors over the age of 68 years as well as evaluable data of donors up to 75 years of age. Data show that a repeat donor can give blood into old age without increased health risk; however, for an assessment regarding donors over the age of 75 years, sufficient data are not yet available. In view of the marginal number of that age group, we consider to apply an upper age limit for the 75+ donors. This would also help in case of sometimes difficult discussions with regard to a deferral.

All in all, the successful continuation of older donors to donate blood is only a limited contribution to securing the long-term blood supply. We should not neglect to focus our attention on the recruitment of suitable donors from the part of the population who has not given blood up to now [20, 21].

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Disclosure Statement

The authors declare that they have no conflict of interest relevant to the manuscript submitted.

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