



Blood Donors in Iceland: A Nationwide Population-Based Study in 2005-2013

Vigdís Jóhannsdóttir

Thesis for degree of Master of Public Health Sciences
Centre of public Health



HÁSKÓLI ÍSLANDS

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Thesis for the degree of Master of Public Health Sciences

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Lýðgrunduð rannsókn á landsvísu frá 2005 til 2013

Vigdís Jóhannsdóttir

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Dedicated to the Icelandic blood donors and my dear Unnur Erna

Ágrip

Markmið þessarar rannsóknar var að lýsa stærð og lýðfræðilegum einkennum íslenska blóðgjafahópsins og þróun hópsins á tímabilinu 2005-2013. Einkum var markmiðið að lýsa öllum nýskráðum blóðgjöfum sem hafa ekki enn gefið í poka og virkum heilblóðsgjöfum. Rannsóknin er lýðgrunduð á landsvísu og byggð á upplýsingum um blóðgjafahópinn úr tölvukerfi Blóðbankans og tölum Hagstofu Íslands um mannfjölda á Íslandi. Niðurstöðurnar gætu gagnast við stefnumótun Blóðbankans til að viðhalda og endurnýja blóðgjafahópinn á Íslandi.

Niðurstöður okkar sýndu að heildarfjöldi virkra heilblóðsgjafa lækkaði um 12,2% frá árinu 2005 til 2013 og heilblóðssöfnunum fækkaði um 13,0% á sama tímabili. Hlutfall kynjanna meðal nýskráðra blóðgjafa var að meðaltali nokkuð jafnt á tímabilinu, þ.e. konur 47,5% og karlar 52,5%. Aftur á móti var hlutur karla (73,3%) sem virkra heilblóðsgjafa mun hærri en kvenna (26,7%). Meðalaldur nýskráðra blóðgjafa var 29,2 ár og flestir þeirra voru í yngsta aldurshópnum, 18-25 ára (51,7%). Meðalaldur virkra heilblóðsgjafa var 38,6 ár og flestir þeirra voru í aldurshópnum, 26-40 ár (34,7%) og 41-55 ára (35,1%). Einnig sýndu niðurstöður okkar að aðeins 57,3% þeirra sem voru nýskráðir blóðgjafar á árinu 2005-2006, kom til baka og gaf a.m.k. einu sinni í poka á tímabilinu fram til 2013. Á tímabilinu 2005-2013 gaf að meðaltali 5,1% af þjóðinni á aldrinum 18-69 ára heilblóð eða blóðhluta að minnsta kosti einu sinni.

Á undanförunum árum hefur einstaklingum sem gefa heilblóð og fjölda heilblóðssafnana fækkað. Þar sem Blóðbankinn virðist samt sem áður anna eftirspurn sjúkrahúsanna má álykta að það hafi tekist að minnka blóðhlutanotkun sjúkrahúsanna og heilblóðssöfnun í kjölfarið á tímabilinu. Til lengri tíma litið þarf hins vegar að fjölga blóðgjöfum á næstu árum og áratugum, meðal annars vegna hækkandi aldurs þjóðarinnar og áframhaldandi þróunar í þá átt samkvæmt mannfjöldaspám, sem getur haft í för með sér aukna blóðhlutanotkun. Minna hlutfall kvenna en karla sem virkra heilblóðsgjafa gefur tækifæri til að leggja áherslu á að auka hlut kvenna á meðal reglulegra heilblóðsgjafa. Þar sem niðurstöður okkar sýna að endurkomur nýskráðra er ekki mjög góð er tækifæri í kjölfarið að leggja áherslu á að viðhalda endurkomum nýskráðra og tryggja þannig nægilega stóran hóp blóðgjafa á Íslandi í náninni framtíð.

Lykilorð: Blóðgjafar, blóðssöfnun, lýðfræði, einkenni blóðgjafa, nýliðun

Abstract

In this study we leveraged on nationwide data to determine the size of the blood donor group in Iceland and describe its demographic- and donation characteristics. In particular we sought to describe all newly registered and regular whole blood donors in the country during the period 2005-2013. Data on the blood donors were based on information from the computer system in the Icelandic Blood Bank. Data on the Icelandic source population were retrieved from the publicly available population statistics from The Bureau of Statistics in Iceland. Following, the findings could be used to develop sound strategies for recruitment and retention of the donor group in Iceland.

Our results indicate that the number of regular whole blood donors and donations decreased by 12.2% and 13.0%, respectively, from 2005 to 2013. The sexes were almost equally represented, as newly registered donors during the period, i.e. on average 47.5% females versus 52.5% males. However males (73.3%) were better represented as regular whole blood donors than females (26.7%). The mean age of newly registered donors was 29.2 years and the majority of newly registered donors were in the youngest age group, 18-25 years (51.7%). The mean age of whole blood donors was 38.6 years and the majority was in the age groups group 26-40 year (34.7%) and 41-55 year (35.1%). Only 57.3% of newly registered donors in 2005-2006, came back to donate at least once in the period 2005-2013. During the period 2005-2013 on average of 5.1% of the general population in Iceland, aged 18-69 years, donated whole blood or other blood components at least once.

Even though the whole blood donor group and number of donations have declined in recent years, the supply seems to have been according to demand. Thus, use of blood components within hospitals is likely to have become more efficient during this period. However, according to population forecasts in Iceland, the need to increase the number of blood donors is foreseeable, as the age of the nation continues to rise. Smaller retention rate among females than males gives the opportunity to focus on increasing the share of women among regular whole blood donors. The same applies to newly registered donors and strategic work toward their effective recruitment to ensure a sufficiently large group of blood donors in Iceland in the near future.

Key words: Blood donors, blood donations, demographics, donor characteristics, recruitment

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List of Abbreviations

DOMAINE	Donor management in Europe
EBA	European Blood Alliance
EU	European Union
Hb	Hemoglobin
RBC	Red Blood Cells
SMS	Short Message Service
TRALI	Transfusion-related Acute Lung Injury
WHO	World Health Organisation

Introduction

Donated blood is the "gift of life" for many people needing long-term treatments due to diseases, illnesses and emergencies (1). A blood donation occurs when a person has blood drawn voluntarily and it is used for transfusion. Reliable and safe blood transfusion is based on healthy blood donors. Today, in the developed world, most blood donors are unpaid volunteers who donate blood as a charity to the community (2).

The main purpose of blood banks around the world is to fulfill the needs in communities for safe blood products and transfusion services. Seifried et al. foresee that in most parts of the world the demand for blood is rising even though currently there is a moderate decrease in blood product consumption per individual in many western countries (3). In Europe alone about 20 million units of whole blood are collected each year from about 13 million blood donors (1). Increasingly more complicated medical procedures, such as cancer treatments and complex surgeries, will in the near future continue to give rise to a need for blood components (3). The fact that the age distribution of Western nations is shifting upward towards older age may also lead to an increasing demand for blood components (4). As the activity of blood banks relies on active donors, their recruitment and retention is of great importance and can be targeted more precisely if good information about the donor pool is available (5, 6). Keeping that in mind we aim to describe the blood donor group in Iceland in 2005-2013 with respect to the size and demographic characteristics of the blood donor group and specific donation characteristics. As an introduction, the history of transfusion medicine and various aspects of blood donation are discussed.

1 The History of Transfusion Medicine

People have always been fascinated by blood and from ancient times blood has been considered mystic and possess power and a life force. Bathing in blood from the stronger ones or even drinking blood was believed to give strength or energy to the weak (7, 8). To let people bleed, a little amount, has also been practiced and was intended to let out bad blood, restore balance and hopefully help the patient to health (7).

It is not known by whom or when the idea of transfusion occurred, but evidence about attempts to transfuse blood from animals to humans or between humans goes as far back as to 15th, 16th, and 17th centuries. The first stories about blood transfusions are from 1492 when Pope Innocent VIII was given blood from three boys. The attempt did not save the Pope and all four died (7, 8).

William Harvey (1616) was an Englishman who discovered the circulation of blood throughout the body, being pumped by the heart, but there is no evidence that he considered blood transfusions (7, 9).

Christopher Wren did many experiments on dogs in the mid-1600s and injected many substances into their veins, but it has not been confirmed that he transfused blood from one dog to another. However also in the mid-1600s, Richard Lower managed to revitalize a dog with transfusion using blood from other dogs that died (7).

Jean Denis was a young professor from France that carried out what was believed to be the first transfusion between animal and a human. He connected the carotid artery of a lamb into 15-year-old boy's vein situated in the arm and the boy recovered despite this mismatched transfusion. Denis made other attempts to transfuse animal blood into humans and one was in 1667 into a 34-year old male named Antoine Mauroy who received a larger amount of blood than the other patients a couple of times. During the second transfusion Mauroy became very sick with a variety of symptoms, which probably were the first hemolytic transfusion reaction reported. Mauroy died two months later without further transfusions, but the transfusion treatment was intended to treat his mental symptoms (7).

James Blundell was a British obstetrician that in early 1800s successfully transfused blood from one human to another to control bleedings after childbirth. The results from further attempts with blood transfusions at this time ended differently and sometimes they caused death (7).

1.1 The Discovery of the Blood Groups and Anticoagulant Use

In 1900 Karl Landsteiner (1868-1943) discovered the ABO blood groups and explained the incompatibility between different blood types which could result in serious reactions with transfusion of the wrong blood type (7, 8, 10).



Fig. 1. Blood transfusion direct from donor to patient at the National Hospital in Iceland 1940. From the (National Hospital Book page 210).

Blood clotting was another barrier to overcome, and because of that, most blood transfusions were done direct from donor to patient (fig. 1). John Braxton Hicks began in 1914 to use sodium phosphate to prevent clotting of blood when transfusions were needed for women after childbirth. There were many attempts to prevent clotting, and when the Belgian doctor Albert Hustin introduced Sodium citrate as an anticoagulant usable in human transfusion in 1914, the basis for blood banking activities began. The Egyptian doctor Luis Agote also made a successful transfusion using sodium phosphate as anticoagulant the same year (7, 11). But it was Richard Lewinsohn of the Mount Sinai Hospital in New York who in 1915 proposed sodium citrate into clinical practice as an anticoagulant (7, 12).

1.2 The Beginning of Blood Banking Activities

At first, blood was certainly not anti-coagulated with a view to long-term storage and was generally used within hours of donations. Experiments with adding dextrose to blood improved red cell survival on storage up to two weeks (12).

Bernard Fantus has been given credit for establishing the first Blood Bank in 1936, which was in Cook County Hospital, Chicago. The blood from a live donor was collected into citrate and stored under refrigeration, between 4 and 6°C for up to 10 days (7, 9, 12).

It has also been stated that the Russian surgeon Sergei Yudin should perhaps also be credited for establishing the first Blood Bank. He stored cadaver blood after special handling without citrate, but cadaveric blood transfusion is the transfusion of blood from a dead body to a living person (7, 9).

Percy Oliver (1878-1944) was secretary of the Camberwell Branch of the Red Cross in London that organized a system of a panel of donor volunteers after he received a call from King's College Hospital in 1921 for volunteers to give blood. He went to the hospital with a few colleagues and one of them, Sister Linstead, was the first voluntary blood donor (13, 14). After that he and his wife kept record cards of volunteers and this service of voluntary blood donors was run from their home. Following, a similar service was started in other parts of Britain (13, 14).

1.3 The Beginning of Blood Banking Activities in Iceland

The first activity of blood donations in Iceland was through a group of volunteers known as the blood donors group; "Rover Scouts Væringjafélagsins", which was established in 1935 by Danish exemplary.

This activity was under the guidance of Gudmundur Thoroddsen, professor at the National Hospital but Jón Oddgeir Jónsson organized the activities on behalf of the Scouts (9, 14). The donor panel consisted of volunteers who had undergone serological tests, to establish the blood group, and a physical examination once a year. They also had to be willing to give blood when the call came at any time, day or night (9, 14, 15). In 1941 an article appeared in a newspaper named "Alþýðublaðið", about the activities of the Blood donors department of the Scouts which consisted of about 50 Scouts, 18 years and older. The article says that in total they donated 14 liters of blood by 30 donations in 1941, used by all the hospitals, mostly because of illnesses or accidents (fig. 2) (15).

It seems that in the beginning the operation was unformulated and the donors donated varying amounts of blood, depending on what was needed at any given time (9). In 1941 a local paper for seamen; "Sjómannablaðið Víkingur" mentioned that the Icelandic Red Cross undertook the establishment of a Blood Bank. There were also mentioned that the students in the school for seamen where first to come forward as blood donors (fig. 2) (9, 16).

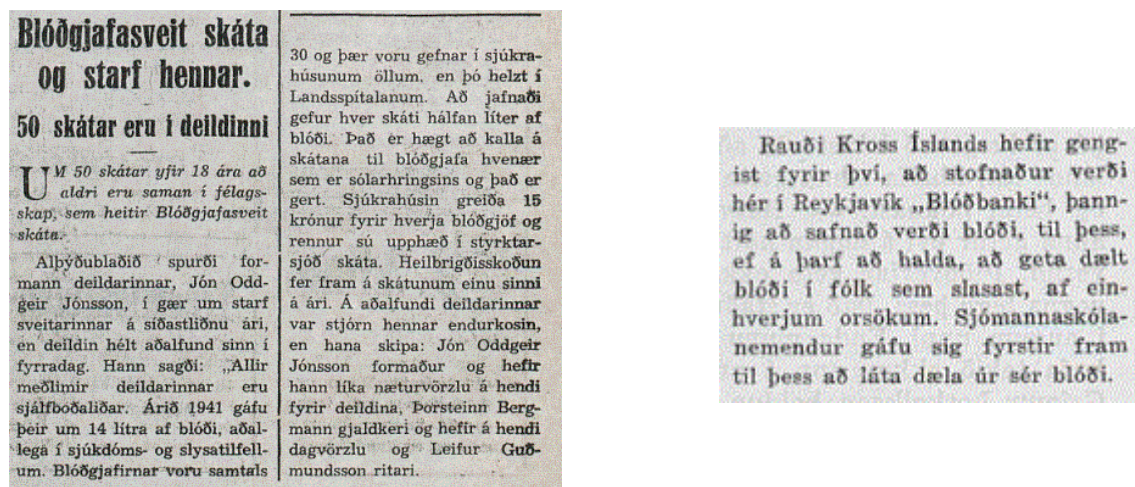


Fig. 2. News from the year 1941 on the Blood donor department of the Scouts which appeared in "Alþýðublaðið" and in "Sjómannablaðið Víkingur" about that the Icelandic Red Cross underwent the establishment of a Blood Bank (15, 16).

However, it was not until November 1953 that the Icelandic Blood Bank was established in a building which was specifically built for blood bank activities (9, 14). Elías Eyvindsson (1916-1980) anesthetist was hired for the position of director of the Blood Bank and Halla Snæbjörnsdóttir (1911-1994) as a nursing director. Their work was an important step forward in blood bank activities in Iceland, and for instance introduced Halla the use of plastic bags instead of glass bottles for blood collection, a knowledge she brought home from the United States (9, 14, 17, 18).

Ólafur Jensson (1924-1996) was the second director of the Blood Bank and served as such until 1994. For a long time Ólafur was a spokesman for larger housing for the Blood Bank as its activities increased rapidly as one can see in fig. 3 about number of whole blood units collected in the Icelandic Blood Bank in 1953-1992 (9, 14).

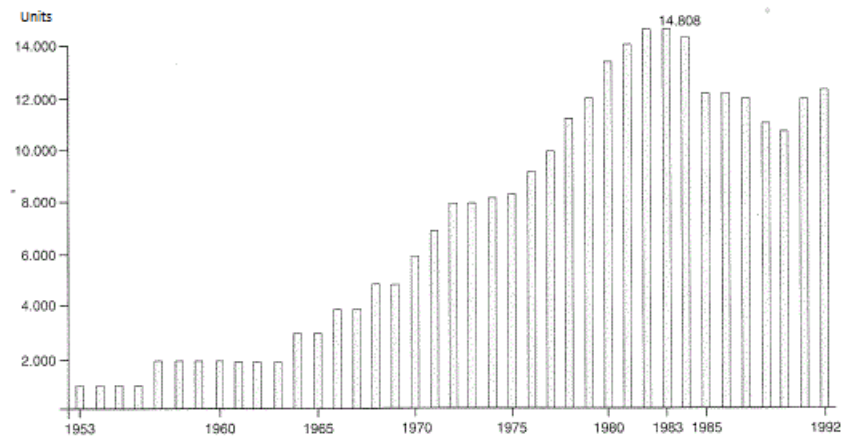


Fig 3. Number of whole blood units collected in the Icelandic Blood Bank in 1953-1992 (14).

During his tenure, the Red Cross bought the Bloodmobile in 1964, which was used to transfer the equipment to collect blood from donors in various locations in Reykjavík and other parts of the country (9). It was not until in the time of existing director of the Blood Bank, Sveinn Guðmundsson which was hired in 1995, that the Blood Bank was moved to a bigger housing in May 2007 (9).

2 The Icelandic Blood Bank

The role of the Blood Bank in Iceland is to provide safe blood bank service nationwide. The Blood Bank also provides services for cell and tissue transplantations and stem cell therapy. The Blood Bank in Iceland is situated in Reykjavík but also has a small establishment in Akureyri Hospital that emerged with the Blood Bank in Reykjavík in May 2007. In addition to whole blood collection in Reykjavík there is also carried out collections of blood components with aphaeresis (9). Platelet aphaeresis began in 2001, plasma aphaeresis in 2005 and aphaeresis collection of red blood cells in 2006. In the year 2002 the Icelandic Red Cross gave the Blood Bank a bus which goes on regular tours to schools and businesses in the metropolitan area and to communities in rural areas to collect blood from donors (9, 19).

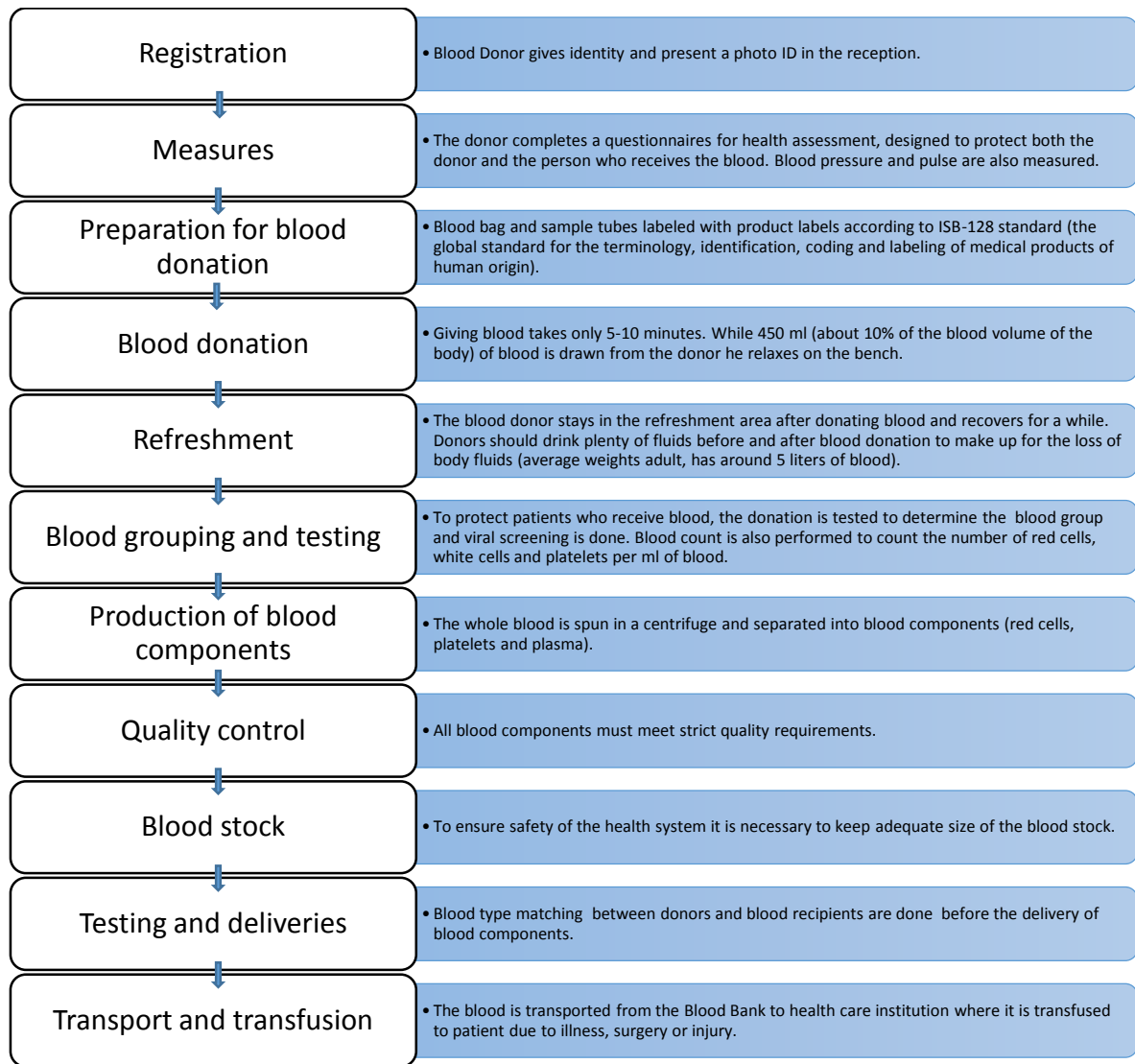
The Blood Bank received the quality standard ISO-9001 in 2000 and was the first Blood Bank in the Northern countries to obtain this certification for its activities. The certification includes regular external evaluation on whether quality standards are followed in the activities of the Blood Bank (9). The Icelandic Blood Bank follows the EU guidelines in blood banking, where the principle is that blood donation should be voluntary and non-remunerated (9, 20).

3 Blood Donation

To donate blood one must be healthy, between the age of 18 – 70 years old and it is important to meet the requirements of infection prevention. On first arrival (newly registration) only samples are collected for blood typing, viral screening, iron storage measurement and complete blood count. The medical history is reviewed and the blood pressure and pulse measured. When the results of the tests are completed, which takes about 14 days, and are safe, the person is permitted to donate blood. The most common type of blood donation is whole blood donation where 450 ml of blood is collected, and the actual donation takes about 5-10 minutes. A healthy blood donor generally does not experience any discomfort by donating blood, but it is important to drink plenty of fluids on the day of the donation to make up for the loss of body fluids (9).

The whole blood is processed further and separated into components of red blood cells, platelets and plasma (9). Donation of whole blood is the most common type of blood donation, but donation of blood components with aphaeresis has become common in modern blood banking (9, 21).

Diseases may be carried from donor to recipient. A blood donor having for example a cold, a sore throat or trauma to the skin probably has little or no symptoms. However, a patient with a compromised immune system may become seriously ill after receiving blood from such a person. Some medications may also harm the recipients and some diseases and medications may also affect the donors' physical reaction to donations. That is why a donor may be deferred from donation temporarily or permanently due to various reasons (9). The process of whole blood donation is further outlined in figure 4.



(Based on promotional brochure for the Icelandic Blood Bank).

Figure 4: The process of whole blood donation

4 Aphaeresis

In the last decades changes have occurred in the approach of blood collection in Iceland like in other western countries. There has been an increase in collections of individual blood component i.e.; platelets, plasma and red blood cells via aphaeresis (9, 19). Donation of blood components with aphaeresis, i.e. the blood of a donor is passed through a machine that separates out one particular blood component and returns the other components to the circulation, makes it easier to meet the demand for certain blood components (8, 9, 21). At the end of the collection the blood components are ready and do not need to go for further processing. The patient may receive two units from the same donor that reduces the chance of transfusion reactions that may occur with components from multiple donors. For platelets it could potentially take a total of eight whole blood donations to provide the equivalent of one platelet donation (7-9).



Fig. 4 Aphaeresis platelet donor (Image displayed with permission from donor).

Two studies, one from Germany and the other from China, indicate that blood donations with aphaeresis are becoming more common than before (21, 22). Using data from Germany, Ritter et al. showed that while rates of whole blood donations remained the same since 2006 to 2010, the number of aphaeresis increased, especially among older donors (22). Guo et al. who conducted the Chinese study revealed differences in demographic characteristics of donors from five blood banks according to whether they donated whole or separated blood. Older (>25 years), male, and non-Han donors and those with less education were more likely to make aphaeresis donation. Some of these different characteristics can be attributed to different methods of promotion recruitment in the blood banks (21).

In the Icelandic Blood Bank platelets have been collected via aphaeresis since 2001, plasma since 2005 and red cells since 2006. The collection of blood components via aphaeresis has increased significantly the years after it began and in 2012 more than 1,000 aphaeresis collections were conducted. In the coming years and decades further development of these activities can be expected (19). Further information on characteristics of aphaeresis donors in 2005-2013 is presented in table 1, 2 and 3.

Table 1. Characteristics of platelets donors by year in Iceland 2005-2013 (18-69 years) N=400

Charecteristics	Year	2005 n (%)	2006 n (%)	2007 n (%)	2008 n (%)	2009 n (%)	2010 n (%)	2011 n (%)	2012 n (%)	2013 n (%)	Mean 2005-2013 n (%)
Total donors		90 (100)	81 (100)	116 (100)	170 (100)	182 (100)	166 (100)	161 (100)	175 (100)	194 (100)	148 (100)
Sex											
Female		13 (14.4)	16 (19.8)	24 (20.7)	44 (25.9)	51 (28.0)	39 (23.5)	34 (21.1)	38 (21.7)	27 (13.9)	32 (21.0)
Male		77 (85.6)	65 (80.2)	92 (79.3)	126 (74.1)	131 (72.0)	127 (76.5)	127 (78.9)	137 (78.3)	167 (86.1)	116 (79.0)
Age group, year											
18-25		14 (15.6)	11 (13.6)	11 (9.5)	29 (17.1)	22 (12.1)	19 (11.4)	13 (8.1)	15 (8.6)	17 (8.8)	17 (11.6)
26-40		46 (51.1)	41 (50.6)	64 (55.2)	76 (44.7)	82 (45.1)	71 (42.8)	75 (46.6)	75 (42.8)	81 (41.7)	68 (46.7)
41-55		30 (33.3)	29 (35.8)	41 (35.3)	64 (37.6)	75 (41.2)	71 (42.8)	67 (41.6)	71 (40.6)	77 (39.7)	58 (38.7)
56-69		0	0	0	1 (0.6)	3 (1.6)	5 (3.0)	6 (3.7)	14 (8.0)	19 (9.8)	5 (3.0)
Mean age		36.0	35.9	36.5	36.3	37.8	38.8	39.4	40.3	40.7	38.3
Blood group											
A-		0	0	2 (1.7)	6 (3.5)	7 (3.8)	4 (2.4)	5 (3.1)	7 (4.0)	7 (3.6)	4 (2.5)
A+		14 (15.5)	15 (18.5)	22 (19.0)	37 (21.8)	41 (22.6)	41 (24.7)	42 (26.1)	47 (26.9)	47 (24.2)	34 (22.1)
O-		24 (26.7)	20 (24.7)	31 (26.7)	42 (24.7)	42 (23.1)	35 (21.1)	32 (19.9)	34 (19.4)	43 (22.2)	34 (23.2)
O+		52 (57.8)	46 (56.8)	61 (52.6)	85 (50.0)	92 (50.5)	86 (51.8)	82 (50.9)	87 (49.7)	97 (50.0)	76 (52.2)
Annual donation frequency											
1x		10	13	14	27	37	33	19	34	41	25 (16.4)
2x		23	12	21	29	27	34	19	25	27	24 (16.8)
3x		7	12	12	28	23	19	15	23	34	19 (12.6)
4x		15	11	17	20	17	10	21	19	17	16 (11.6)
5x		11	8	7	15	17	15	22	19	22	15 (10.1)
6x		10	7	22	14	24	18	32	14	14	17 (11.8)
7x		10	13	14	14	13	17	14	20	20	15 (10.6)
8x		3	5	9	11	10	14	14	15	15	11 (7.0)
9x		1	0	0	8	12	4	3	3	4	4 (2.3)
10x		0	0	0	4	2	2	2	1	0	1 (0.7)
11x		0	0	0	0	0	0	0	2	0	0 (0.1)
Total donations		355	330	497	706	756	668	745	727	755	615
Mean annual donation frequency		3.9	4.1	4.3	4.2	4.2	4.0	4.6	4.2	3.9	4.1

Table 2. Characteristics of plasma donors by year in Iceland 2005-2013 (18-69 years) N=180

Charecteristics	Year	2005 n (%)	2006 n (%)	2007 n (%)	2008 n (%)	2009 n (%)	2010 n (%)	2011 n (%)	2012 n (%)	2013 n (%)	Mean 2005-2013 n (%)
		n=32	n=19	n=24	n=32	n=43	n=92	n=33	n=79	n=87	n=49
Sex											
Female		7 (21.9)	6 (31.6)	4 (16.7)	4 (12.5)	5 (11.6)	3 (3.3)	0	0	0	3 (10.8)
Male		25 (78.1)	13 (68.4)	20 (83.3)	28 (87.5)	38 (88.4)	89 (96.7)	33 (100)	79 (100)	87 (100)	46 (89.2)
Age group, year											
18-25		4 (12.5)	3 (15.8)	2 (8.3)	3 (9.4)	3 (7.0)	12 (13.0)	5 (15.1)	5 (6.3)	7 (8.1)	5 (10.6)
26-40		16 (50.0)	8 (42.1)	12 (50.0)	15 (46.9)	21 (48.8)	33 (35.9)	13 (39.4)	37 (46.8)	37 (42.5)	21 (44.7)
41-55		11 (34.4)	8 (42.1)	10 (41.7)	14 (43.7)	17 (39.6)	42 (45.7)	13 (39.4)	30 (38.0)	33 (37.9)	20 (40.3)
56-69		1 (3.1)	0	0	0	2 (4.6)	5 (5.4)	2 (6.1)	7 (8.9)	10 (11.5)	3 (4.4)
Mean age		36.9	38.6	37.2	37.9	36.9	38.9	37.3	40.3	41.4	39.0
Blood group											
A-		1 (3.1)	0	0	0	0	0	0	0	0	0.1 (0.3)
A+		6 (18.8)	1 (5.3)	0	0	0	0	0	3 (3.8)	0	1.1 (3.1)
AB-		7 (21.9)	7 (36.8)	9 (37.5)	9 (28.1)	10 (23.3)	10 (10.9)	9 (27.3)	8 (10.1)	8 (9.2)	9 (22.8)
AB+		17 (53.1)	11 (57.9)	15 (62.5)	18 (56.3)	25 (58.1)	25 (27.2)	24 (72.7)	28 (35.4)	27 (31.0)	21 (50.5)
B-		0	0	0	0	0	10 (10.8)	0	9 (11.4)	8 (9.2)	3 (3.5)
B+		0	0	0	5 (15.6)	8 (18.6)	47 (51.1)	0	31 (39.3)	44 (50.6)	15 (19.5)
O+		1 (3.1)	0	0	0	0	0	0	0	0	0.1 (0.3)
Annual donation frequency											
1x		31	12	8	11	13	23	4	24	29	17 (39.9)
2x		0	4	3	5	4	27	7	15	22	10 (17.0)
3x		1	1	8	4	12	22	3	16	14	9 (16.8)
4x		0	1	3	3	2	8	10	12	4	5 (10.1)
5x		0	0	0	3	4	2	1	4	7	2 (4.1)
6x		0	1	2	2	2	1	1	3	4	2 (4.1)
7x		0	0	0	1	2	3	3	1	2	1 (2.6)
8x		0	0	0	2	4	4	2	2	3	2 (3.5)
9x		0	0	0	1	0	0	2	0	0	0.3 (1.0)
10x		0	0	0	0	0	1	0	1	2	0.4 (0.5)
11x		0	0	0	0	0	0	0	0	0	0.1 (0.1)
16x		0	0	0	0	0	0	0	1	0	0.1 (0.1)
Total donations		34	33	62	104	143	254	133	237	248	139
Mean annual donation frequency		1.1	1.7	2.6	3.2	3.3	2.9	4.0	3.0	2.9	2.9

Table 2. Characteristics of red cells donors by year in Iceland 2005-2013 (18-69 years) N=237

Charecteristics	Year	2005*	2006	2007	2008	2009	2010	2011	2012	2013	Mean 2005-2013
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Total donors		94 (100)	97 (100)	129 (100)	138 (100)	115 (100)	108 (100)	94 (100)	48 (100)	103 (100)	
Sex											
	Female	0	0	0	0	0	0	0	0	0	0
	Male	94	97	129	138	115	108	94	48	103	103 (100)
Age group, year											
	18-25	0	0	9 (7.0)	5 (3.6)	6 (5.2)	2 (1.9)	4 (4.3)	2 (4.2)	3 (3.3)	3 (3.3)
	26-40	38 (40.4)	39 (40.2)	53 (41.1)	60 (43.5)	50 (43.5)	51 (47.2)	44 (46.8)	21 (43.7)	45 (43.3)	45 (43.3)
	41-55	47 (50.0)	49 (50.5)	53 (41.1)	63 (45.7)	54 (47.0)	48 (44.4)	40 (42.5)	21 (43.7)	47 (45.6)	47 (45.6)
	56-69	9 (9.6)	9 (9.3)	14 (10.8)	10 (7.2)	5 (4.3)	7 (6.5)	6 (6.4)	4 (8.4)	8 (7.8)	8 (7.8)
Mean age		43.6	43.2	41.3	41.0	41.0	41.0	40.3	40.8	41.5	
Blood group											
	A-	3 (3.2)	4 (4.1)	3 (2.3)	5 (3.6)	6 (5.2)	5 (4.6)	4 (4.2)	1 (2.1)	4 (3.7)	4 (3.7)
	A+	13 (13.8)	13 (13.4)	23 (17.8)	29 (21.0)	22 (19.2)	23 (21.3)	21 (22.3)	10 (20.8)	19 (18.7)	19 (18.7)
	B-	2 (2.1)	2 (2.1)	2 (1.6)	2 (1.4)	2 (1.7)	1 (0.9)	0	0	1 (1.2)	1 (1.2)
	B+	14 (14.9)	10 (10.3)	11 (8.5)	8 (5.8)	9 (7.8)	5 (4.6)	4 (4.3)	0	8 (7.0)	8 (7.0)
	O-	17 (18.1)	21 (21.6)	24 (18.6)	24 (17.4)	20 (17.4)	14 (13.0)	14 (14.9)	9 (18.8)	18 (17.5)	18 (17.5)
	O+	45 (47.9)	47 (48.5)	66 (51.2)	70 (50.7)	56 (48.7)	60 (55.6)	51 (54.3)	28 (58.3)	53 (51.9)	53 (51.9)
Annual donation frequency											
	1x	77 (81.9)	59 (60.8)	50 (38.7)	56 (40.6)	48 (41.7)	49 (45.4)	39 (41.5)	24 (50.0)	50 (50.1)	50 (50.1)
	2x	16 (18.0)	35 (36.1)	75 (58.1)	81 (58.7)	65 (56.6)	56 (51.8)	48 (51.1)	19 (39.6)	49 (46.1)	49 (46.1)
	3x	1 (0.1)	3 (3.1)	2 (1.6)	1 (0.7)	2 (1.7)	3 (2.8)	7 (7.4)	4 (8.3)	3 (3.3)	3 (3.3)
	4x	0	0	2 (1.6)	0	0	0	0	1 (2.1)	1 (0.5)	1 (0.5)
Total donations		112	138	214	221	184	170	156	78	141	
Mean annual donation frequency		1.2	1.4	1.7	1.6	1.6	1.6	1.7	1.6	1.5	

5 The Blood Donor Base

To ensure adequate blood supply, it is essential to have access to individuals of good health and low risk of developing infections, thus eligible to donate blood. These individuals must also be willing to give their valuable time to the community (23). Blood donors' recruitment and retention can be targeted more precisely if good information about the donor base is available. The first step in formulating strategies to reach new donors and maintain current donors is to examine current donor group, e.g. with respect to size, age, sex distribution and as well as donation frequency. Questions like; are the sexes equally represented in the donor population, what is the mean age of the regular donor group, is the donor population ageing and are there enough donors so that each blood group is provided for, are important for managing the donor base (1).

Previous studies, of various designs, on the demographic characteristics of blood donors reveal that the blood donor populations differ with respect to demographic characteristics and whether those giving blood are replacement donors or voluntary non-remunerated donors. The main purpose of most of these studies has been to use the information to develop strategies to attract new blood donors and maintain the donor group.

Blood donors are commonly divided into replacement donors (or community donors) and active donors (repeat donors) (23, 24). The replacement donors often have personal reason for donating blood, e.g. have a friend or relative who needs blood, while the active donors are volunteers who have no knowledge of who receives the blood. The main factor that encourages people to donate blood is altruism (25).

Results based on data from a large blood center in the city of Sao Paulo, Brazil, where information was collected on donors' sex and age and type of donation in 1995-2001, show trends towards the direction of voluntary blood donations (24). Residents of Sao Paulo have responded well to promotions and marketing campaigns recruiting donors from among friends and relatives of hospitalized patients. The study authors are confident that similar promotional methods would have a positive effect elsewhere in Brazil (24).

Not everybody within the general population is willing to become a blood donor so it is necessary to raise blood donor awareness (1). Veldhuizen et al. examined whether factors such as social status and place of residence affects whether people donate blood. They demonstrated that within a population of 370,470, that active donors had, compared with occasional donors, higher incomes, lived in less urbanized areas or areas with little ethnic diversity (26).

According to the Donor Management in Europe (DOMAINE) it is feasible that 3-4% of a nation's population, at eligible donor age, are blood donors (1). A survey, conducted by DOMAINE, which 48 establishments from 38 countries in Europe participated in, showed that the average total number of blood donations in 2007 for each donor, was 1.6 including the first time donors and 1.9 if they were not included (1).

Generally and according to The World Health Organisation (WHO) the number of donations needed is expressed as number of donations per 1,000 inhabitants. The donation rate varies in the World and

the rate is 36.8 in high-income countries per 1,000 inhabitants, 11.7 in middle income countries and 3.9 in low income countries (2).

5.1 Women as Blood Donors

Various sources review that women seem more willing to donate blood than men (27, 28). Other studies show that men generally donate blood more often than women (23, 24, 26, 29, 30). Boulware et al. conducted population-based pilot study in Maryland US, where women had 80% lower odds of prior donations compared with men (29). A study conducted in Port Moresby Papua New Guinea indicated, however, there were significant increases in female donors from 17% to 25% of all donors during 1990-1994 (30). Female donors also increased from 20% of all blood donors to 37% in the period from 1995 to 2001 in the study conducted in Sao Paulo Brazil (24). Study conducted by Veldhuizen et al. which consisted of all registered whole blood donors in the Netherlands in 2004-2005 (N = 370 470) showed that men were five times more likely to be regular blood donors than women (26). Studies also show that women tend to begin as newly registered donors and first time donors as much as men but are less likely to become regular donors (27, 31).

By nature women have less blood volume in the body than men and then give higher percentage of their blood volume than men. There is also a higher rate of temporary deferrals among them due to hemoglobin levels below acceptable limits (27, 28, 32). That is why the policy in the Icelandic Blood Bank is that females can generally donate whole blood every four months and males every three months. Women suffer the adverse effects of blood withdrawal more than men and are more susceptible to vasovagal reactions, which negatively affect their experience as donors (27, 32). Evidence exists that negative experiences during whole blood donation have a discouraging effect upon retention. The fact that women must refrain from blood donation during pregnancy and breastfeeding may also affect their return to donation afterwards (33).

According to unpublished historical data the proportion of female blood donors was for a long time less than 10%. However in recent years women have almost been equally represented as newly registered donors as men and about 25% of regular whole blood donors in Iceland (9).

Transfusion-related acute lung injury (TRALI) is a rare serious adverse event that can be associated with blood transfusion (34, 35). The main theory is that antibodies (immune molecules) in donor plasma attack white cells in the recipient (patient), causing pulmonary edema with breathing problems. The antibodies thought to cause TRALI are more common in women, particularly after pregnancy. The plasma from female donors is associated with an increased risk of TRALI, while red blood cells from female donors are not. TRALI can be prevented by predominantly use plasma from males for transfusion. That is why many Blood Services have the policy to defer female donors from donating high-plasma-volume components such as plasma and aphaeresis platelets (34-36).

Despite the limitations that affect females' donation rate and pattern, they seem equally or even more willing to donate blood than men according to Madrona et al. in a study of women as whole blood donors. Madrona et al. propose that measures should be taken to reduce the obstacles that prevent women

from donating whole blood (27). Since iron deficiency is common cause of low hemoglobin it is important to educate female whole blood donors about a healthy iron enriched diet to help restore the iron removed with blood donation (9, 27, 28). Also to introduce measures to offset reactions related to whole blood donation, like adequate fluid intake (9, 27, 28). As whole blood donors females can be an important source for the communities' blood supply (27, 28).

5.2 The Effect of Age Distribution/Demography of Populations

The age distribution of Western nations is shifting upwards towards older age (4). Such changes in the demographics of the general population are likely to affect the age distribution of blood donors and those who are eligible to donate blood. At the same time the number of individuals that need blood transfusion increases, as a large proportion of blood products are transfused to patients who are older than 65 years (37). Following is a need for clear recruitment and retention efforts to maintain blood donors, both among younger and older age groups. According to the American Red Cross the total blood donations among active donors older than 50 years old increased from 22.1% of all age groups in 1996 to 34.5% in 2005, equivalent to a 1.4% increase per year. In contrast, there was reduction in blood donations in the group of active blood donors aged 25 to 49 years from 49.1% blood donors of all age groups in 1996 to 37.1% in 2005, a 1.3% decrease per year. Such trends in the age distribution of donors could lead to a severe shortage of blood components, because of the aging population in need of blood and fewer young and healthy who can give blood (38).

According to publicly available population statistics from the Bureau of Statistics in Iceland, the proportion of the Icelandic population aged 65 and older has increased from 11.8% in 2005 to 12.9% in 2013 (39). This ratio will most likely continue to rise and according to the medium projection of the population in Iceland, it is estimated to be 18.6% in 2030 and 20.8% in 2040. Furthermore the ratio of the population aged 65 and older for males was 12% and 13.9% for females or 12.9% for both sexes in 2013. However it will be 19% for males and 22.5% for females or 20.8% for both sexes in 2040, according to the medium projection of the population in Iceland (39).

The DOMAINE survey, which 48 establishments from 38 countries in Europe provided information about blood donors reported that the mean age of donors was 38.3 years among males and 37.4 years among female donors (1).

6 Blood Supply and Demand

To ensure an adequate number of blood components needed for the hospitals, a balance between the demand and the number of blood donations is required (1). The effort to ensure both safety of blood donors and recipients of blood components have reduced the number of population eligible to donate. However these efforts have made blood products safer than ever in the history of modern medicine (40).

Clinical guidelines are an important factor in promoting the proper use of blood components. The main aim of clinical guidelines is to ensure that blood components are only used in cases where they have a beneficial effect for the patient. In several countries clinical guidelines have contributed to a decrease in blood use, towards a universal "good clinical practice" (41). In 2004, clinical guidelines were published for use of red cells in The National University Hospital of Iceland and reviewed for use of other blood components in 2012 (42, 43). Potential increase in demand will outstrip the supply in the near future given the above mentioned reasons; ageing population, increased demand for transfusions and a smaller pool of healthy eligible population. The effort to ensure both safety of blood donors and recipients of blood components have reduced the number of population eligible to donate. However these efforts have made blood products safer than ever in the history of modern medicine (40).

However Borkent-Raven et al. predicted the demand of red blood cells (RBC) for Netherland by developing mathematical models and found that the demand may not increase as much as predicted in other studies (37). Despite the concerns of ageing population in western countries they will probably be neutralized by optimal use of blood components (37).

The importance of apheresis has increased in recent years and helps the Blood Bank to manage production so that it is in accordance with the demand, and as a result the number of whole blood collections decreased. The share of blood components collected with aphaeresis is constantly expanding and in 2012 it was 8% of overall collections in the Icelandic Blood Bank (9, 19).

7 Donor Recruitment and Retention

The recruitment and retention is the key to enhance strong blood donor base for blood services, while it is a challenging task that requires dedicated and committed staff (26, 27). It requires identification of low-risk population who is willing to donate blood regularly, voluntary and non-remunerated (27). Although many people in communities are eligible to donate blood only a small proportion donates regularly (25, 44). The recruitment of young people as new blood donors is important because young donors can guarantee the blood supply for a longer time than older donors but the retention of already active blood donors is becoming more and more important (33, 45).

Important barriers to blood donation are fear of the "unknown", the needle and of fainting. The donation experience itself can also have deterrent effect on return behavior. Being deferred or experiencing adverse reaction predict a decreased likelihood of donor return (44). The lack of direct connection with the need of blood and blood products is also a factor that affects the public's intention to give blood. That is why it is important to make the general population realize that blood donation and its blood products can become vital in anybody's life (28, 29).

Blood establishments need to have a strategy in marketing and advertising for donor recruitment to encourage donors to donate regularly, and first time donors to return to donate again (2, 13, 27). Recruitment of first time donors is essential to add up for those who stop donating because of positive results in screening test, illnesses and older age (13).

The DOMAINE project states that marketing strategy for blood Establishment comprises of four phases; 1. Position marketing, 2. Operational marketing, 3. Relationship marketing and 4. Recognition (2). Position marketing aims at making the public aware of the benefit for the community for blood and blood products. Operational marketing is the call to action and is both directed to first time donors and existing donors and often includes personal invitation methods like phone calls invitations, e-mails and text message by SMS. Relationship marketing aims to maintaining the returns of the donors to become regular donors. It involves for instance reducing the waiting time; ensure hearty welcomes and appropriate handle of deferral wherein it can cause frustration and disappointment. Recognition aims at acknowledging and developing a good donor relationship. It can involve a thank you message, refreshments after having made the donation and little gifts (2).

It has been shown that a good education for blood donors, especially first time donors, is important in reducing anxiety and adverse events (45). Education about simple tasks like water ingestion shortly before blood donation and of applied muscle tension (repeated contraction of the major muscle groups) may be a simple and cost-effective strategy to enhance the donation experience (46, 47). It is also important to motivate and educate the Blood Donor Service Staff and make the blood donation convenient. Good accessibility and atmosphere and distraction like music, video or conversation can also help to reducing anxiety and increase retention (45).

7.1 Blood Donors Management and Recruitment Methods

To ensure safe and secure blood supply the key activities for all blood establishments are donor recruitment and retention strategies (1). Blood establishments in Europe use a wide variety of Marketing strategies and recruitment methods. It is stated in the DOMAINE manual that the top five most effective recruitment methods are commercials on national TV, donor-recruit-donors, commercials on national radio, direct mail campaigns and telephone actions (1).

Information technology (IT) is becoming of more importance in recruiting and retaining blood donors, for instance social media like Facebook, Twitter, Instagram and Snapchat. The Icelandic Blood Bank already has a Facebook account (<https://is-is.facebook.com/Blodbankinn>) but it would be wise to look at opportunities in other social media wherein different social media sites have different uses, strengths, and advantages.

7.1.1 Digital Experience from Germany

In the EBA (European Blood Alliance) benchmarking workshop held in Helsinki in March 2015, Dr. Sigrun Leipnitz introduced IT strategies which the German Red Cross has developed to recruit and retain blood donors (48). One of them is Blood Donor Community (blutspender.net), which started in June 2009 and had 150,588 users in Feb. 2015. This community is similar to Facebook with a network of blood donors that can share things like, when they donate blood, state why they donate blood and so on. They can also see when their friends have appointments for the next blood donation and then keep that in mind for their own appointment to be able to meet friends at the blood donor site. In November 2011 they also started with Mobile Application where one can also connect with the donors' community, book an appointment and see where a Blood drive is next to one's location. It is also possible to see personalized profile which for instance one can see how many days are until one can donate again and overview about last donations including bloodpressure and Hb-value (48).

Pre-Donation Health-Check is another feature which can be accessed via website and app. It includes 21 short questions based on the Blood Banks criterias for blood donation that can save time and effort with a little predonation check. The German Red Cross, like many other Blood Banks in Europe, has also developed Online Appointment Booking-System where the blood donor can book a session time that suits him and get a reminder (48).

7.1.2 Recruitment Strategies in the Icelandic Blood Bank

The mobile vehicle site (Bloodmobile) is of major importance for the Icelandic Blood Bank to recruit new donors by regular visits to schools and businesses in the capital area and to communities in rural areas.

The main recruitment strategy in the Icelandic Blood Bank is also by sending text messages, e-mails and through phone calls. Probably the "donor-recruit-donor" i.e. donor that recruits another donor also plays a major role in recruiting new donors where active donors encourage friends and relatives to donate blood. Regular blood donors influence their children that are used to their parents giving blood and come in visits to the Blood Bank getting to know the environment. Promotional activities are also very important to recruit donors and many of them have been in partnering with companies and the Icelandic blood donors association ("Blóðgjafafélag Íslands"). It is important for the Icelandic Blood Bank

to monitor new methods to reach out to donors/general population and assimilate them. The strategies can be targeted more precisely if good information about the donor pool is available.



Fig. 6 The Bloodmobile in collection tour in Húsavík 6. May 2013.

8 Aims

The overall aim of the study was to describe the blood donor group in Iceland in 2005-2013 with respect to the size and demographic characteristics of donors and specific donation characteristics. Further we aimed to assess potential time trends in the patterns of blood donation and compare the donor base with the general population in Iceland.

Specifically, for each study year we described newly registered and regular whole blood donors according to their sex, age, blood group and residency. Characteristics of blood donation were examined according to site of donation, donation frequency per year and type of blood collection. Further we determined:

- The proportion of total donors, newly registered donors and first time donors among the general population eligible to donate blood in Iceland.
- The number and characteristics of newly registered donors per year over the study period.
- The number and characteristic of regular whole blood donors per year over the study period.
- The retention of newly registered donors, measured as the proportion of newly registered donors who became regular whole blood donors during the study period.

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Article Manuscript

Blood Donors in Iceland:

A Nationwide Population-Based Study in 2005-2013

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Why this manuscript is appropriate for TRANSFUSION: This manuscript focuses on blood donors and blood collection which are important basis of transfusion medicine.

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ABSTRACT

BACKGROUND: Demographic information of blood donors is important to formulate strategies for recruitment and maintenance of the donor group. Factors like ageing population, increasingly advanced medical treatments and growing safety initiatives to protect donor and recipient of blood components, will affect the size of the donor group in the future. The purpose of this study was to determine the size of the donor group in Iceland and describe the demographic and donation characteristics.

STUDY DESIGN AND METHODS: We determined the size of the donor group in Iceland and described the demographic and donation characteristics, particularly of all newly registered and regular whole blood donors in the country from 2005 to 2013.

RESULTS: The number of regular whole blood donors and donations decreased by 12.2% and 13.0%, respectively, from 2005 to 2013. Females and males were almost equally represented as newly registered (47.5%/52.5%) donors but males are better represented as regular whole blood donors (26.7%/73.3%). Only 57.3% of newly registered donors in 2005-2006, came back to donate in the period 2005-2013.

CONCLUSION: Even though the whole blood donor group and number of donations has declined in recent years, the supply has been according to demand. Smaller retention rate among females than males gives the opportunity to focus on increasing the share of women among regular blood donors. The same applies to newly registered donors and strategic work toward their effective recruitment is ideal to ensure a sufficiently large group of blood donors in Iceland in the near future.

Key words: Blood donors, blood donations, demographics, donor characteristics, recruitment

INTRODUCTION

The main purpose of blood banks around the world is to fulfill the communities' needs for safe blood products and transfusion services. Increasingly more complicated medical procedures, such as cancer treatments and complex surgeries, require transfusion of blood components.^{1, 2}

The age distribution of Western nations is shifting upward towards older age.³⁻⁵ Such changes in the demographics of the general population also affect the age distribution of blood donors and those who are eligible to donate blood. At the same time, the number of individuals who need blood transfusion increases, as a large proportion of blood products are transfused to patients who are older than 65 years.⁴⁻⁶ The effort to ensure both safety of blood donors and recipients of blood components with criteria for donors, have also reduced the number of population eligible to donate.⁷

Even though the best transfusion practices grounded on evidence based clinical trials can lead to optimal and reduced use of blood components, the need for blood products will likely increase in an aging population more susceptible to malignancies and chronic diseases.⁸⁻¹⁰ Therefore recruitment and maintenance of active, healthy donors with low risk of developing infections, is of obvious importance for blood product supply and transfusion.^{11, 12}

According to publicly available population statistics from the Bureau of Statistics in Iceland, the proportion of the Icelandic population aged 65 and older has increased from 11.8% in 2005 to 12.9% in 2013.¹³ This ratio will most likely continue to rise and according to the medium projection of the population in Iceland, it is estimated to be 18.6% in 2030 and 20.8% in 2040. Furthermore the ratio of the population aged 65 and older for males was 12% and 13.9% for females in 2013. However it will be 19% for males and 22.5% for females in 2040, according to the medium projection of the population in Iceland (Supplementary fig. 1).¹³

Demographic information of blood donors is important to formulate strategies for recruitment and maintenance of the donor group.¹⁴ It is beneficial to increase donors' retention and long-term commitment, and information on demographic of the donor group is also important to investigate blood donors return behavior.^{15, 16} Many factors can affect donors' commitment to donate blood regularly, such as temporary deferrals and experienced discomfort by donating blood.¹⁶

The sole supplier of blood products in Iceland is the Icelandic Blood Bank, which is a part of the National University Hospital of Iceland situated in the capital city, Reykjavík. This setting allows for relatively easy to access data of all blood donors and donations, ideal for the evaluation of the demography and donation pattern, as well as nationwide comparisons. Nevertheless, to date the basic patterns and time trends of blood donations in Iceland, and general population eligible to become blood donors, have yet to be described.

Leveraging on nationwide data we aimed to determine the size of the donor group in Iceland and describe the demographic and donation characteristics, particularly of all newly registered and regular whole blood donors in the country from 2005 to 2013. Following, the findings could be used to develop sound strategies for recruitment and retention of the donor group in Iceland.

MATERIALS AND METHODS

Study setting

This was a descriptive nationwide population-based study, based on data from the Icelandic Blood Bank from January 1st 2005 to December 31st 2013. Information was derived from the ProSang computer support tool (blood management system - Databyrán AB), which keeps track of all blood donations and donor information at the Icelandic Blood Bank, including, donation type, donors' blood type, sex, age and residency, as well as information of blood sites and donating location. The Icelandic Blood Bank has three collection sites in the country: Reykjavík, Akureyri and a mobile vehicle site (Bloodmobile). The Akureyri-site collects only whole blood, while the Reykjavík-site also collects blood components with aphaeresis, i.e. platelets, plasma and red blood cells. The Bloodmobile goes on regularly visits to schools and businesses in the capital area and communities in rural areas to collect whole blood from donors.¹⁷

The source population consisted of all individuals aged 18-69 years (blood donor age eligible to donate) living in Iceland in 2005-2013, on average 205,892 individuals each year.¹³ Data on the Icelandic source population, as of January 1st each year, were retrieved from the publicly available population statistics from The Bureau of Statistics in Iceland.¹³ Included as subjects in this study were all donors (n=27,406) in Iceland, registered in the Icelandic Blood Bank, during the study period.

Measures

With reference to DOMAINE (Donor Management in Europe – guidance in donor management)¹⁸ we used the following definitions to describe blood donors: *Newly registered donor*; an individual registered as a donor but who has not donated any blood yet, only been tested for infectious disease markers and answered health-questionnaires. From 2012 onwards there were changes in the computer system and donors returning after a break of five years or more have also been registered as newly registered donors the second time. To ensure the continuity of data throughout the period we excluded these (n=280) from the donor population as newly registered donors. We also excluded individuals (N=402) who came for phlebotomy and autologous collection who also where registered as newly registered donors at their first visit/registration. *First time donor*; an individual who has donated their first and only one donation. *Regular whole blood donor*; a blood donor who has made one or more donation in the past year. *Aphaeresis donor*; a donor who donates only one type of blood component with aphaeresis, i.e. platelets, plasma and red blood cells. Information on aphaeresis donors (N=817) were included in the total donor population but were not analyzed for the main results of the study, but is presented as a supplementary analysis (supplementary table 1).

Data analysis

We used descriptive statistics, according to the above study measures.

For the overall study period, we described the number of *newly registered* and *first time donors* as a proportion of the total source population and the total donor population by sex and age (18-25, 26-40, 41-55 and 56-69 years). Age at the time of donation was categorized with reference to the DOMAINE manual.¹⁸

To examine the retention pattern of *newly registered donors*, we calculated donation frequency over the period 2005-2013 among donors registered as new donors in 2005-2006. For each study year we described demographic characteristics of whole blood donors, as well as donation characteristics, i.e. distribution of ABO and Rh blood groups, donation frequency and donation site (Reykjavík, Bloodmobile and Akureyri). Residency of donors was based on zip codes and categorized as urban (Reykjavík area and Akureyri) and rural (other territories).

In May 2007 the small (n=1,133) fixed blood collection site in Akureyri merged with the Reykjavík site and all whole blood collected there is transported to Reykjavík for processing. Since then a single database keeps track of all donor information nationwide. Donors from Akureyri prior to 2007 were, however, registered as newly registered donors into the combined database. As we were unable to separate these from those who were truly new, the overall figures from years 2007 and 2008 may be somewhat biased. We used R-studio statistical software (version 0.98.490) and Excel spread sheets to analyze all data. The study was approved by the Ethics Committee of the National University Hospital of Iceland (40/2013) and reported to the Icelandic Data Protection Authority (S6484, S6497, S6664).

RESULTS

Donor base and the general population

Table 1 shows that, on average 5.1% of the Icelandic population aged 18-69 years in 2005-2013 were blood donors, 0.9% were *newly registered donors* and 0.4% *first time donors*.

Newly registered female donors was 26.2% of the total female donor population, whereas amongst male donors the comparative proportion of newly registered donors was 14.8%.

Similarly, among the group of female donors, the recruitment of first time donors was a higher proportion of total donor population (11.7%) in comparison to males (7.5%).

The number of whole blood donors was 27.1 per 1,000 inhabitants in 2006 and decreased to 21.1 per 1,000 inhabitants in 2013. Similarly, donations per 1,000 inhabitants were 51.4 in the year 2006 but decreased to 40.1 in the year 2013.

Newly registered donors

The total number of newly registered donors in 2005-2013 was 17,309, or on average 1,924 each year. The female/male ratio was 47.5%/52.5% on average in 2005-2013 and was approximately the same throughout the period (Fig.1, panel A). The majority of newly registered donors pertained to the youngest age group (18-25 years), and mean age of newly registered donors was 29.2 years (Fig.1, panel B). Blood type O was the most common among the newly registered donors, 44.8% were O+ and 9.0% were O-. The majority (58.7-53.2%) of the newly registered donors were recruited in the Bloodmobile in 2005-2009, but after 2010 the majority (47.8-49.0%) was recruited in Reykjavík. Fig. 2 depicts that of 4,315 newly registered donors in 2005-2006, 2,479 (57.5%) came back at least once to donate during the period 2005-2013; thereof 52.4% (1,009) of the females and 61.5% (1,470) of the males. Of those who continued to donate (n=2,479), only 18% donated five times or more, thereof 14.2% of the females and 21.2% of the males in same period.

Whole blood donors

In 2005-2013, a total of 18,915 whole blood donors donated at least one donation, on average 7,524 donors each year. Table 2 shows that the whole blood donor pool was highest in 2006 (8,121) but has declined since then until 2013 (6,800), by 16.3%. The female/male ratio was 26.7%/73.3% on average in 2005-2013. The number of female whole blood donors increased from 1,856 (24.0%) in 2005 to 1,977 (29.1%) in 2013. The number of males decreased from 5,890 (76.0%) in 2005 to 4,823 (70.9%) in 2013. The mean age of whole blood donors was 38.6 years, 34.5 years for females and 40.0 years for males. In 2005-2013 the number of males decreased most in the age groups 26-40 years and 41-55, by 26.0% and 20.8% in each age group.

Blood type O was most common among regular whole blood donors in 2005-2013, 44.1% were O+ and 13.3% were O-. The majority of the whole blood donors were from urban regions and the majority donated in Reykjavík. Whole blood donations decreased from 14,829 donations (from 7,746 donors) in 2005 to 12,907 donations (from 6,800 donors) in 2013. Among whole blood donors the mean donation frequency per year was 1.9 during the study period.

DISCUSSION

Main results

In this nationwide study of all blood donations in Iceland 2005-2013, we found a decrease in collection of whole blood, likely explained by a parallel trend of decreasing demand of red cells occurring in many Western countries.¹ Yet, throughout the study period the mean donation frequency remained stable, at 1.9 donations per donor each year. Females and males were almost equally represented as newly registered donors, while males were better represented as regular whole blood donors. We detected a relatively poor retention rate of newly registered donors.

Donor base and the general population

In 2006, the median blood donation proportion in Europe was 43 blood donations per 1,000 of the population and currently, according to information published in 2014 from the World Health Organization, the proportion of blood donation in high-income countries is 36.8 donations per 1,000 population.^{1, 14} We found slightly higher proportions in our data from Iceland, with 51.0 donations per 1,000 of the general population in 2006, dropping to 40.1 donations per 1,000 in 2013. For communities to be self-sufficient in blood supply for their health systems, the goal is to have 3-4% of the general population at the age 18-69 years as active blood donors.¹⁸ With an observed 5.1% of the general population as blood donors in the study data, Iceland should fulfill this criteria of self-sufficiency in blood supply.

Our data show that 18.4% of the Icelandic donor base were newly registered donors and 8.8% were first time donors, indicating a somewhat lower retention rate of newly registered donors in Iceland than on average in Europe.¹⁸ According to the DOMAINE survey of 20 establishments in Europe, 19% were newly registered donors and 15% first time donors. In Iceland newly registered donors do not donate blood during their first visit to the Blood Bank,

which could explain a poorer retention. Our results may warrant reason to further investigate this policy and ways to increase retention of newly registered donors.

The study data show an increasing average age of regular whole blood donors in Iceland from 37.8 years in 2005 to 39.1 years in 2013. Yet, they remain slightly younger than the average index population of 18-69 year-olds in Iceland; 40.1 years in 2005 and 41.5 years 2013.¹³

Newly registered and first time donors

Females accounted for 44.7% and males for 55.3% of all newly registered donors in Iceland during the study period. This gender ratio, which remained relatively stable throughout the study period, is inverse from what Lattimore et al. found in England and North Wales. There, females accounted for 56.6% and males 43.4% of all new donors in 2011.⁸

Our study data indicate a relatively poor retention rate of newly registered donors particularly among females, as only 57.3% of newly registered donors returned to donate for first time (52.4% of females, 61.5% of males). Various sources indicate that it is becoming increasingly difficult to retain regular blood donors,^{16, 19, 20} including newly registered and first time donors. This needs to be taken into account in the management of blood donors in Iceland.

Most newly registered donors and first time donors in Iceland were aged 18 to 25, which is in accordance with the DOMAINE survey wherein the majority of newly registered donors and first time donors in Europe were under 25 years.¹⁸ Recruitment of young blood donors is important as they can guarantee the blood supply for a longer time than older donors. But likewise, it is important to watch out for their retention of young donors because they tend to show higher deferral rates related to lifestyle.^{12, 21} Also, they may experience more complications to blood donations than other age groups like vasovagal reactions, which are associated with a decreased likelihood of repeated donations.^{12, 21}

Group O was the most common blood group in Iceland according to our data, with 44.8% of newly registered donor categorized as O+ and 9.0% as O-; the “universal” blood type, which can be safely used for all patients.²²⁻²⁵ Blood group A (32.6%) was the second most common in our data, somewhat lower than what has been found in Iceland’s neighboring countries, like Denmark and Norway (45-50%).²⁵

The majority of newly registered donors in Iceland were recruited in the Bloodmobile during the years 2005 to 2009, but in Reykjavík from 2010 onwards. A reason for this change could be that during the first study years after the Bloodmobile came into practice (2002) many of those who visited the Bloodmobile were newly registered donors but after several visits to the same location the ratio changes when they come back as regular donors in the Bloodmobile.

Whole blood donors

Our data show that the number of regular whole blood donors and donations decreased by 12.2% and 13.0%, respectively, during the period 2005-2013. However the proportion of females in the total donor pool increased from 24.0% to 29.1% during this same period. The reciprocal drop among male donors, especially those aged 26-40 years and 40-55 years, could be related to the emigration of males after the economic crisis in October 2008 because of increased domestic unemployment.¹³ According to publicly available population statistics from the Bureau of Statistics in Iceland, 632 males at the age 26-55 years emigrated from Iceland in 2005, but the number doubled to 1,380 in 2009.¹³

Males were better represented as regular whole blood donors than females (73.3%/26.7%) in Iceland during the period 2005-2013. This is in line with the results of the DOMAINE survey (2007) where 55% of regular whole blood donors are males and 45% females but the gender ratio is significantly larger in Iceland.¹⁸ However, much has been accomplished since 2001 when the Icelandic Blood Bank launched a campaign under the title: "Women can also give

blood". Before that females accounted for only about 10% of the regular donors.²⁶ This demonstrates that the favorable increase among female donors during the last 20 years needs to be pursued even further. Actually, a study by Jökulsdóttir et al. concluded by use of forecasting models that the Icelandic Blood Bank place emphasis on increasing the amount of female donors with the aim of equalizing male and female blood donors in Iceland.²⁷ The mean age for female donors in Iceland was 34.7 years and 40.0 years for males in 2005-2013. The responding blood establishments in the DOMAINE survey reported that the mean age for female donors was older (37.4 years) and younger for males (38.3 years).¹⁸ Our findings show that the proportion of blood type O- is higher among regular whole blood donors (13.3%) than among newly registered donors (9.0%). This probably reflects that the staff of the Blood Bank informs O- regular whole blood donors in a more effective way about the importance of their donations as "universal blood donors" in comparison with donors in other blood groups.

The mean donation frequency of Icelandic blood donors in the years 2005-2013 was 1.9 which is roughly the same throughout Europe according to the DOMAINE survey from the year 2007.¹⁸

Supply and demand

Despite this overall decrease of donors and donations, a shortage of blood components has not been a problem for the Icelandic health system in recent years.²⁸ It is fortunate that effective use of clinical guidelines introduced in 2004 and 2012 seems to have resulted in decreased use of blood components on a nationwide basis.^{1, 10, 29} In 2004, clinical guidelines were published for use of red cells in The National University Hospital of Iceland and reviewed for use of other blood components in 2012.^{29, 30} The main aim of clinical guidelines is to ensure that blood components are only used in cases where they have a beneficial effect for the patient. In several countries, clinical guidelines have contributed to a decrease in blood use, towards a

universal "good clinical practice". This decrease in blood use is furthermore an important factor in ensuring a balance between supply and demand for blood components.³¹ Strategic work towards effective recruitment of newly registered blood donors and retention of donors is an important factor in achieving a sufficient supply of blood products in proportion to the demand.¹ Potential increase in demand will outstrip the supply in the near future given the above mentioned reasons; ageing population, increased demand for transfusions and a smaller pool of healthy eligible population. It is also prudent to take into account, like Riley et.al. pointed out, that the conventional method for determining eligible blood donors in a population using only age as the criterion, as done in this study, is not so accurate. Their findings shows that overestimate eligible donor prevalence is approximately 59% due to other factors known to cause donor deferrals and exclusion to ensure both safety of blood donors and recipients of blood components.⁷

Conclusions

This study attempts to describe the fundamental changes in the donor population in Iceland during the study period. This period has been characterized by a decrease in use of blood components, probably through effective application of clinical guidelines of blood use. Therefore, the Icelandic Blood Bank is not currently under pressure to increase the number of donors on a large scale. On the other hand, foreseeable changes in the demography of the Icelandic population will, in line with other western societies, call for an increase in blood usage, and therefore put extra pressure on the blood transfusion service in Iceland. It seems prudent to focus on feminization as regular whole blood donors, even though there has been a positive development in recent years and the proportion of females among blood donors has been growing. It is also advisable to do some strategic work towards effective recruitment of newly registered blood donors and retention of donors.

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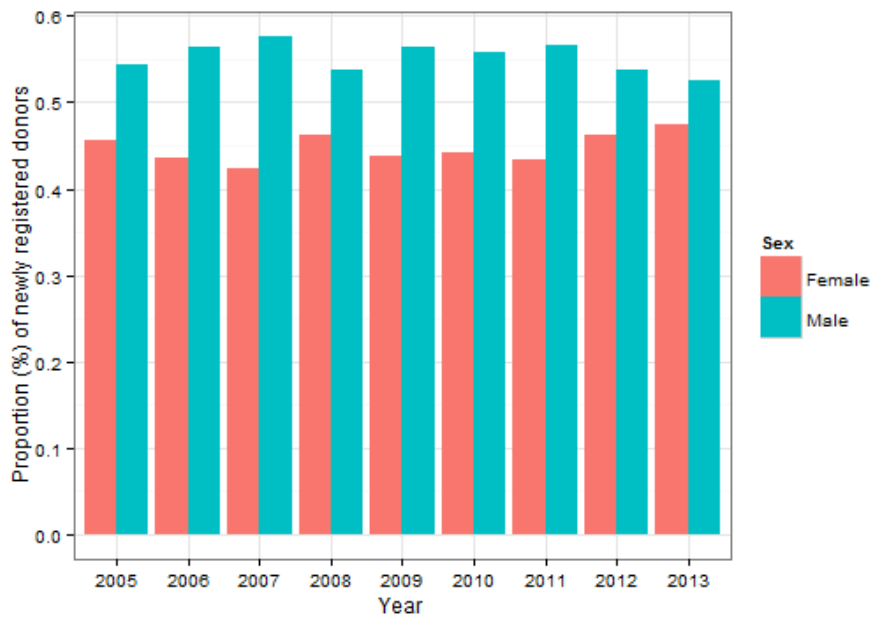
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TABLES AND FIGURES

TABLE 1. Newly registered and first time donors as a proportion (%) of the annual number of the general population and the donor population in 2005-2013 (18-69 years)

Characteristic	Total general populatio n	Total donor populatio n	Newly registre d donors	First time donors	Proportion of general population			Proportion of donor pop.	
					Total donors	Newly registre d donors	First time donors	Newly registered donors	First time donors
	n	n	n	n	%	%	%	%	%
Total	205,892	10,485	1,924	924	5.1	0.9	0.4	18.4	8.8
Age group, year									
18-25	36,638	2,665	994	493	7.3	2.7	1.3	37.3	18.5
26-40	66,610	3,614	567	290	5.4	0.9	0.4	15.7	8.0
41-55	63,521	3,307	323	125	5.2	0.5	0.2	9.8	3.8
56-69	39,123	899	40	16	2.3	0.1	0.0	4.4	1.8
Female	100,854	3,287	860	385	3.3	0.9	0.4	26.2	11.7
Age group, year									
18-25	17,917	1,199	473	211	6.7	2.6	1.2	39.4	17.6
26-40	32,344	1,166	239	108	3.6	0.7	0.3	20.5	9.3
41-55	31,208	789	137	60	2.5	0.4	0.2	17.4	7.6
56-69	19,385	133	11	6	0.7	0.1	0.0	8.3	4.5
Male	105,038	7,199	1,064	539	6.9	1.0	0.5	14.8	7.5
Age group, year									
18-25	18,720	1,466	521	282	7.8	2.8	1.5	35.5	19.3
26-40	34,266	2,448	327	182	7.1	1.0	0.5	13.4	7.4
41-55	32,314	2,518	186	65	7.8	0.6	0.2	7.4	2.6
56-69	19,738	767	30	10	3.9	0.2	0.1	3.9	1.3

Panel A



Panel B

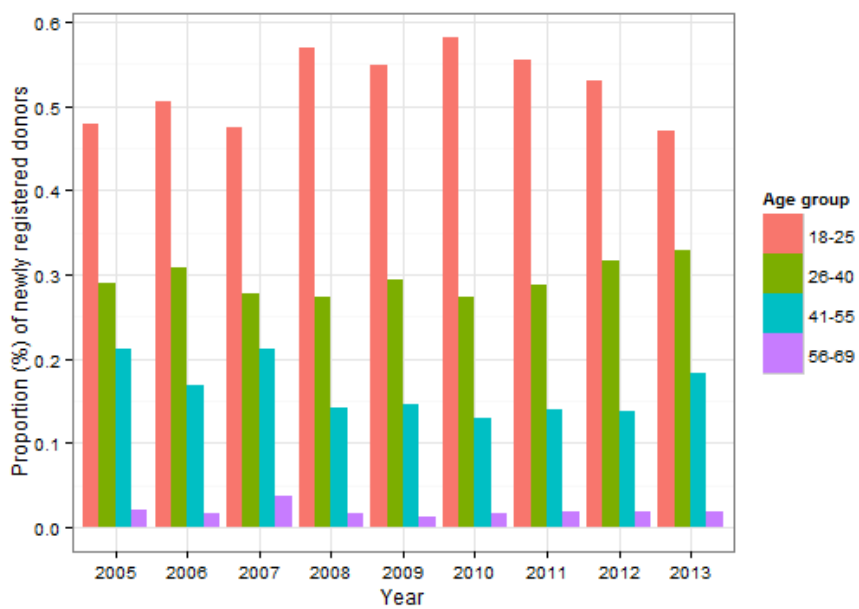


Fig. 1. The proportion of newly registered donors by sex (Panel A) and age groups (Panel B) in Iceland 2005-2013.

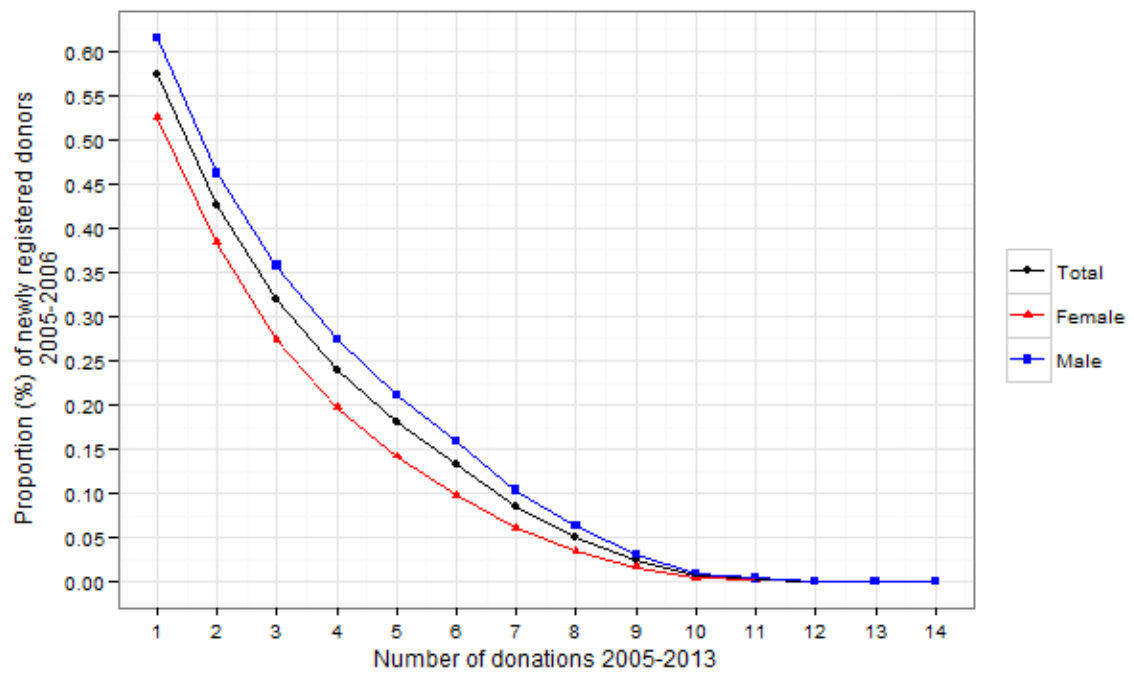


Fig. 2. Donation frequency over the period 2005-2013 among all newly registered donors in 2005-2006 that came back to donate whole blood.

TABLE 2. Characteristics of whole-blood donors by year in Iceland 2005-2013 (18-69 years) N=18,915

Characteristic		Year	2005	2006	2007*	2008	2009	2010	2011	2012	2013	Mean 2005-2013
		Total	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Sex												
	Female		1,856 (24.0)	2,014 (24.8)	2,130 (26.5)	2,081 (26.7)	2,027 (26.7)	2,051 (27.4)	1,925 (27.1)	1,962 (27.9)	1,977 (29.1)	2,003 (26.7)
	Male		5,890 (76.0)	6,107 (75.2)	5,920 (73.5)	5,701 (73.3)	5,566 (73.3)	5,446 (72.6)	5,168 (72.9)	5,070 (72.1)	4,823 (70.9)	5,521 (73.3)
Age group, year												
	Female											
	18-25		621 (33.5)	677 (33.6)	674 (31.6)	641 (30.8)	603 (29.7)	621 (30.3)	519 (27.0)	562 (28.6)	576 (29.1)	610 (30.5)
	26-40		720 (38.8)	737 (36.6)	803 (37.7)	774 (37.2)	720 (35.5)	729 (35.5)	716 (37.2)	679 (34.6)	644 (32.6)	725 (36.2)
	41-55		439 (23.7)	511 (25.4)	554 (26.0)	562 (27.0)	595 (29.4)	582 (28.4)	575 (29.9)	590 (30.1)	623 (31.5)	559 (27.9)
	56-69		76 (4.1)	89 (4.4)	99 (4.6)	104 (5.0)	109 (5.4)	119 (5.8)	115 (6.0)	131 (6.7)	134 (6.8)	108 (5.4)
	Male											
	18-25		966 (16.4)	925 (15.1)	907 (15.3)	902 (15.8)	843 (15.1)	902 (16.6)	849 (16.4)	900 (17.8)	836 (17.3)	892 (16.2)
	26-40		2,107 (35.8)	2,202 (36.1)	2,046 (34.6)	1,930 (33.9)	1,917 (34.4)	1,843 (33.8)	1,720 (33.3)	1,668 (32.9)	1,560 (32.3)	1,888 (34.2)
	41-55		2,239 (38.0)	2,315 (37.9)	2,292 (38.7)	2,189 (38.4)	2,130 (38.3)	2,011 (36.9)	1,941 (37.6)	1,844 (36.4)	1,774 (36.8)	2,082 (37.7)
	56-69		578 (9.8)	665 (10.9)	675 (11.4)	680 (11.9)	676 (12.1)	690 (12.7)	658 (12.7)	658 (13.0)	653 (13.5)	659 (11.9)
Mean age			37.8	38.1	38.4	38.6	38.8	38.7	39.0	38.9	39.1	38.6
	Female		33.3	33.5	34.0	34.4	34.9	35.0	35.5	35.7	36.0	34.5
	Male		39.2	39.6	40.0	40.0	40.2	40.1	40.3	40.1	40.3	40.0
Blood group												
	A-		376 (4.9)	434 (5.3)	460 (5.7)	466 (6.0)	429 (5.6)	430 (5.7)	399 (5.6)	376 (5.3)	368 (5.4)	415 (5.5)
	A+		1,886 (24.3)	1,981 (24.4)	2,061 (25.6)	2,081 (26.7)	1,988 (26.2)	1,953 (26.1)	1,812 (25.6)	1,839 (26.2)	1,789 (26.3)	1,932 (25.7)
	AB-		64 (0.8)	51 (0.7)	43 (0.5)	43 (0.6)	35 (0.5)	36 (0.5)	23 (0.3)	25 (0.4)	27 (0.4)	39 (0.5)
	AB+		209 (2.7)	175 (2.2)	174 (2.2)	179 (2.3)	153 (2.0)	129 (1.7)	136 (1.9)	136 (1.9)	152 (2.2)	160 (2.1)
	B-		128 (1.7)	146 (1.8)	128 (1.6)	120 (1.5)	126 (1.7)	144 (1.9)	116 (1.6)	116 (1.6)	124 (1.8)	128 (1.7)
	B+		556 (7.2)	572 (7.0)	518 (6.4)	503 (6.5)	553 (7.3)	549 (7.3)	532 (7.5)	503 (7.2)	521 (7.7)	534 (7.1)
	O-		1,053 (13.6)	1,115 (13.7)	1,040 (12.9)	1,007 (12.9)	1,019 (13.4)	995 (13.3)	937 (13.2)	964 (13.7)	893 (13.1)	1,003 (13.3)
	O+		3,474 (44.8)	3,647 (44.9)	3,626 (45.1)	3,383 (43.5)	3,290 (43.3)	3,261 (43.5)	3,138 (44.3)	3,073 (43.7)	2,926 (43.1)	3,313 (44.1)
Donation site												
	Reykjavík		6,150 (79.4)	6,294 (77.5)	5,935 (73.7)	5,485 (70.5)	5,214 (68.7)	5,074 (67.7)	4,828 (68.1)	4,776 (67.9)	4,426 (65.1)	5,354 (70.9)
	Bloodmobile		1,596 (20.6)	1,827 (22.5)	1,676 (20.8)	1,681 (21.6)	1,791 (23.6)	1,727 (23.0)	1,612 (22.7)	1,600 (22.7)	1,662 (24.4)	1,686 (22.5)
	Akureyri				439 (5.5)*	616 (7.9)	588 (7.7)	696 (9.3)	653 (9.2)	656 (9.4)	712 (10.5)	484 (6.6)
Residency†												
	Urban		6,072 (79.2)	6,401 (79.5)	6,264 (78.5)	6,138 (79.0)	5,891 (77.7)	5,717 (76.4)	5,368 (76.0)	5,369 (76.5)	5,156 (76.0)	5,820 (78.0)
	Rural		1,595 (20.8)	1,649 (20.5)	1,712 (21.5)	1,631 (21.0)	1,689 (22.3)	1,767 (23.6)	1,696 (24.0)	1,647 (23.5)	1,631 (24.0)	1,669 (22.0)
Annual donation frequency												
	1x		3,266 (42.2)	3,419 (42.1)	3,424 (42.5)	3,049 (39.2)	2,988 (39.4)	2,949 (39.3)	2,762 (38.9)	2,919 (41.5)	2,956 (43.5)	3,081 (41.0)
	2x		2,388 (30.8)	2,612 (32.2)	2,590 (32.2)	2,378 (30.6)	2,424 (31.9)	2,374 (31.7)	2,290 (32.3)	2,224 (31.6)	2,022 (29.7)	2,367 (31.4)
	3x		1,589 (20.5)	1,612 (19.8)	1,534 (19.1)	1,736 (22.3)	1,578 (20.8)	1,593 (21.3)	1,507 (21.3)	1,379 (19.6)	1,385 (20.4)	1,546 (20.6)
	4x		495 (6.4)	470 (5.8)	495 (6.1)	605 (7.7)	585 (7.7)	564 (7.5)	524 (7.4)	496 (7.1)	434 (6.4)	519 (6.9)
	5x		8 (0.1)	8 (0.1)	7 (0.1)	14 (0.2)	18 (0.2)	17 (0.2)	10 (0.1)	13 (0.2)	2 (0.0)	11 (0.1)
	6x		0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.0)	1 (0.0)	0 (0.0)
Total donations			14,829	15,399	15,221	15,503	15,000	14,817	14,009	13,559	12,907	14,583
Mean annual donation frequency			1.9	1.9	1.9	2.0	2.0	2.0	2.0	1.9	1.9	1.9
	Female		1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
	Male		1.9	1.9	1.9	2.0	2.0	2.0	2.0	1.9	1.9	1.9

* Akureyri merged with Reykjavík in may 2007

† Total number for residency does not match with total number of whole blood donors because of missing data of residency

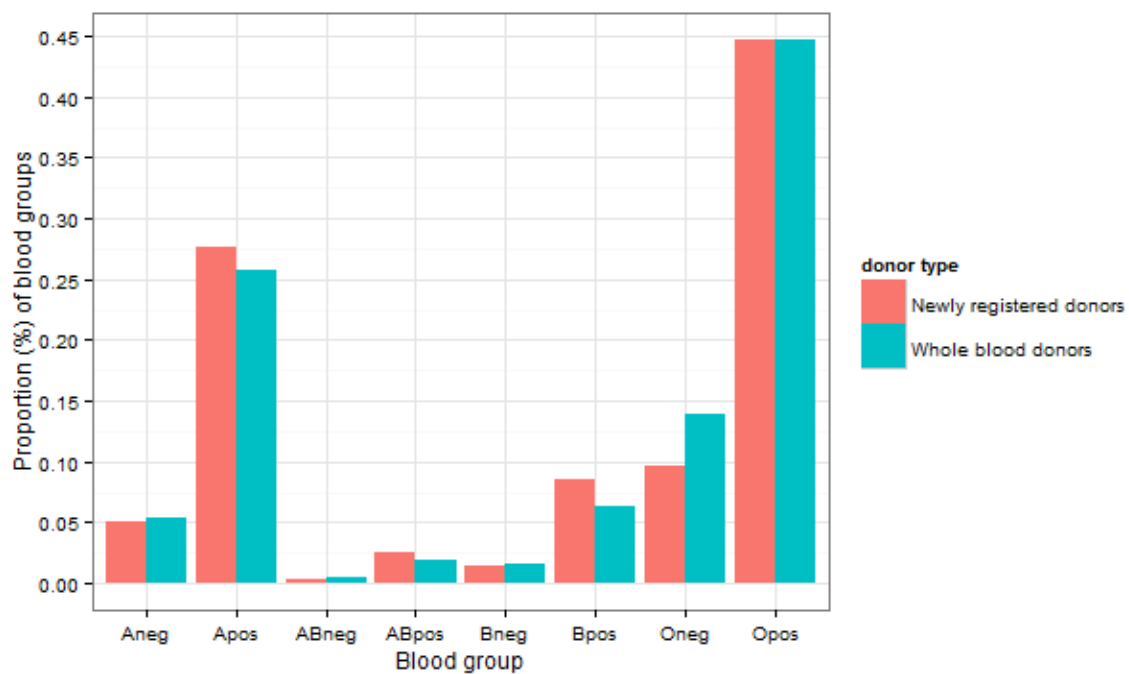
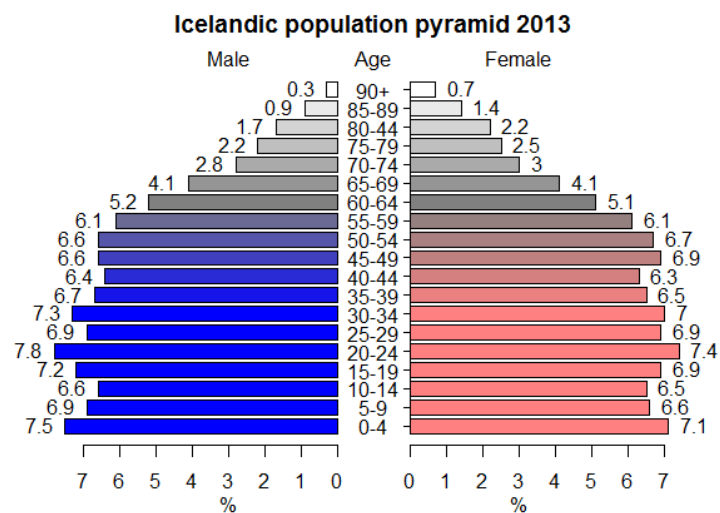


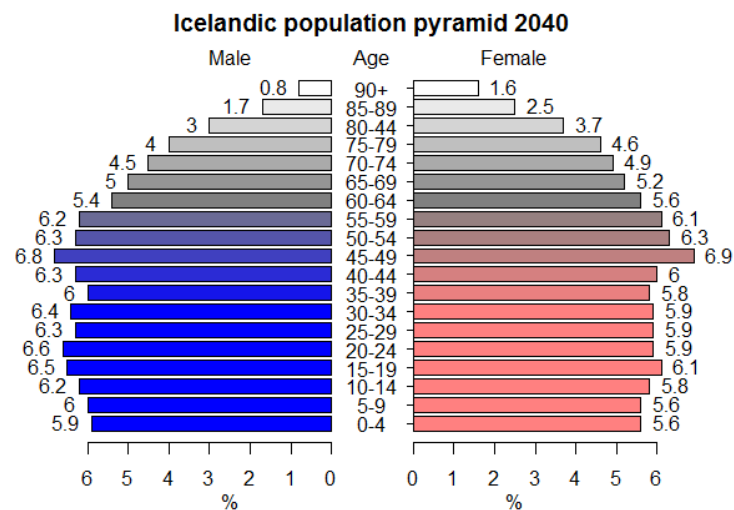
Fig. 3. The distribution of the blood groups among newly registered donors and regular whole blood donors in 2005-2013.

SUPPLEMENTARY TABLES AND FIGURE

Panel A



Panel B



Suppl. fig. 1. Icelandic population pyramid 2013 (Panel A) and medium projection of the population in Iceland 2040 (Panel B).

SUPPL. TABLE 1. Characteristics of aphaeresis donors

Characteristic	Platelets donors		Plasma donors		Red cells donors	
	2005 n (%)	2013 n (%)	2005 n (%)	2013 n (%)	2006* n (%)	2013 n (%)
Total	90 (100)	194 (100)	32 (100)	87 (100)	94 (100)	48 (100)
Sex						
Female	13 (14.4)	27 (13.9)	7 (21.9)	0	0	0
Male	77 (85.6)	167 (86.1)	25 (78.1)	87 (100)	94	48
Age group, year						
18-25	14 (15.6)	17 (8.8)	4 (12.5)	7 (8.1)	0	2 (4.2)
26-40	46 (51.1)	81 (41.7)	16 (50.0)	37 (42.5)	38 (40.4)	21 (43.7)
41-55	30 (33.3)	77 (39.7)	11 (34.4)	33 (37.9)	47 (50.0)	21 (43.7)
56-69	0	19 (9.8)	1 (3.1)	10 (11.5)	9 (9.6)	4 (8.4)
Mean donors age	36.0	40.7	36.9	41.4	43.6	40.8
Blood group						
A-	0	7 (3.6)	1 (3.1)	0	3 (3.2)	1 (2.1)
A+	14 (15.5)	47 (24.2)	6 (18.8)	0	13 (13.8)	10 (20.8)
AB-	0	0	7 (21.9)	8 (9.2)	0	0
AB+	0	0	17 (53.1)	27 (31.0)	0	0
B-	0	0	0	8 (9.2)	2 (2.1)	0
B+	0	0	0	44 (50.6)	14 (14.9)	0
O-	24 (26.7)	43 (22.2)	0	0	17 (18.1)	9 (18.8)
O+	52 (57.8)	97 (50.0)	1 (3.1)	0	45 (47.9)	28 (58.3)
Total number of donations	355	755	34	248	112	78
Mean donation frequency	3.9	3.9	1.1	2.9	1.2	1.6

*Two units of leukoreduced red cells collection began 2006 in the Blood Bank in Reykjavík

Appendix A – Study Approvals



Reykjavík, 15. nóvember 2013

JSn/js

Sveinn Guðmundsson, yfirlæknir
Blóðbankinn, Snorrabraut 60.

Varðar erindi 40/2013 „hverjir eru blóðgjafar? Lýðfræðileg einkenni íslenska blóðgjafahópsins. Who are the blood donors? Demographics of the Icelandic donor group.“

Ágæti Sveinn.

Umsókn þinni til siðanefndar hefur verið gefið númerið 40/2013. Við förum vinsamlegast fram á að það númer verði notað í samskiptum vegna þessarar umsóknar. Umsóknin var tekin fyrir á fundi siðanefndar þann 14. nóvember 2013. Hún var samþykkt án athugasemda.

Endanlegt samþykki siðanefndar Landspítala fyrir ofangreinda rannsókn er hér með veitt.

Siðanefnd LSH bendir rannsakendum á að birta siðanefndarnúmer rannsóknarinnar þar sem vitnað er í leyfi nefndarinnar í birtum greinum um rannsóknina. Jafnframt fer Siðanefnd LSH fram á að fá send afrit af birtum greinum um rannsóknina.

Gangi þér vel við rannsóknarstörfin.

Virðingarfyllst fyrir hönd siðanefndar Landspítala,

Jónína Sigurðardóttir, forstöðumaður.

Siðanefnd Landspítala
Vísinda- og þróunarsviði
Eirbergi, Eiríksgötu 34
101 Reykjavík

Formaður: Jón Snædal
Varaformaður: Elísabet Guðmundsdóttir
Forstöðumaður: Jónína Sigurðardóttir
Tölvupóstur: sidanefnd@landspitali.is



Vigdís Jóhannsdóttir
Hjúkrunarfræðingur
Blóðbanki Snorrabraut
101 Reykjavík

Reykjavík, 6. nóvember, 2013

**Efni: Umsókn til Siðanefndar LSH um meistaraverkefni: "Hverjir eru blóðgjafar?
Lýðfræðileg einkenni íslenska blóðgjafahópsins**

Undirritaðri hefur borist rannsóknaráætlun þín um greiningu á íslenska blóðgjafahópnum á árunum 2005-2012 úr heildarþýðinu Íslendingar á aldursbilinu 18-70 ára skv. gögnum Hagstofunnar.

Tilgangur rannsóknarinnar er að lýsa stærð og lýðfræðilegu útliti blóðgjafahópsins á Íslandi árin 2005-2012. Þættir eins og kyn, aldur, blóðflokkur, tegund blóðgjafa og búseta blóðgjafanna verða skoðaðir. Einnig heildartíðni blóðgjafa á hverjum blóðtökustað og fjöldi nýrra blóðgjafa fyrir hvert rannsóknarár.

Unnið verður með ópersónugreinanleg gögn úr gagnagrunni Blóðbankans (PROSANG pivot statistic) og aflað mikilvægra upplýsinga um samsetningu íslenska blóðgjafahópsins og bera m.a. saman við birtar niðurstöður úr erlendum rannsóknum á þessu sviði.

Rannsóknin hefur mikilvægt rannsóknargildi auk þess að geta veitt mikilvægar upplýsingar sem lúta að skipulagningu og kynningarstarfi meðal almennings við öflun nýrra blóðgjafa í framtíðinni og greina möguleika á því að ná til yngra fólks í auknum mæli.

Undirrituð veitir fyrir sitt leyti heimild til ofangreindrar rannsóknar, í samræmi við framkomna lýsingu. Heimildin er veitt með fyrirvara um samþykki siðanefndar Landspítala

Vigdís mun vinna rannsóknina undir leiðsögn Helgu Zoega dósent í lýðheilsuvísindum við HÍ og dr. Sveins Guðmundssonar yfirlæknis Blóðbankans.

Lilja Stefánsdóttir,
framkvæmdastjóri skurðlækningasviðs

