

Evaluation of the return rate of volunteer blood donors

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Background: To convert first-time blood donors into regular volunteer donors is a challenge to transfusion services.

Objectives: This study aims to estimate the return rate of first time donors of the Ribeirão Preto Blood Center and of other blood centers in its coverage region.

Methods: The histories of 115,553 volunteer donors between 1996 and 2005 were analyzed. Statistical analysis was based on a parametric long-term survival model that allows an estimation of the proportion of donors who never return for further donations.

Results: Only 40% of individuals return within one year after the first donation and 53% return within two years. It is estimated that 30% never return to donate. Higher return rates were observed among Black donors. No significant difference was found in non-return rates regarding gender, blood type, Rh blood group and blood collection unit.

Conclusions: The low percentage of first-time donors who return for further blood donation reinforces the need for marketing actions and strategies aimed at increasing the return rates.

Keywords: Blood donors/psychology; Attitude to health; Altruism; Hemotherapy service; Motivation; Blood banks

Introduction

In 2003, a study on availability, safety and quality of the blood used for transfusions in the Americas⁽¹⁾ showed that Brazil had an annual transfusion rate of 16.1 per 1000 inhabitants. This figure is relatively low compared to the 53.8 donors in Cuba, 45.9 in the United States, 32.7 in Canada, and 35.0 in Uruguay. Because of the increasing elderly population, better access of the general population to healthcare and the complexity of procedures, lack of blood becomes a clear concern. Therefore, programs aiming to improve blood collection by selecting volunteer donors from low-risk populations on a fidelity basis are needed.

In Brazil, remunerated blood donation ended in 1980.⁽²⁾ In launching the Pro-Sangue program, the Brazilian government opted for volunteer blood donation by establishing a project to control transfusion services.⁽²⁾ The transition from a remunerated blood donation model to a non-remunerated altruistic one brought the need for strategies to encourage the population to donate blood voluntarily and regularly. The search for regular donors is mainly based on economic and safety reasons as, with testing and re-testing of donors, transfusion blood bags are safer for recipients and a smaller number of blood components are discarded⁽³⁾ due to the smaller number of positive infectious disease screening tests. Therefore, converting first-time donors into regular volunteer donors is the challenge for blood transfusion services.

In the United States, less than 5% of people donate blood regularly although 60% of the population are eligible for blood donation.^(4,5) It is estimated that only 8% of first-time donors come back regularly for further blood donations, with approximately 62% no longer returning to the same blood collection centre as they donated for the first time.^(6,7) Some special situations can increase the number of first-time donors, but this does not necessarily convert them into regular donors. For example, a study⁽⁸⁾ showed that the amount of blood donations was high among North Americans after the terrorist attacks on 11th September 2001, with the number of first-time donors increasing dramatically but without an increase in the absolute risk of viral infections resulting from these blood transfusions. On the other hand, the return rates of first-time donors reduced over time reaching levels similar to those observed before the terrorist attacks. The authors concluded that first-time donors do not have a behavior favoring regular blood donation, a fact that reinforces the need for educative measures to explain the importance of donating blood regularly.

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By analyzing the trends in the profile of donors attending the São Paulo Blood Centre, Gonçalves et al.⁽⁹⁾ observed that individuals who donated altruistically in 1995 and 2001 represented 20% and 57% of all donors, respectively. It was also observed that first-time donors represented only 52% of all donors in 2001 compared to 88% in 1995. This situation shows the need for studies on the behavior of first-time donors' regarding their return for voluntary blood donation so that useful data can be gathered and strategies planned to educate⁽¹⁰⁾ and encourage further blood donations.

For Schreiber et al.⁽⁷⁾ the first year after the first donation is crucial to establish efforts aimed at keeping the habit of blood donation. According to the authors, the first-time donor who returns for one other donation is more likely to do it again. This, in turn, encourages educational actions⁽¹¹⁾ and strategies to increase the convenience of further donations⁽¹²⁾ by promoting the training of professionals at blood collection centers⁽¹²⁾ and showing them the expectations and satisfaction of donors in respect to the service provided.⁽¹³⁾

The objective of the present study is to estimate the return rate of first-time donors who attended the Blood Center of the Medical School of Ribeirão Preto, University of São Paulo.

Methods

The data used in the present study were obtained from a retrospective survey of all blood donations registered by the Ribeirão Preto Blood Center, which accounts for more than 95% of blood collection and distribution of blood components in a region involving 213 towns and 4.8 million people. A network of 4 transfusion and hematology centers (Araçatuba, Fernandópolis, Franca and Presidente Prudente), 4 transfusion units (Batatais, Bebedouro, Olímpia and Serrana) and blood collection units, in addition to the central unit, are all integrated by a computerized system.

In a first step, a database was set up with information about all blood donors enrolled between 23 July 1996 (date on which a system to control donors and laboratories entered into operation) and 23 June 2005. In a second step, the database was filtered according to inclusion and exclusion criteria established by the present study. Individuals aged 18-65 years old whose first donation was recorded within this period were included. Exclusion criteria were the following: autologous donations (individuals who donated blood for themselves on medical grounds), aphaeresis (procedure separating blood components such as platelets, red blood cells, plasma, granulocytes and lymphocytes) and routine blood tests (donor who undergoes the screening process before blood donation but who does not effectively donate). Donors whose blood was definitively rejected at the first blood donation were also excluded. Therefore, the final database consisted of 115,553 individual records.

In order to produce quality blood components for the population, every individual who attends a blood collection unit of Ribeirão Preto receives a folder containing preliminary guidelines on blood donation to be read by the donor candidate before the procedure. In the cases of illiterate candidates or those who have reading difficulties, a 5-minute video containing the same donation guidelines is shown. One theme is that regarding the frequency of donations, that is, men can donate up to four times within one year at a minimum 60-day interval, whereas women can donate up to three times at a minimum interval of 90 days. These frequencies are based on technical norms for blood transfusion procedures that were established by a resolution of the Brazilian government (RDC number 153, 24 June 2004). Encouragement for donors to come back is also given and reinforced at the end of the session by the professionals who collect the blood.

With the aim of providing special care for donor candidates, in particular first-time donors, a distinction is made between them and repeat donors. First-time donors stick a red card on their clothes saying "Safe Blood Begins with Me". Repeat donors, on the other hand, use a green card with the same phrase. This policy has been adopted in order to improve communication between candidates and staff by allowing the professionals to provide specific care depending on the color of the card, as first-time donors (red card) do not know routine procedures.

Three months after blood donation, the Blood Bank System produces a report containing the names and addresses of volunteers eligible for donation regardless of gender, blood type and Rh blood group. The Social Communication Sector uses this mailing list to invite first-time donors to attend one of the blood collection units for another donation. This occurs between the third and fourth month following donation. If the donor does not return, then a second invitation is sent within nine months. In fact, the Ribeirão Preto Blood Center sends two invitations to all donors on a yearly basis, including repeat donors. When there is need of special donations related to blood type, Rh blood group or phenotype due to low stocks or the requirements of a given recipient, the Social Communication Sector telephones specific donors.

Statistical analysis of data on the return of first-time donors is based on survival analysis tools.⁽¹⁴⁾ The accumulated probability that an individual will not come back for a further donation at moment $t > 0$ is given by the function $S(t)$, which is called the survival function. This function assumes that $S(t) = 1$ for $t = 0$, thus it decreases as t increases. That is, $S(t)$ describes how the proportion of individuals not attending the blood donation sessions changes as the elapsed time from the first donation increases. In the present article, $S(t)$ is estimated by the Kaplan-Meier method^(15,16) and by the parametric long-duration model⁽¹⁷⁾ based on the extended generalized gamma distribution (see technical details of these and probability distribution in Lourençon et al.⁽¹⁸⁾

This model allows an estimation of the proportion of donors who will never return for further donations.

The research project of the present study was evaluated and approved by the Research Ethics Committee of Faculdade de Medicina de Ribeirão Preto, Universidade de São Paulo, (number HCRP 3907/2005).

Results

Table 1 describes the blood donations registered in the regions controlled by the Ribeirão Preto Blood Center between 23 July 1996 and 23 June 2005. Table 1 shows the total number (third line) and percentage (fourth line) of first-time donors registered in the database every year. The percentage relative to 1996 is 100%, thus indicating the year in which blood donations began being recorded in the database. One can note that a percentage of first-time donors decreases every year, reaching 20.4% in 2005. In 1996, 2795 first-time donors were recorded among a total of 17,541 donors, that is, 15.9%. This proportion increased to 32.3% in 2000 and 44.4% in 2005.

Data on 115,553 volunteer donors were used to estimate the return rates of 45,143 female (39.1%) and 70,410 male (60.9%) first-time donors. The age distribution of first-time donors were the following: 15.7% were 18-19 years old, 38.1% were 20-29 years old, 24.5% were 30-39 years old, 15.3% were 40-49 years old, 6.1% were 50-59 years old and 0.3% were older than 60. Only 0.4% of the donors were illiterate, whereas 27.2% had incomplete primary school, 17.2% had completed primary school but incomplete secondary school, 46.0% had completed secondary school but incomplete university and 9.2% had completed university. With regards to blood type, 37.6% had type-A blood, 3.7% had type-AB blood, 11.2% had type-B blood and 47.4% had type-O blood. Of all donors,

87.3% had positive Rh blood group. The blood donation record for this group of donors is composed of a total of 346,211 donations. The highest number of donations by just one donor was 40.

Figure 1 shows the accumulated probability that an individual will not come back for a further donation at moment *t* as estimated by the Kaplan-Meier method. Because of the great number of individuals present in the cases, one can note that the Kaplan-Meier plot is in the form of a curve instead of the traditional stairway shape.⁽¹⁶⁾ This curve remains equal to 1 in the first months, which corresponds to the period in which further blood donation is not allowed (minimum interval is two months), decreasing later on and tending to stabilize in the last months. Only 40.2% of the first-time donors returned for a second donation within one year of the first donation, whereas 53% returned within two years. In Figure 1, the survival function shows that 59% of the donors return within three years, 62.2% within four years and 64.3% within five years. From the sixth year on, the survival function exhibits a less accentuated slope, thus indicating that first-time donors rarely come back to donate for a second time. The use of the parametric long-term survival model⁽¹⁷⁾ based on an extended generalized gamma distribution⁽¹⁸⁾ allowed an estimate that at least 19.6% of all first-time donors will never return to donate blood.

Figure 2 shows the risk function, also adjusted by survival analysis techniques, representing the "instant rate" of first-time donor return.⁽¹⁴⁾ This function can demonstrate the moments of higher trends of return since the first blood donation. The risk function (Figure 2) exhibits an expressive peak at four months following the beginning of the donation cycles at 12 and 24 months.

Table 2 lists the non-return rates estimated after 180, 360, and 720 days as well as at the end of the experimental

Table 1 - Records of blood donations between 23 July 1996 and 23 June 2005 for individuals aged 18-65 years old - Ribeirão Preto Blood Center

	Year										Total
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	
Total number of individuals who intended to donate blood	17,595	54,262	57,749	71,389	76,485	88,710	94,580	96,459	93,169	47,104	
Total number of first-time donors who intended to donate blood	17,595	46,691	38,392	43,561	39,786	43,754	42,558	40,711	36,638	14,469	364,155
First time donors as a percentage of total donors	100.0%	86.0%	66.5%	61.0%	52.0%	49.3%	45.0%	42.2%	39.3%	30.7%	
Total number of first-time volunteer donors	2795	11,489	9398	11,569	12,750	15,372	16,756	16,555	15,157	3712	115,553
First-time volunteer donors as a percentage of total first time donors	15.9%	24.6%	24.5%	26.6%	32.0%	35.1%	39.4%	40.7%	41.4%	25.7%	
Total intentions to donate blood*	19,115	69,036	75,959	93,261	102,653	119,427	128,571	132,759	124,882	52,841	918,504
Total intentions to donate blood among first-time volunteer donors*	3065	17,726	21,878	29,216	37,556	46,718	54,046	57,925	56,147	21,934	346,211

*There is the possibility that the same individual has the intention to donate blood twice a year

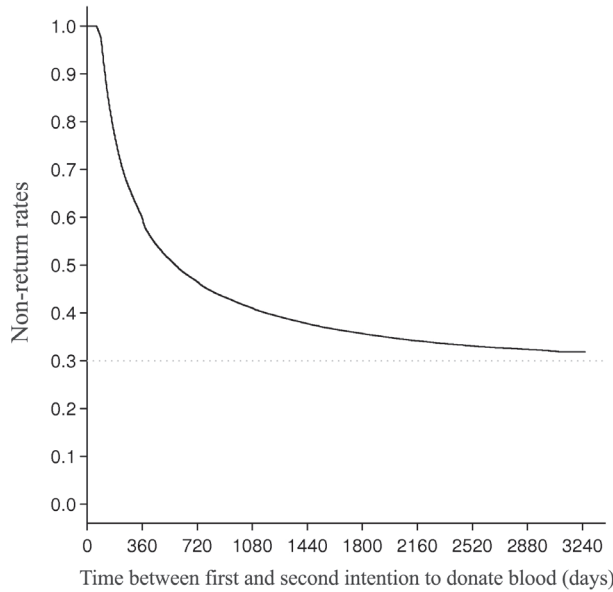


Figure 1 – Cumulative probability that an individual does not return to donate at a time *t*, as estimated by the Kaplan-Meier method

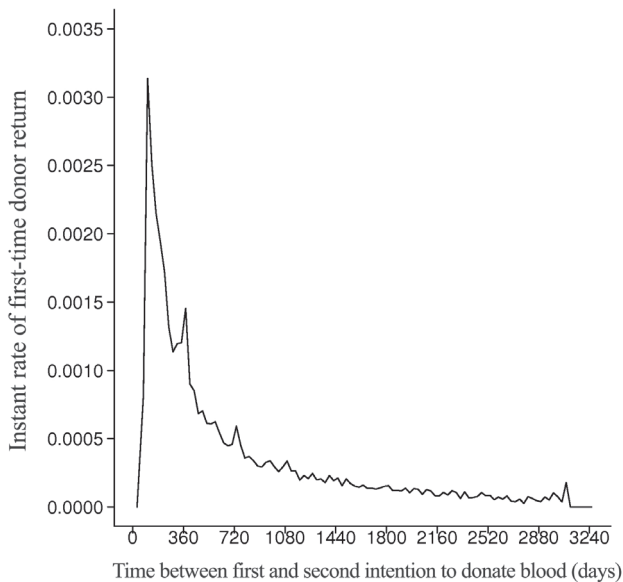


Figure 2 – Risk function, representing the “instantaneous rate” of return of blood donors intending to donate blood for a second time

period (3240 days) according to gender, skin color, age group, marital state, blood type, Rh blood group and size of the blood collection unit. This last variable was classified according to the number of enrolled donors in the cities as follows: small units are located in Batatais, Bebedouro, Olímpia, and Serrana; large units are in Araçatuba, Fernandópolis, Franca, and Presidente Prudente, in addition to Ribeirão Preto (Blood Center and Quintino Blood Collection Unit); and external blood collection units exist in Ribeirão Preto, Araçatuba, Fernandópolis and Franca. Higher return rates were observed among Black donors while lower rates were

Table 2 - Non-return rates according to characteristics of volunteer donors

Variable	n (b)	Non-return rates (%) (a)			
		180 days	360 days	720 days	3240 days
Gender					
Female	45,143	78.1	60.1	47.1	33.5
Male	70,409	76.5	59.6	46.2	30.9
Skin color					
Asian	652	85.0	71.4	60.1	42.1
White	87,610	77.5	60.2	46.8	32.2
Black	26,660	75.5	57.6	44.7	29.6
Age group(d)					
18 and 19 years old	18,115	75.0	59.0	45.3	30.8
20 to 29 years old	43,990	78.0	61.8	48.9	33.2
30 to 39 years old	28,275	77.3	58.6	45.0	30.2
40 to 49 years old	17,634	77.3	58.2	44.7	30.9
50 to 59 years old	7088	75.7	57.1	44.9	33.7
60 to 65 years old	408	82.0	70.6	61.4	55.6
Marital status(d)					
Single	54,187	78.1	61.9	49.2	36.4
Widow	1358	74.8	55.2	42.9	33.0
Married	51,323	76.6	58.2	44.3	27.7
Divorced	5524	74.0	54.8	41.6	27.3
Others	2152	72.6	54.5	41.0	25.0
Blood type					
A	43,299	77.8	60.4	47.1	32.5
B	12,909	76.8	59.0	45.7	31.8
AB	4253	74.9	57.6	44.1	31.4
O	54,549	76.7	59.3	46.1	31.0
Rh factor					
Positive	100,402	77.5	60.4	47.0	32.3
Negative	14,559	74.1	55.2	41.8	27.3
Blood collection unit (d)					
External collection	58,156	80.1	61.5	47.4	32.3
Small units	7311	65.5	49.6	38.6	27.9
Large units	50,086	75.3	59.3	46.7	32.1
Total	115,553	77.1	59.8	46.5	31.8

(a) Estimates by Kaplan-Meier method

(b) Sums do not always equal to the total of 115,553 donors due to missing data

(c) Significant differences according to long-duration models

(d) At the moment of first donation

reported for Asian donors (70.4% vs. 57.9%, respectively, at the end of the experimental period). Also, lower return rates were observed among unmarried individuals (63.6% at the end of the experimental period). As expected, higher non-return rates (55.6%) were reported for individuals aged 60-65 years old. No significant difference was found in non-return rates regarding gender, blood type, Rh blood group and blood collection unit.

Discussion

The return rates found in the present article are similar to those found in a study on type-O blood donors conducted in the United States.⁽¹⁹⁾ There, 32% of the first-time donors had returned for a second blood donation at the end of the 1st year, whereas 64% had not after five years. Based on the

records of North American donors, Schreiber et al.⁽⁷⁾ also found that 32% of the donors came back for a second donation within the first year. However, another study,⁽²⁰⁾ conducted in the United States following the terrorist attacks on 11 September 2001, estimated that 20.5% of first-time donors had returned for second donations within a 6-month period. In the present study, about 23% (see Table 2) of first-time donors returned for a second donation within the experimental period.

The difference in the return rates between Black and Asian donors found in the present study justifies further investigations. Although some studies, such as that by Shaz et al.⁽²¹⁾ showed that different ethnic groups have different motivations for blood donation, it is possible that the results found in the present study are more socio-economical rather than ethnical. For example, the study conducted by Brener et al.⁽²²⁾ showed that 53.6% of the individuals who attended the Belo Horizonte Blood Center for blood donation had a family income of 0.8 minimum salaries, thus indicating that people of lower socioeconomic conditions are more inclined to donate blood and maybe return. Social differences according to ethnic groups⁽²³⁾ would then hypothetically account for these differences in the return rates between Black, Asian and White individuals in the study.

One hypothesis for the high return rates after 4, 12 and 24 months (Figure 2) might be the efficient "marketing" role played by the Social Communication Sector of the Ribeirão Preto Blood Center, which is responsible for attracting blood donors as described in the Methods section.

Conclusion

In summary, the low percentage of first-time donors who returned for further blood donation reinforces the need for marketing actions and strategies aimed at increasing the return rates. As the results suggest that ethnic groups have different behaviors towards returning to donate blood, which might also reflect social differences, proposals could be drawn up based on these characteristics in order to fulfill the specificities of different populations eligible for blood donation.

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