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Inter-Donation Intervals and Patterns of Return among Blood Donors in Brazil

Cesar de Almeida-Neto¹, Alfredo Mendrone-Junior¹, Brian Custer², Jing Liu³, Anna Bárbara Carneiro-Proietti⁴, Silvana A. Carneiro Leão⁵, David J. Wright³, Edward L. Murphy², and Ester Cerdeira Sabino¹ For the NHLBI Retrovirus Epidemiology Donor Study-II (REDS-II), International Component

¹Fundação Pró-Sangue – Hemocentro de São Paulo, SP, Brazil

²Blood Systems Research Institute, San Francisco, CA, USA

³Westat, Rockville, MD, USA

⁴Fundação Hemominas, Belo Horizonte, MG, Brazil

⁵Fundação Hemope, Recife, PE, Brazil

Abstract

Background—In Brazil, most of donations come from repeat donors, but there is little data on return behavior of donors.

Material and Methods—Donors who made at least one whole blood donation in 2007 were followed for two years using a large multicenter research database. Donation frequency, inter-donation intervals and their association with donor demographics, status, and type of donation were examined among three large blood centers in Brazil, two in the Southeast and one in the Northeast.

Results—In 2007 out of 306,770 allogeneic donations, 38.9% came from 95,127 first-time and 61.1% from 149,664 repeat donors. Through December 31, 2009, 28.1% of first-time and 56.5% of repeat donors had donated again. Overall, the median inter-donation interval was about six months. Among men it was 182 and 171 days for first-time and repeat donors and among women 212 and 200 days. Predictors of return behavior among first-time donors were male sex (OR, 1.17; 95% CI, 1.13–1.20), community donation (OR, 2.26; 95% CI, 2.20–2.33) and age ≤ 24 years (OR range 0.62–0.89 for donors ≥ 25 years). Among repeat donors predictors were male sex (OR 1.35; 95% CI 1.32–1.39), age ≥ 35 years (OR range 1.08–1.18 vs. ≤ 24 years), and community donation (OR, 2.39; 95% CI 2.33–2.44). Differences in return by geographic region were evident with higher return rates in the Northeast of Brazil.

Conclusion—These data highlight the need to develop improved communication strategies for first-time and replacement donors to convert them into repeat community donors.

Keywords

Blood donors; blood donor recruitment and retention; Brazil; donor retention; type of donation; first-time donors; repeat donors

Address reprint requests to: Cesar de Almeida Neto, MD, PhD. Avenida Dr Enéas de Carvalho Aguiar, 155 1º andar, bloco 12. Cerqueira Cesar. São Paulo, SP, Brazil; zip code 05403-000. cesarnt@uol.com.br, Phone: +55-11-3061-5544 extension 376, fax: = +55-11-3088-2747.

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INTRODUCTION

The Brazilian Ministry of Health estimates that 1.9% of the population donated blood in 2008.¹ The World Health Organization considers that donation by 1% of the population is generally the minimum to meet a nation's most basic requirement for transfusion. The average proportion of the population donating in developed countries is 3.8%; in transitional countries, this proportion is 0.75% and in developing countries 0.23%. These numbers reflect a major imbalance between developing and developed countries in the availability of blood for transfusion.²

However, worldwide, it is worrisome that the aging population and the continuous implementation of new donor screening deferral criteria have decreased blood availability. In contrast, the increasing number and complexity of medical procedures and the extension of human life expectancy have increased transfusion demands.³ The challenge blood banks face is to recruit and retain more qualified blood donors. The decision to donate and keep donating blood involves many complex issues such as altruism, empathy, social responsibility, personal credit, social pressure, material incentives, blood donor satisfaction, and personal characteristics.⁴⁻⁶ Blood banks have developed various strategies and incentives to retain donors through training and improving the donation experience, keeping close and personal contact with donors^{7,8}, soliciting post donation feed-back⁹, minimizing adverse donation reactions^{10,11}, monitoring and assessing the necessity and effectiveness of deferral criteria¹², re-contacting temporarily deferred donors¹³ and, offering a convenient and accessible place to donate⁴, among others. Blood banks need to know who their donors are to fulfill their needs. Consideration of the demographic characteristics associated with a higher likelihood of return is important to the donor recruitment and retention process.

In Brazil, around 40% of donations are given by first-time donors and 60% by repeat donors. But there are still no broadly representative data about how frequently these donors return to donate and, whether certain demographic characteristics are associated with donor return¹⁴. Thus, the objective of this study is to evaluate the return rates among first-time and repeat donors and the demographics, donor status and type of donation associated with a higher likelihood of return.

MATERIALS AND METHODS

Overall study design and setting

Using the REDS-II donation data collected in the study period of January 1, 2007-December 31, 2009, we conducted a two-year follow up study to evaluate the return rates and demographic characteristics, donor status and donor type associated with a higher probability of return among those first-time and repeat donors who gave a whole blood donation in three Brazilian blood centers during 2007.

The international REDS-II study in Brazil includes three public blood centers. Fundação Pró-Sangue, located in São Paulo city; Fundação Hemominas, in the state of Minas Gerais, Southeast of Brazil and, Fundação Hemope, in the city of Recife, Pernambuco State, located in the Northeast of Brazil. Together these three blood centers collect almost 8% of all donated blood per year in Brazil. For the purpose of this study, we only recovered data from the fixed collection sites of Hemocentro de São Paulo, Hemocentro de Recife, the main site of Fundação Hemope located in the metropolitan area of Recife, and Hemocentro de Belo Horizonte, also the main site of Fundação Hemominas, located in Belo Horizonte (State of Minas Gerais).

The study was approved by the Brazilian national ethics committee as part of the REDS-II International Program.

Study subjects

All donors who made one allogeneic whole blood donation at three Brazil blood centers in January 2007 through December 2009 were included in the analysis. Donors between 18 and 65 years donated between 400 mL (only for women under 57 kilograms) to 450 mL.

Measures

We recorded the following information for each donation at each site: donors' gender, age, donor status (first-time vs. repeat), donation type (community vs. replacement), donation date, previous donation date if there was any. First-time donors were considered those who never donated in the blood center before and gave a donation in 2007. Repeat donors were considered those who had previously donated in the blood center and donated in 2007. Although paying donors is forbidden in Brazil, volunteer donors can give either at the request of or on behalf of a specific donor to replace units in the overall supply (defined as replacement donation) or to the general blood supply (defined as community donation). Replacement donors are recruited friends and relatives of hospitalized patients and community through media campaigns. Recruitment and retention of donors are routinely performed by the three centers through mailing and phone calls. São Paulo campaigns are directed mainly at organizations, such as corporations, soccer teams, professionals, as military personal. Belo Horizonte focuses more on community and hospital donor recruitment. Recife is different in that it emphasizes identifying community leaders (through Healthy Family Programs, schools and universities, public and private corporations) who will in turn recruit other donors.

In Brazil, men can donate whole blood four times a year in an interval of 60 days between each donation and women, three times a year, maintaining an interval of 90 days between every two donations. Platelet apheresis donation can be given 56 days after a whole blood donation and 48 hours after a previous platelet apheresis donation. To avoid the complexity of different inter-donation intervals, we selected first-time and repeat donors who gave a whole blood donation in 2007 and passively followed them for two years. The number of returns and intervals between every two donations made by these donors in the 2-year follow up period were calculated.

Retrospectively, for all repeat donations, our system records information about a previous donation date that went back to as early as 1988 in Belo Horizonte, 1994 in São Paulo, and 1998 in Recife, although more detailed information about these donations was not available. Thus, we also examined the inter-donation intervals of some repeat donors who made a donation prior to the beginning of REDS-II study period (2007) but did not return in the study period of 2007–2009. Such retrospective information allowed us to explore the return patterns of at least some, if not all, repeat donors whose inter-donation intervals were longer than two years.

Statistical analysis

All allogeneic donations and corresponding demographic variables were tabulated by center and first-time vs. repeat donor status, which was defined based on information about their first donation in 2007. Total number of follow up donations was tabulated by gender and first-time vs. repeat donor status. In addition, a dichotomous variable 'Return vs. No Return' was generated to identify donors who made one vs. more than one donation in the 2-year period. Donors who never returned to make another donation in the 2-year period were

censored, and the intervals between their donation dates and the end of the study period (12/31/2009) were calculated.

Among donors who made at least one follow up donation in the 2-year period, inter-donation intervals in days were calculated by subtracting the donation date for a previous record of donation from the donation date for a current donation. The median inter-donation intervals were compared by center, gender, and first-time vs. repeat donor status using Kruskal-Wallis median test (PROC NPAR1WAY). Survival analysis using PROC LIFETEST with Kaplan-Meier estimation was used to estimate survival probability and generate survival curves to visually examine the inter-donation intervals between the first whole blood donation in 2007 and a follow up whole blood or platelet apheresis donation in the following two years for first-time and repeat donors, and by community and replacement donation type and blood center. Logistic regression analysis was conducted on the 'Return vs. No Return' variable to examine predictors of donor return among first-time and repeat donors separately.

Finally, using the retrospective databases prior to 2007, we calculated the inter-donation intervals for all repeat donations based on information about the previous donation date and the current donation date, recoded them into the following categories: ≤ 90 days, 91–180 days, 181–365 days, 1–2 years, 2–5 years, and > 5 years, and tabulated them by center.

All analyses were conducted using SAS Windows Version 9.1.3 (SAS Institute, Cary, NC). A P value < 0.05 was defined as statistically significant.

RESULTS

In 2007 alone, 38.9% of blood donations came from 95,127 first-time donors and 61.1% came from 149,664 repeat donors, contributing a total of 306,770 whole blood (98.6%) and platelet apheresis (1.4%) donations. Most donations came from male, young (under 35 years old), repeat and community donors (Table 1). By December 31, 2009, 28.1% of the first-time and 56.5% of the repeat donors donated again (Table 2). In addition, 16.8% and 6.4% of first-time and 25.6% and 14.8% of repeat donors returned once and twice, respectively. The rest made three or more donations in the same period. The patterns of return frequency were similar between males and females for both first-time and repeat donors, with females showing a higher no-return rate than males (73.6 vs. 70.8% among first-time donors and 49.1% vs. 41.4% among repeat donors; p values < 0.01).

The median inter-donation interval among all donations had a range of 173–208 days. Considering the median inter-donation intervals for first-time and repeat donations, repeat donors on average returned 16 days earlier than first-time donors. Meanwhile, donors in Recife and São Paulo returned earlier than those in Belo Horizonte during the two year follow-up, p values < 0.001 (Table 3). Both repeat and first-time donors in Belo Horizonte showed an average delay of 16–26 days in return when compared with donors from Recife and 12 to 10 days when compared with donors from São Paulo. A significant gender difference was also found among both first-time and repeat donors and across the three centers. Among repeat donors, inter-donation intervals for females were on average 29 days longer than for males, $p < 0.001$. Among first-time donors, the difference was 30 days in the same direction, $p < 0.001$. Center by gender differences were also observed (Table 3). Both male and female donors in Belo Horizonte, regardless of their first-time and repeat status, displayed the longest inter-donation intervals, with 224 and 213 days for female first-time and repeat donors, and 194 and 179 days for male first-time and repeat donors respectively. Among first-time donors, both male and female donors in Recife displayed shorter inter-donation intervals than those in São Paulo (200 vs. 214 days for female and 177 vs. 186 days

for male), p -values < 0.001 . Among repeat donors, however, female donors in Recife had the same inter-donation intervals as in São Paulo (196 vs. 196 days) but male donors on average returned 2 days later than those in São Paulo (170 vs. 168 days).

Figure 1 displays the survival curves of return probability by first-time and repeat donors among centers. In all three centers, repeat donors displayed a significantly higher probability of return than first-time donors, p values < 0.001 . The difference in return probability increased over time, suggesting that the longer the lapse, the less likely a first-time donor would return than a repeat donor. Community donors also showed a higher probability of return than replacement donors. Independent of donation type or first-time vs. repeat donor status, donors from Recife were more likely to return than those from São Paulo and Belo Horizonte, except that first-time replacement donors in Recife displayed similar return probability as those in Belo Horizonte, both of which were higher than in São Paulo.

We examined predictors of donor return behavior among first-time and repeat donors separately, with the hypothesis that different demographic characteristics were associated with first-time and repeat donors' return. Results of logistic regression analyses suggest that blood centers vary in return rates (Table 4), yet similar characteristics such as male gender and community donation type were associated with both first-time and repeat donors' return at all sites. There were a few differences in age groups in that older first-time donors were less likely to return than those < 25 years of age whereas older repeat donors were more likely to return. These older, repeat donors are most likely regular or frequent repeat donors.

Shown in Table 5 are the retrospective inter-donation intervals for all repeat donations by center. Overall, 56.1% of donors with at least two donations returned within one year, 18.2% between one and two years, 15.7% between two and five years, and 9.8% of donors with at least two donations made their second donation more than five years later. These data, in combination with our findings from the two year follow up study, suggest that, while more than half (including both the prospective and retrospective) of repeat donors returned within two years, about a quarter of repeat donors might return after two years.

DISCUSSION

We evaluated 927,683 whole blood and platelet donations and tracked the return behavior of 244,791 donors in the three largest blood centers in Brazil and found that almost one third of first-time and about 60% of repeat donors returned to make a new donation in a 2-year period. We also found that donations from males and community donors were associated with a higher likelihood of return. Recife showed higher rates of return when compared with São Paulo and Belo Horizonte.

Return rates among first-time donors were similar to the rates described by Schreiber et al., in a 12-month period in the USA¹⁵. In addition, Notari et al.¹⁶ also found, that 45% of first-time US donors followed in a cohort analysis returned for another donation in 25 months. Higher blood donor return rates can be found in Norway¹⁷ (54% in a two year follow-up) and, in the opposite, lower return rates were recently described in China¹⁸ (14% during a 9 months follow up). It is noteworthy that most of the Chinese blood supply comes from first-time donors, and the return rates in first-time donors in Brazil were somewhat higher than in China, but during a longer follow-up period.

A higher return rate and an earlier return were expected among repeat donors when compared with first-time donors¹⁹. Moreover, the retrospective analyses showed results in accordance with the prospective analyses, and permitted us to identify that approximately 25% and 10% of repeat donors returned after two and five years. Previous publications had addressed that the earlier a donor returns for a new donation the higher the probability of

that he/she becomes a regular donor^{4,15,20}. Thus, for blood banks, strategies to encourage blood donors to return to donate more frequently¹⁵ and to create the right environment and make the process of giving blood a good experience may play an important role in maintaining an adequate blood supply⁴. Nevertheless, donors can return after long interval and interventions focused on these individuals are also needed to increase the pool of available donors.

In accordance with other studies, men were more likely to return to make a new blood donation in Brazil^{10,17,21}. Inter-donation intervals among women are longer than among men, in part because women are not allowed to donate as frequently as men. Regional differences in the gender of donors were already described in the Brazilian REDS-II participating centers.¹⁴ In the Northeast of Brazil, represented here by Recife, donations by women accounted for approximately 20% of donations, whereas in the Southeast cities of Belo Horizonte and São Paulo, donations by women represented almost 40% of all collected units.

Regional differences in donor return behavior was reflected in the varying overall return rates at the three centers, with Recife donors consistently presenting higher rates of return with lower mean and median inter-donation intervals than those for the other centers. We speculate that recruitment strategies in Recife may be more effective, and could be used as a model for the other centers to improve donor return frequency.

Our study also showed that community donors had a higher likelihood of return. Community donors contribute the majority of donations in Brazil, but there is substantial variability across the centers, varying from 75.7% in São Paulo to 46.4% in Minas Gerais¹⁴. Interestingly, replacement donors also showed good rates of return varying from 15% up to 60% across the centers. Given evidence of comparable or even enhanced safety of replacement donors relative to community donors in Brazil^{22,23}, it seems appropriate to enhance efforts to retain qualified replacement donors in the pool of repeat donors not only in Brazil but also other developing countries where family replacement donors are important since participation of community donors is insufficient to fulfill transfusion demand.

One limitation of our study is the inability to track all return donations in São Paulo, since donors can give blood in other centers within this large city which would not be captured in our data. On the other hand, data from our three blood centers located in different geographic regions are more representative of the Brazilian population. In addition, two years would be considered a short follow-up period. However, the retrospective five year analyses reassured us that the findings in the prospective follow-up repeat donors detected demographic correlates of return behavior among our donors.

In conclusion, understanding donor return patterns is necessary to ensure that the donated supply meets transfusion requirements. These data highlight the need to develop improved communication strategies for first-time and replacement donors. Efforts to convert these donors into repeat community donors may be easier to achieve than recruiting persons who have never donated before. Motivation, satisfaction, response to incentive programs, impact of deferral and adverse events among blood donors should be subject of on-going research in Brazil and other developing countries settings.

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Figure 1.
Return Probability of first time vs. repeat donors who made at least one whole blood donation in 2007 by blood center. A. All donors. B. Community donors. C. Replacement donors.

Table 1

Demographic and donation characteristics of donors who made at least one whole blood donation in 2007, by center

	Recife	Belo Horizonte	São Paulo	Total
Gender				
Female	14272 (18.6%)	21455 (37.4%)	43154 (39%)	78881 (32.2%)
Male	62613 (81.4%)	35915 (62.6%)	67382 (61%)	165910 (67.8%)
Age in Years				
<25	19310 (25.1%)	15481 (27%)	26619 (24.1%)	61410 (25.1%)
25–34	26011 (33.8%)	22555 (39.3%)	40767 (36.9%)	89333 (36.5%)
35–44	19251 (25%)	12664 (22.1%)	25773 (23.3%)	57688 (23.6%)
45–54	9720 (12.6%)	5558 (9.7%)	13182 (11.9%)	28460 (11.6%)
>55	2561 (3.3%)	1112 (1.9%)	4191 (3.8%)	7864 (3.2%)
Donor Status				
Repeat	48065 (62.5%)	34957 (60.9%)	66642 (60.3%)	149664 (61.1%)
First-time	28820 (37.5%)	22413 (39.1%)	43894 (39.7%)	95127 (38.9%)
Donation Type				
Community	42130 (54.8%)	28647 (49.9%)	82928 (75%)	153705 (62.8%)
Replacement	34749 (45.2%)	28723 (50.1%)	27608 (25%)	91080 (37.2%)

Number of Follow up Donations in the 2-Year Follow up Period from Donors who made at least One Whole Blood in 2007, by Gender and First-time vs. Repeat status.

Table 2

Number of follow up donations	First-time(N = 95127)			Repeat (N = 149664)		
	Total (%)	Female (%)	Male (%)	Total (%)	Female (%)	Male (%)
0	71.9	73.6	70.8	43.5	49.1	41.4
1	16.8	16.6	16.9	25.6	26.0	25.5
2	6.4	5.9	6.6	14.8	13.8	15.2
3	2.8	2.5	3.1	8.0	6.7	8.5
4	1.3	1.0	1.4	4.2	3.2	4.6
5	0.55	0.30	0.71	2.2	1.1	2.6
≥6	0.36	0.21	0.57	1.61	0.22	2.21

* The percentages of donors who made each number of donations during the 2-year period were rather similar at three centers. Therefore, results of three centers were combined.

Table 3

Median (Minimum-Maximum) Inter-donation Intervals in Days by Gender, First-time vs. Repeat Donor Status, and Center in the 2-year Follow up Period

	First-time Donors			Repeat Donors		
	Female	Male	Total	Female	Male	Total
Recife	200 (41–730)	177 (30–731)	182 (30–731)	196 (17–730)	170 (4–731)	173 (4–731)
Belo Horizonte	224 (28–731)	194 (18–731)	208 (18–731)	213 (21–731)	179 (16–731)	189 (16–731)
São Paulo	214 (4–731)	186 (3–731)	198 (3–731)	196 (4–731)	168 (3–731)	177 (3–731)
Overall	212 (4–731)	182 (3–731)	194 (3–731)	200 (4–731)	171 (3–731)	178 (3–731)

P-values < 0.001 from Kruskal-Wallis tests for median comparisons between centers for female, male, total and by first-time vs. repeat donor status.

Table 4

Logistic Regression Analyses Predicting Donor Return among First-time and Repeat Donors in the 2-year Follow up Period

Variables	OR (95% CI)	
	First-time Donors (N = 95127)	Repeat Donors (N = 149664)
N (%) returned within 2 years	26760 (28)	84509 (56)
Center		
Recife	1.54 (1.49–1.60)	1.56 (1.52–1.60)
Belo Horizonte	1.35 (1.30–1.40)	1.03 (1.01–1.06)
São Paulo	1	1
Gender		
Female	1	1
Male	1.17 (1.13–1.20)	1.35 (1.32–1.39)
Age		
≤24 years	1	1
25–34 vs. ≤ 24	0.89 (0.86–0.92)	0.95 (0.93–0.98)
35–44 vs. ≤ 24	0.84 (0.80–0.88)	1.10 (1.06–1.12)
45–54 vs. ≤ 24	0.81 (0.76–0.85)	1.18 (1.14–1.23)
≥55 vs. ≤ 24	0.62 (0.56–0.70)	1.08 (1.01–1.14)
Type of Donation		
Replacement	1	1
Community	2.26 (2.20–2.33)	2.39 (2.33–2.44)

* p-value less than .05 for all variables

Table 5
Retrospective analysis: Number and Percentage of Donations for Each Specified Inter-Donation Interval by Center

Blood Center	≤90 days		91–180 days		181–365 days		1–2 years		2–5 years		>5 years	
	n	%	n	%	n	%	n	%	n	%	n	%
Recife	9166	4.2	64813	29.8	54372	25	40009	18.4	33744	15.5	15726	7.2
Belo Horizonte	10372	7.3	30015	21	32987	23.1	27249	19.1	24393	17.1	17983	12.6
São Paulo	20047	7.2	68923	24.8	68087	24.5	49227	17.7	42374	15.3	29200	10.5
Total	39585	6.2	163751	25.6	155446	24.3	116485	18.2	100511	15.7	62909	9.8

* About 3148 repeat donations did not have a valid Previous Donation Date.