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Demographic profile of blood donors in Brazil: Results from the International REDS II Study, 2007–2008

AB Carneiro-Proietti[1,*], **EC Sabino**[2,*], **D Sampaio**[3], **FA Proietti**[4], **TT Gonçalez**[5], **CDL Oliveira**[6], **JE Ferreira**[7], **J Liu**[8], **B Custer**[5], **GB Schreiber**[9], **EL Murphy**[5,*], and **MP Busch**[5,*]

[1] Hemominas Foundation, Brazil

[2] Pró-Sangue Foundation, Brazil

[3] Hemope Foundation, Brazil

[4] Federal University of Minas Gerais, Brazil

[6] Federal University of São João Del Rei, Brazil

[7] University of São Paulo, Brazil

[5] Blood Systems Research Institute, USA

[8] Westat, USA

[9] Independent Consultant

Abstract

BACKGROUND—The profile of blood donors changed dramatically in Brazil over the past 20 years, from remunerated to non-remunerated and then from replacement to community donors. Donor demographic data from three major blood centers establish current donation profiles in Brazil, serving as baseline for future analyses and tracking longitudinal changes in donor characteristics.

STUDY DESIGN AND METHODS—Data were extracted from the blood center, compiled in a data warehouse, and then sent to a coordinating center for analysis. Population data were obtained from Brazilian census.

RESULTS—During 2007–2008 there were 615,379 blood donations from 410,423 donors. 426,142 (69.2%) were from repeat (Rpt) and 189,237 (30.8%) from first time donors (FT). 20% of FT returned to donate in the period. FT were more likely to be younger, and Rpt to be community donors. All were predominantly male. Differences in gender, age, and community/replacement status by blood center were significant. Mean percentage of the potentially apt general population who were donors was 1.3% for the three centers (FPS=0.9%, FH-MG=1.8% and FH-PE=3.4%). Adjusting for the catchment's area, FPS and FH-MG were comparable (approximately 2%).

CONCLUSION—Donors in the three Brazilian centers tended to be younger with a higher proportion of males than in the general population. Donation rates were lower than desirable, with variability among the three centers. Replacement donors still represent 50% of FT and 30% of the

Corresponding author: Anna Bárbara Carneiro-Proietti, Hemominas Foundation, Rua Grão Pará, 882, Belo Horizonte, Minas Gerais, Brazil 30150-241, Phone: 5531-32807490, anna.proietti@hemominas.mg.gov.br, annaproietti@gmail.com.
*Contributed equally to the paper.

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Rpt donors. Studies on the safety, donation frequencies and motivations of donors are in progress to orient efforts to enhance the availability of blood.

Keywords

blood donor; demographic profile; recruitment; blood safety

To ensure an adequate blood supply, it is crucial to recruit suitable blood donors. These are ideally individuals with low risk for infectious diseases, who are in good health, and willing to spend their time to help someone out of a sense of solidarity and altruism. Prior to the late 1970s and early 1980s, blood collections in Brazil were mainly performed by private blood banks. Cash reimbursement for donation was a common practice, and there were few laws regulating blood bank activities. An assessment performed for the Brazilian Ministry of Health Blood by the World Health Organization (WHO) in early 1970s documented serious problems with the blood banking policies and practices[1], which led the federal government to define blood safety as a national security problem. Measures were taken to improve the safety and quality of blood and components, especially after the onset of the AIDS epidemic, when blood transfusion practices became an important political issue.[2,3]

The Brazilian network of public blood centers was created in the late 1970s and early 1980s, as a response to these blood safety concerns. Although the centers were under the state administrations, federal funds were allocated to support these public blood centers and cooperation with the French government made it possible to train a large number of professionals in blood collection and processing and transfusion practices.

Blood transfusion is now regulated by the Federal Government through Anvisa, the national health surveillance agency, and by the Blood Coordination Office in the Ministry of Health which is responsible for the policies of the system. Specific methodologies are defined for donor recruitment, deferral criteria, laboratory tests, cold chain, and related component preparation procedures[2]. The regulations are very similar to those in place in the US and Europe, and internationally accepted procedures and guidelines are used as reference in the development of Brazilian rules and practice guidelines.[1]

In addition to establishing “sanitary policies” regarding donor selection, blood testing and handling of blood products, paid blood donations were forbidden.[2] The prohibition from paid donations could have had an enormous impact on the blood supply due to the lack of experience of centers in recruiting voluntary blood donors. General concern that this prohibition would dramatically decrease blood availability led Brazilian blood centers to rapidly develop programs to recruit donors among friends and relatives of hospitalized patients, termed “replacement donors”. This procedure had the effect of maintaining the blood supply, following the sudden reduction in collections due to the elimination of paid blood donors, and replacement donors became the major source of blood units in Brazil in the 1980s.

One of the main problems in relying on this type of donor is that most of them are first-time blood donors, so the prevalence of infectious disease markers is higher[3,4,5], leading to an elevated percentage of discarded units and greater risk of a window-period donation. In addition, families and friends of patients were frequently “asked” to donate in a forceful way. Replacement donations, solicited prior to medical procedures, with numbers determined by the hospitals/procedures, were compulsory before the patient would be treated or undergo surgery. This led to an undesirable situation, where, in the quest for blood donors, the patients and/or their families would recruit potential donors at the entrances of blood banks to donate in the name of a specific donor, sometimes offering to pay these

unrelated individuals for blood donation. Hence, some donors were still paid, although not by the blood bank.

Recognizing the inherent problem with these practices, concerted efforts were made during the 1990's to change the blood donor supply from replacement first-time donors to community voluntary repeat donors. However, still today, replacement donors are responsible for up to 50% of blood donations in many regions of Brazil.[2]

It is estimated that 3 million units of blood are collected per year in Brazil, with approximately 70% of donations in these regions collected through the public system.[1,2] However, national studies on blood donation are scarce in Brazil. Data on blood donation and use is now compiled, in a semi-manual way, at the federal level by Anvisa and by the Blood Coordination Office, but these data are usually incomplete and outdated.[1,2] Although blood donor systems in Brazil are required by law to store their donor/and donation data, they have been unable to combine data from multiple centers or systematically analyze these data due to lack of computer database systems with the capacity to create and analyze large datasets.

The NHLBI International REDS-II study in Brazil started in 2007, and is comprised of three major public blood banks. Two of them are in the Southeast region of Brazil[6], where most of the blood is collected, while the third is in Northeastern coastal Brazil. There are considerable regional differences between the Southeastern and Northeastern parts of Brazil[7], and differences in blood donor profile and behavior were expected. The present work describes the demographic profile of blood donors in the three centers, how it compares with the general population of the cities where each center is located, and discusses strategies to increase the proportion of the general population that donates blood in Brazil.

MATERIALS AND METHODS

Participating centers in Brazil

The International REDS II study in Brazil includes three blood centers: (1) Fundação Pró-Sangue (FPS), in São Paulo, (2) Fundação Hemominas (FH-MG) in Minas Gerais, both in the Southeastern part of Brazil, and (3) Fundação Hemope (FH-PE), in the State of Pernambuco, in the Northeastern part of the country. Donor and donation data from each center are centralized in a single data warehouse in São Paulo, and then transferred to a coordinating center in the USA. This direct extraction minimizes errors related to the consistency of the data and facilitates the data analysis. The present study is part of the international arm of REDS-II that conducts research studies involving safety and adequacy of the blood supply. Standardized demographic and test data on all blood donations are collected, prepared and electronically sent to the study Coordinating Center (Westat, Rockville, MD) for compilation and analysis.

FPS is based at a major public hospital (Hospital das Clínicas of the São Paulo University) in São Paulo, Brazil. It is the largest single blood bank in Latin America, collecting, testing and processing approximately 90,000 units of blood annually, which represents about 33% of the blood collected in the public system of the city of São Paulo, a city with approximately 19 million inhabitants, with 12,678,096 ranging from 18 to 65 years old and hence potentially eligible to donate blood.

FH-MG collects blood for the State of Minas Gerais, and is responsible for 92% of the blood collected in the State.[7] Donor and donation data from Belo Horizonte, the capital of the State are included in REDS-II International Brazil. Belo Horizonte Blood Center is the main

center, collects about 50,000 units of blood that are processed and distributed to 76 hospitals, located in 32 cities in the Belo Horizonte metropolitan area, which has 5,195,817 inhabitants, with 3,249,787 in the 18 to 65 years old range.

FH-PE is the blood center of the State of Pernambuco. Donor and donation data from the main center located in Recife, the capital of State of Pernambuco is included in REDS-II. This facility collects approximately 75,000 units of blood per year, and has coverage estimated in 98% of the blood needs of the area. This unit supplies blood to various hospitals in the metropolitan area, which has 2,681,970 inhabitants, with 2,399,557 in the 18 to 65 years old range.

REDS II project structure

The present study is part of the international arm of REDS-II that conducts research studies involving safety and adequacy of the blood supply. Standardized demographic and test data on all blood donations are collected, prepared and electronically sent to the study Coordinating Center (Westat, Rockville, MD) for compilation and analysis.

Data collection and storage

Demographic data were extracted from the computer system of each center and sent to a data warehouse at the University of São Paulo. Data included coded donor ID, age, gender, self-reported skin color (captured as 5 options but recoded into white, black, mixed or other), and educational attainment. The number of donations in the year was recorded and donors were classified according to the number of times they donated. Those who had never donated blood in the center before and did only once in 2007–8 were classified as “first time donors only” (oFT); those who returned in the period were called “returning first time donors” (rFT)and those who had previously donated in the center and donated once or more in the period were named “repeat donors only” (oRpt). For the analysis, we have considered “fist time donors” (FT) those originally classified as oFT or rFT, and repeat donors (Rpt) donors classified as rFT or oRpT. Donor type (replacement, community, autologous, directed) and donation type (whole blood or apheresis) were also evaluated.

Data warehouse architecture for REDS-II International Brazil

For the REDS-II project we had to address the different operations database structures used by the three centers. The heterogeneous operational databases and distinct data coding practices required the development of specific algorithms for data processing. The central data warehouse architecture has four hierarchical levels, as follows:

Level 1 raw data, i.e., transactional database: donations, exams, and clinical data.

Level 2 transformation into the warehouse database: this Level 2 integrates all primary data belonging to Level 1. Modular inclusion of information in Level 1 is achieved by building, at this level, a data warehouse on top of the operational databases of Level 1.

Level 3 MOLAP/ROLAP servers: this Level 3 implements *Online Analytical Process* (OLAP) queries (Multidimensional/Relational). OLAP is a decision support system that allows for easy querying on the underlying relational databases. The basic conceptual model that drives the OLAP tools is composed of fact and dimension tables. In the USP database the fact tables store the donation data. The dimension tables include data such as the donor region of residence, blood type, infectious marker screening results, etc. With this interface users can construct frequency tables and

other queries online. These queries can be stored, edited, and accessed multiple times, through a data interface named “cube”.

Level 4 pre-analysis tools, i.e., views of optimized relational queries, reports, files, spreadsheets, data selection to mining kernel: this Level 4 houses all components responsible for data retrieval including components for data visualization, QA/QC, data entry, and data export such as spreadsheet generators, relational views and processes that select data for mining programs.

With this infrastructure for the three REDS-II centers in place, integrating databases from other blood centers in Brazil is also feasible. Data are prepared for monthly downloads from the operational databases of each center, other data elements captured include other demographic and personal data (country of birth, ever transfused, zip code), donation data [date of donation, blood unit number, first/repeat donation, donation type (whole blood, apheresis), donor type (community/altruistic, replacement, autologous)], infectious disease data (screening and alternate EIA or other confirmation test data for HIV, HTLV, HBV, HCV, syphilis, and *Trypanosoma cruzi*). The data is then transferred to Westat on a quarterly basis and additional QA/QC procedures are conducted before analyses of the information are conducted.

Analysis

The donors were classified with respect to their first donation in 2007–2008. The information about skin color and educational level was not included in FH-MG until April 2008, and therefore was not available before this date. The donor profile was compared with the population 18 to 65 year old of the regions studied, available in the official government statistics (DATASUS) for each metropolitan area[7]. Statistical analyses were performed by Westat, after data cleaning, using the SAS software version 9.1.3 for Windows (SAS Institute Inc., 2003–2004, Cary, NC, USA).

RESULTS

In 2007–2008, 410,423 individuals donated blood to the three centers, giving a total of 615,379 units of whole blood or platelets by apheresis donations, and including 91 stem cells and 5 unknown donation types. 44.7% of the donors were from São Paulo (FPS), 31.4% from Recife (FH-PE) and 23.9% from Belo Horizonte (FH-MG). The mean donations per donor per year was 1.48 in FPS, 1.58 in FH-PE and 1.42 in FH-MG in the 2-year period.

Overall, the number of male donors was more than twice as high as that of females (Fig. 1 and Table 1). However, there was a significant regional variation with Recife having the lowest percentage of female donors (20.0 %), whereas Belo Horizonte (38.2%) and São Paulo (39.8%) had similar proportions. As for the donation type, community donors were higher than replacement (61.0 versus 39.0%), but with regional variation, with FPS having the highest proportion of community donors (75.7%) and FH-MG the lowest (46.4%).

When the gender of the donors was cross-tabulated with first time (FT) or repeat donor (Rpt) status (Fig. 2), we observed that the proportion of female donors was higher in FT donors (39.6%, Fig. 2A) than among Rpt during the period (28.8%, Fig. 2B). Replacement donors were less frequent among Rpt (37%) when compared to FT donors (46.4%). First time donors were younger than Rpt donors.

Donor educational attainment was uneven across the three centers. With considerable data missing for education in FH-PE and FH-MG (Table 1) data were analyzed after excluding it. Donors tended to concentrate in educational level C – which is completion of 11 years of

education (essentially equivalent to completing high school in the U.S.), with few donors on the extremes, i.e., levels A (elementary education or less), and level D - college or higher. There were several differences across centers, with São Paulo showing higher percentage of donors with 11 years of education and above (76%, vs. 68% for Belo Horizonte and 63% for Recife), whereas Recife showed a higher percentage of donors with less than 8 years of education (21.6% vs. 17.8% for Belo Horizonte, and 12.5% for São Paulo).

Skin color was evaluated in the three centers (Table 1) and showed that in Recife and Belo Horizonte the self-reported mixed skin color predominated (60.8% and 47.1%), whereas in São Paulo most of the donors (54.6%) were white. The proportion of black donors in Belo Horizonte (18.1%) was twice as high as in São Paulo (9.7%) and Recife (9.4%). We also examined the demographic distribution between community and replacement donors across centers, which was rather similar (not shown).

The proportion of donors compared with the potentially eligible subsets (18–65 years of age) of the general populations of each corresponding metropolitan areas was 1.3% overall. According to blood centers, the percentages were 0.9% for FPS, 1.8% for FH-MG, and 3.4% for FH-PE. Despite these apparent differences, when we adjust for the catchment area of each center studied, the proportions of FPS and FH-MG were rather similar (2.1 and 2.3% of the population). FH-PE. which is virtually the sole blood provider in its region, has the highest proportion of the population donating blood.

DISCUSSION

For the first time a comprehensive database exists comprised of donor and donation data from 3 geographically dispersed blood centers in Brazil, from regions with diverse socio-economic conditions. The data capture system that was developed for collecting systematic data in each center and transferring it to a single data warehouse involved considerable work of translating the local operational data elements into common definitions. This recoding of the data element structure was crucial to establish a common language and develop a system based on an information technology that will stay within Brazil and that can be expanded in the future to other blood centers.

In the past 10–15 years, Brazilian public health policies have sought to change the profile of blood donation from remunerated to non-remunerated blood donors[1,2,3] and from replacement donors to community volunteer blood donors, because they are thought to be safer.[8] The proportion of “safe donors”, based on low infectious disease marker rates, is considered higher where all donors are voluntary and non-remunerated – conditions that exist in 85% of developed countries, but in only 15% of developing ones and in only 7% of undeveloped countries[5]. For example, in Trinidad and Tobago, 87% of blood donations were replacement donations in a 2007 report.[9] In sub-Saharan Africa, 75–80% of blood still comes from hospital-based replacement donors.[4] In the present study, we have found that community donors now contribute the majority of donations in the three Brazilian centers studied, but that substantial variability exists among the centers.

A recommendation by the Ministry of Health, issued in 1993, advised the blood center recruitment personnel to talk to the families about blood donation, appealing to humanitarian feelings of family and friends of hospitalized patients, but avoiding coercing donation.[1,2] To enhance community donation, one strategy would be to deliberately transform replacement donors into community donors. A possible approach to achieve this is to talk to replacement donors after their first donation, showing them the importance of donation, and how their blood type is necessary. A study conducted by Chamla *et al* revealed that sending a personalized and informative letter to new donors would increase the number returning to

donate again.[10] Another study showed that the shorter the donation interval between the first and next donation, the more likely the donor was to make subsequent donations.[11] For example, if a donation appointment is set up right after the first replacement donation, it could help to convert a replacement donor into a "dedicated" community donor. Another study showed that donor satisfaction varies with demographics, and is positively correlated with the intent to return for future donation. Therefore, incentives to future donation may need to be adjusted to demographic sub-groups.[12]

Gonçalez *et al*[13] studied the evolution of altruistic donors in FPS, and documented the substantial impact produced after the enhancement of the recruitment department in 1998.[13] There was a considerable increase in the proportion of community and repeat donors that stabilized after a certain time at ~ 60%. These changes have led to a ~50% decrease in the rate of discarded blood units from 1995 to 2001.

One concern is about the "spurious altruistic donation", defined as a donor who donated blood for non-monetary compensation, for example blood testing.[14] It was shown by Barreto *et al*[3] that community first time donors in São Paulo, Brazil, had higher HIV prevalence than replacement first-time donors, and test seeking apparently plays an important role in bringing at-risk people to donate blood. In this case, offering anonymous testing to the general population and not immediately releasing negative results from blood bank testing may be effective in reducing this behavior.

In order to expand the safe donor pool it is fundamentally important to understand the segments of population that are donating, both as community/altruistic and replacement donors; this includes an understanding of demographic correlated of donation behaviors including gender, age, race/skin color and educational level.

Although donors were and still are mostly males in Brazil, female donations have been stimulated in the past few years, with diverse campaigns targeting women, a segment of the population that was historically not donating, probably due to myths on the health impact of donation, related to mensal blood losses, pregnancies and lactation.[1] Our data document that females still contribute a smaller proportion of donations than males in Brazil in all three regions represented in REDS-II. However, there were regional differences in the gender of donors, with the center in the Northeast (FH-PE) having the lowest proportion of female donation (19.3%, versus 37.6% in FH-MG and 39.0% in FPS). This could be due to the high proportion of anemia in the female population in Recife, possibly caused by iron deficiency and/or the presence of sickle cell trait in this population. However, further research is needed to better understand this heterogeneous gender distribution among the centers.

Gonçalez *et al* showed differences in the evolution of type of donor in Fundação Pró-Sangue Foundation. In 1995, only 20% of the donors were females, but their numbers increased steadily and, in 2001, female donation comprised 37% of the total and, as we have shown, in 2008 reached 39.0%.[13] Another study in Brazil, from Hemominas Foundation, Belo Horizonte[15], conducted in 1994–95, showed that the proportion of females was 23.5% at that time, whereas it is presently 37.6%. This increase is likely attributable to recruitment campaigns and educational programs, such as "Donor of the Future", that educate children and teenagers of both genders about the importance of blood donation. The REDS-II data confirm that these have been very successful programs in Brazil.

The majority of donors in the three centers studied were below 34 years of age. First-time donors were younger (most were 18–34 years old) than repeat donors, and concentrated in the 25–44 year age range. This result was expected, since the prototype of the Brazilian blood donor used to be a young male. Donors tended to be younger in Minas Gerais (FH-MG) and had similar age pattern in São Paulo and Pernambuco (FPS and FH-PE). In

Germany, a study revealed that the percentage of donors in the general population was higher among the youngest age group (18–24 years). While the age distribution of repeat whole blood donors roughly resembled that of the general population (most in the 35–44 range), younger groups were overrepresented among repeat plasma donors, who receive money to donate[23]. In the three centers studied in Brazil we found that the distribution of donors also tends to be younger than the general population.

The REDS-II centers captured the education data of blood donors for the first time in Brazil. Most donors completed high school, which follows the population pattern, as observed in the official Brazilian census (Datasus). The proportions of different categories of donor educational levels varied among the centers, likely reflecting the educational levels in the populations in the corresponding regions.

Due to the high degree of population admixture in Brazil, considered one of the greatest in the world[16] it is difficult to assess race or ethnicity based on skin color. The study of *Parra et al* indicated that in Brazil, at an individual level, color, as determined by physical evaluation, is a poor predictor of genomic African ancestry, estimated by molecular markers[16].

Therefore we used self-reported skin color in the present study, not race evaluation. There were differences in skin color of donors in the three centers studied, with a majority of white donors in São Paulo (FPS) and non-white donors in Belo Horizonte (FH-MG) and Recife (FH-PE). In some countries, e.g., United States, it is important to monitor the presence of minority groups (Hispanic, African American, and others) in part due to the fact that these groups tend to have lower blood donation rates.[17,18] In Brazil these differences are not clearly defined, and therefore skin color may not yield useful information, except for rarer blood groups and due to the fact that non-whites tend to be in the lower socio-economical stratum of the population, and could have higher infectious disease rates.

Blood transfusion is a frequent event and one study in Denmark and Sweden has shown that at age of 80 years, approximately one in five persons in the general population had received blood at least once.[19] We may anticipate that up to 30% of a given population will need transfusion during their lifetime, and benefit from the blood supply, even if only as a blood reserve for surgery. This may be even more conspicuous in countries like Brazil, where urban violence and traffic accidents have a relatively higher incidence.[24]

It is estimated by WHO that the suitable percentage of donors in a given population is about 5% of the individuals in the usual donation age range[20], which is the reported proportion of individuals donating blood each year in US[21]. In Germany, it was reported that overall 4% of the population eligible to donate were active as repeat whole blood donors in 2006.[22] The present work indicates that the Brazilian REDS-II centers collect blood from an average of 1.3% of their eligible catchment populations, with a range of 0.9–3.4%. The variation observed among the centers is in part due to differences in the proportion of local coverage of the centers. FH-PE, where there is the highest proportion of the population donating blood (3.4%), is practically the sole blood center in the State of Pernambuco, supporting over 95% of its transfusion needs. In São Paulo there are multiple blood services, and it is estimated that FPS provides 33% of the units transfused, whereas FH-MG provides 92% of the units transfused in Minas Gerais State, but about 85% in the Belo Horizonte metropolitan area.

Although there is a recognized need to increase donation in Brazil including the States covered in this report, it is also necessary to conduct more studies in order to determine what percentage of the population are appropriate candidates for blood donation, taking into consideration the local variations in the complexity of the medical procedures and demand

for blood. The study about the actual size of the potential donor pool in the US published by Riley *et al*[23] takes into account other donor-exclusion factors besides age, and this calculation likely reflects the proportion of potentially donor population closer to the real one. It reduces the denominator in the eligible donor equation dramatically, by excluding an additional 37.2% of the population due to permanent (cancer, heart disease, STDs, among others) or temporary deferrals (flu, cold, anemia, tattoo, etc). It remains to be determined what the adequate supply of blood should be for Brazil, and what factors would be needed to be considered for each region, balancing inadequate supply versus blood loss due to outdating of blood components. While these U.S. estimates are useful, we doubt that they can be extrapolated to the Brazilian donor population. Future work to estimate the likely eligibility of donors in the broader population of Brazil will determine the proportion of the population that actually qualifies to be donors in Brazil and whether there are differences in the regions. This study represents the first effort to comprehensively describe the demographic characteristics of blood donors at three large blood centers in Brazil, and is the first step toward understanding differences in donor characteristics compared to the general population of the corresponding catchment area.

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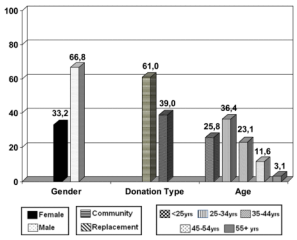

Figure 1.
Percentage of all donors by gender, donation type, and age three centers, Brazil, 2007 – 2008.

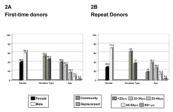

Figure 2.
Percentage of first time and repeat donors by gender, donation type, and age in the three centers, Brazil, 2007–2008.

Table 1

Donor demographic characteristics by donation type and blood center. REDS II, Brazil, 2007–2008.

	N (%)								
	FPS – SP[1]			FH – MG[2]			FHP – PE[3]		
	Community	Replacement	Total	Community	Replacement	Total	Community	Replacement	Total
Total	138768 (75.7%)	44538 (24.3%)	183306(100%)	45495 (46.4%)	52488 (53.6%)	97983 (100%)	66275 (51.3%)	62846 (48.7%)	129134 (100%)
Gender									
Males	82824 (59.7%)	27473 (61.7%)	110297 (60.2%)	26881 (59.1%)	33668 (64.1%)	60549 (61.8%)	51084 (77.1%)	52166 (83%)	103260 (80%)
Females	55944 (40.3%)	17065 (38.3%)	73009 (39.8%)	18614 (40.9%)	18820 (35.9%)	37434 (38.2%)	15191 (22.9%)	10680 (17%)	25874 (20%)
Age									
18 <25	35708 (25.7%)	9719 (21.8%)	45427 (24.8%)	13256 (29.1%)	13513 (25.7%)	26769 (27.3%)	19391 (29.3%)	14153 (22.5%)	33546 (26%)
25<35	51728 (37.3%)	15555 (34.9%)	67283 (36.7%)	17784 (39.1%)	20446 (39%)	38230 (39%)	21605 (32.6%)	22186 (35.3%)	43797 (33.9%)
35<45	31061 (22.4%)	10983 (24.7%)	42044 (22.9%)	9326 (20.5%)	12026 (22.9%)	21352 (21.8%)	14912 (22.5%)	16574 (26.4%)	31488 (24.4%)
45<55	15534 (11.2%)	6290 (14.1%)	21824 (11.9%)	4237 (9.3%)	5362 (10.2%)	9599 (9.8%)	8048 (12.1%)	8026 (12.8%)	16075 (12.4%)
55 +	4731 (3.4%)	1988 (4.5%)	6719 (3.7%)	892 (2%)	1141 (2.2%)	2033 (2.1%)	2263 (3.4%)	1897 (3.0%)	4162 (3.2%)
Education*									
A - < 8 years	9280 (10.5%)	3137 (16.3%)	12417 (11.5%)	2193 (11.9%)	3394 (16.2%)	5587 (14.2%)	3675 (14.4%)	4671 (15.2%)	8347 (14.8%)
B - 8 years	10673 (12%)	2834 (14.7%)	13507 (12.5%)	3089 (16.8%)	3915 (18.7%)	7004 (17.8%)	5566 (21.8%)	6576 (21.3%)	12144 (21.6%)
C - 11 years	51544 (58.2%)	9948 (51.6%)	61492 (57%)	9941 (54%)	10889 (52%)	20830 (52.9%)	13663 (53.5%)	16176 (52.5%)	29844 (53%)
D - College and above	17140 (19.3%)	3342 (17.4%)	20482 (19%)	3203 (17.4%)	2754 (13.1%)	5957 (15.1%)	2620 (10.3%)	3386 (11%)	6006 (10.7%)
Race*									
Black	8908 (10%)	1613 (8.4%)	10521 (9.7%)	4069 (18.1%)	4063 (18%)	8132 (18.1%)	2724 (8.4%)	3487 (10.4%)	6211 (9.4%)
Mixed	29892 (33.7%)	6475 (33.6%)	36367 (33.7%)	10294 (45.8%)	10917 (48.4%)	21211 (47.1%)	19221 (59.0%)	20915 (62.6%)	40142 (60.8%)
White	48205 (54.3%)	10782 (56%)	58987 (54.6%)	7740 (34.4%)	7254 (32.2%)	14994 (33.3%)	10437 (32.1%)	8873 (26.6%)	19312 (29.3%)
Other	1800 (2%)	397 (2.1%)	2197 (2.0%)	372 (1.7%)	315 (1.4%)	687 (1.5%)	178 (0.5%)	139 (0.4%)	317 (0.5%)
Donor Type									
First Time only[4]	45961 (33.1%)	26571 (59.7%)	72532 (39.6%)	12797 (28.1%)	24508 (46.7%)	37305 (38.1%)	20814 (31.4%)	26555 (42.3%)	47369 (36.7%)
First time who returned[5]	10823 (7.8%)	2589 (5.8%)	13412 (7.3%)	3496 (7.7%)	3701 (7.1%)	7197 (7.3%)	7433 (11.2%)	3941 (6.3%)	11374 (8.8%)
Repeat only [6]	81984 (59.1%)	15378 (34.5%)	97362 (53.1%)	29202 (64.2%)	24279 (46.3%)	53481 (54.6%)	38028 (57.4%)	32350 (51.5%)	70378 (54.5%)

[1]FPS – Pró-Sangue Foundation,

[2]FH-MG – Hemominas Foundation,

[3]FHP- PE – Hemope Foundation.

[*]Data for Race and Education were collected starting April 2008. Therefore, only 2008 data were reported. In addition, 9 donors in São Paulo and 66 donors in Recife did not report age.

[4]First time donating in the blood center (donated once in the period),

[5]First time donor who returned in the period studied,

[6]Donated previously in the blood center.