



Published in final edited form as:

*Transfusion*. 2013 November ; 53(11): 2734–2743. doi:10.1111/trf.12166.

## Undisclosed Human Immunodeficiency Virus Risk Factors Identified through a Computer-based Questionnaire Program among Blood Donors in Brazil

Paula Fraiman Blatyta<sup>1</sup>, Brian Custer<sup>2</sup>, Thelma Terezinha Gonzalez<sup>2</sup>, Rebecca Birch<sup>3</sup>, Maria Esther Lopes<sup>4</sup>, Maria Ines Lopes Ferreira<sup>5</sup>, Anna Barbara Carneiro Proietti<sup>6</sup>, Ester Cerdeira Sabino<sup>7</sup>, Kimberly Page<sup>8</sup>, and Cesar de Almeida Neto<sup>1</sup> for the NHLBI Retrovirus Epidemiology Donor Study-II (REDS-II), International Component

<sup>1</sup>Fundação Pró-Sangue Hemocentro de São Paulo, São Paulo, SP, Brazil

<sup>2</sup>Blood Systems Research Institute, San Francisco, CA, USA

<sup>3</sup>Westat, Rockville, MD, USA

<sup>4</sup>Fundação Hemorio, Rio de Janeiro, RJ, Brazil

<sup>5</sup>Fundação Hemope, Recife, PE, Brazil

<sup>6</sup>Fundação Hemominas, Belo Horizonte, MG, Brazil

<sup>7</sup>Department of Infectious Diseases, Medical School, University of São Paulo, São Paulo, SP Brazil

<sup>8</sup>University of California, San Francisco, San Francisco, CA, USA

### Abstract

**Background**—HIV risk factor screening among blood donors remains a cornerstone for the safety of blood supply and is dependent on prospective donor self-disclosure and an attentive predonation interview. Residual risk of HIV transmission through blood transfusion is higher in Brazil than in many other countries. Audio computer-assisted structured-interview (ACASI) has been shown to increase self-reporting of risk behaviors.

**Study design and methods**—This cross-sectional study was conducted between January 2009 and March 2011 at four Brazilian blood centers to identify the population of HIV-negative eligible blood donors that answered face-to-face interviews without disclosing risks, but subsequently disclosed deferrable risk factors by ACASI. Compared to the donor interview, the ACASI contained expanded content on demographics, sexual behavior and other HIV risk factors questions.

**Results**—901 HIV-negative blood donors were interviewed. On the ACASI, 13% of donors (N=120) declared a risk factor that would have resulted in deferral that was not disclosed during the face-to-face assessment. The main risk factors identified were recent unprotected sex with an unknown or irregular partner (49 donors), sex with a person with exposure to blood/ fluids (26 donors), multiple sexual partners (19 donors), and male-male sexual behavior (10 donors). Independent factors associated with the disclosure of any risk factor for HIV were age (< 40 years

---

Author responsible for correspondence/ reprint request: Paula Fraiman Blatyta, Av. Dr Eneas de Carvalho Aguiar, 155, Sao Paulo-SP-Brazil, Phone/ Fax: (+55) 11-3061-5544 extension 410/ 305, pblatyta@yahoo.com.br.

**Conflict of interest:** the authors declare that they have no conflicts of interest relevant to the manuscript submitted to TRANSFUSION.

vs. 18–25 years, AOR=0.45; 95% CI 0.23–0.88) and blood center (Hemope vs. Hemominas, AOR=2.51; 95% CI 1.42–4.44).

**Conclusion**—ACASI elicited increased disclosure of HIV risk factors among blood donors. ACASI may be a valuable modality of interview to be introduced in Brazilian blood banks.

### Keywords

HIV; transfusion; blood donors; ACASI; Brazil; risk factors

## Introduction

HIV behavioral risk factor screening among blood donors is a cornerstone for the safety of the blood supply, especially in countries where HIV prevalence is high and nucleic acid testing (NAT) is not routinely performed. Risk during the window period, which consists of the time-frame after infection when a person can transmit HIV through blood donation but still has not produced antibodies detectable by serology<sup>1</sup>, can be reduced only by prospective donor self-disclosure of behavioral risk factors and/or an attentive predonation interview with identification by blood center staff of any deferrable HIV risk factor or behavior.

In Brazil, a substantial proportion of the donor population believes that blood banks are a convenient place for free HIV testing, and they believe it is acceptable not to answer the screening questions truthfully in order to be tested since infections will be accurately detected and the infected units interdicted<sup>2</sup>. Gonzalez et al. showed the rate of acknowledged test-seekers was 9% in 2006<sup>3</sup> in one of our blood bank donor populations. Similarly, de Almeida-Neto et al. showed in 2007 in Brazil that almost 50% of the recently diagnosed HIV-positive blood donors and about 9% of the HIV negative control donors were aware of their HIV risk behaviors, but did not disclose them during the face-to-face interview before donation<sup>4</sup>.

Because there is a concern that donors may be in the window-period, the possibility of human error in testing and other blood bank procedures, mutant virus strains and immunological silent infections, it is important to have full disclosure of HIV exposure risk<sup>5</sup>. In an attempt to overcome these challenges, blood centers rely on donor compliance with the screening interview questions. Full disclosure is challenging, however, as the questionnaires are lengthy, time consuming and complex<sup>6</sup>. The questions intrude into the private and potentially stigmatized aspects of donors' lives, with the effect that prospective donors may not feel comfortable disclosing such information to unknown individuals for fear of judgment or social discomfort. The risk of no or partial disclosure is particularly relevant in Brazil because donors are screened for eligibility in face-to-face interviews, as opposed to other countries where they may answer a written or a self-administered computer questionnaire. There is also the possibility that repeat donors, who have been exposed many times to the same interview and are familiar with the questions, avoid disclosure and instead will answer the questions according to how they "should" be answered in order to be accepted for donation<sup>2</sup>.

Sabino et al.<sup>7</sup> showed in a recent study that residual risk of HIV transmission through blood transfusion among first time and repeat donors is higher in Brazil than in developed countries (1:88,500 versus 1:1,467,000 in USA<sup>8</sup>, 1:7,800,000 in Canada<sup>9</sup>, 1:4,300,000 in Germany<sup>10</sup>). Country-wide implementation of mini-pool NAT testing, now in progress, will be able to decrease the HIV risk transmission, but the donor eligibility interview is still crucial for maintaining blood donation safety because donors will probably continue to seek

HIV testing at blood centers facilities rather than free testing in health clinics. In fact, test-seeking at blood center may actually increase.

Audio computer-assisted structured-interviews (ACASI) have been shown to lead to increased risk behavior reporting from donors who did not disclose risks in a previous written or face-to-face questionnaire<sup>11-14</sup>. ACASI has the advantage of providing a standardized interview that respondents may perceive as being more non-judgmental, with reduced chances of measurement and transcriptional error because the data is automatically saved in a computerized file. In addition, ACASI also helps to create a private atmosphere, where the subject may feel more comfortable answering personal and potentially stigmatizing questions, and there is no time limit for answering the questions, as would be expected with a face-to-face interview<sup>15, 16</sup>.

We conducted a cross-sectional study to identify and describe undisclosed risk factors in a population of HIV-negative blood donors that answered face-to-face interviews to determine eligibility to donate and subsequently disclosed HIV deferrable risk factors by ACASI following donation.

## Material and Methods

### Setting

Data were collected between January 2009 and March 2011 from eligible blood donors that attended four large Brazilian blood centers: Fundação Pró-Sangue (FPS) in Sao Paulo, Fundação Hemope in Recife, Fundação Hemominas in Belo Horizonte and Fundação Hemorio, in Rio de Janeiro. These blood centers participated in the Retrovirus Epidemiology Donor Study (REDS-II), funded by the National Heart Lung and Blood Institute (NHLBI). The FPS, Hemorio and Hemominas centers are located in the Southeast region of the country, where the HIV incidence in 2010 was 9.2:100,000 habitants. Hemope is located in the Northeast region of the country, where the HIV incidence in 2010 was 6.9:100,000 habitants<sup>17</sup>. Together, these four blood centers collect over 400,000 blood units per year, representing approximately 10% of collections for the entire country.

This is a secondary analysis of the data for HIV-negative controls in a REDS-II project where risk factors for HIV infection in blood donors in Brazil were assessed using a case-control study design that included HIV-positive cases also. Accepted blood donors were randomly recruited to participate in the study as HIV-negative controls, either at the blood center following the donation process (on-site donors), or by telephone or e-mail, inviting them to come back to the blood center to participate (off-site donors). In the HIV case-control study, recruitment of off-site donors was discontinued because the study coordinators noticed that off-site donors were not responding to the invitations to participate in the study. Ethical committee approval to conduct the HIV case-control study was obtained for all sites in Brazil and also for collaborating institutions in the US.

### Study subjects

Inclusion criteria were being an eligible blood donor at any of the four main aforementioned blood centers and having an HIV-negative serostatus, as well as negative serological status for Chagas' disease, HBV, HCV, HTLV-1/2 and Syphilis. HIV was tested with two enzyme immunoassays (EIA) using a dual strategy<sup>18</sup>. Control donors for the HIV case-control study were excluded from the study if they had indeterminate serological results for any of the infections.

## Measures

Donors were interviewed to assess donation eligibility through face-to-face interviews that contain standardized content required by the Brazil Ministry of Health<sup>19</sup>, but not necessarily identical questions. Interviews were conducted by trained physicians, nurses or medical technologists, and included approximately 60 questions. Approximately 35% of these questions included sexual behavior and other risk factors for HIV/AIDS acquisition. Participants for this study were recruited in two ways: 1) On-site recruitment – after donating blood, the donors were invited to answer the ACASI questionnaire during specific work shifts, according to randomly assigned numbers applied to each shift of the week. Donors who agreed to participate were taken to a private room where informed consent was obtained and the study coordinator explained and demonstrated how to use the ACASI program and 2) Off-site recruitment – the second method of recruitment relied on letters sent to donors' home addresses asking them to return to the blood center to participate in the HIV case control study. For the subjects included in this study (control donors), donors were randomly selected to receive study invitations. The recruitment letters clearly indicated that the results from the recent blood donation were negative for all infectious markers. When participants returned to the blood center they were taken to the same private location for the ACASI interview as described above. Off-site recruitment of donors had limited success and was discontinued approximately 6 months into the study.

Study participants had unlimited time to answer the ACASI questions using a touch-screen computer with headphones to hear the audio recitation of the questions and answer options. The coordinator was available to help with comprehension and computer issues. The questionnaire included the following domains: sociodemographic factors, previous blood donation and HIV testing, incentives and motivations to donate, sexual history, sexual partners' risks, a social matrix inquiring about detailed information on sexual behaviors and the study donors last five sexual partners before blood donation, alcohol and drug use, medical history, other potential risk factors (tattoo, body piercing, acupuncture), and work place exposure. The questions were previously pilot-tested to verify donor comprehension. For our study, risk factors for HIV were defined as showed in Table 1. The blood center eligibility criteria are not identical for all four centers as shown in the table. However, for the higher risk behaviors donor acceptance criteria at each site are similar. The notable difference is the number of allowed heterosexual partners in the previous year. Regarding the type of sexual partnerships, during the ACASI interview donors could select the type of partners they had, according to response options: For each reported partner we asked "What type of partner is your partner? 1-Anonymous - Did not know, met for sex, never plan to see again, 2-One time - Already knew person, but had sex only once, 3-Acquaintance - Had sex more than once but not regularly, 4-Friend (you socialize with this person) - Had sex more than once but not regularly, 5-Main partner - Your spouse or main sex partner, 6-Sex worker - Money or other goods were exchanged for sex, 7-Don't Know, 8-Refuse to Answer".

Responses with answers of 1, 2 or 3 and with disclosure that condoms were either sometimes or never used, for the purpose of our study, were classified as "unprotected sex with an unknown or irregular partner". Medical procedures were excluded from our analysis, as the ACASI questions did not distinguish between deferrable and undeferrable medical exposures at each site. Based on the answer to questions related to risk factors, the donors were classified as having an "undisclosed risk factor" donor if he/she had at least one positive answer to any of the questions.

## Laboratory methods

Laboratory testing was performed at the donation testing division of each blood center. Donors were tested for HBV surface antigen, HBV core antibody, syphilis, anti-HCV, anti-

HTLV-1/2, Chagas' disease, and anti-HIV-1 and-2. HIV testing followed national guidelines and consisted of two different EIAs and one confirmatory Western blot for dual EIA reactive donations. Brazilian Ministry of Health approves all tests for commercial use, but they change over time based on improvements in test performance and also a required tender process that each blood center uses. The most recent algorithm for HIV detection at FPS in Sao Paulo was an HIV antigen and antibody capture (Architect System HIV Ag/Ab Combo, AbbottWiesbaden, Germany) and an HIV antibody test (Murex HIV-1.2.0, DiaSorin, Dartford, UK), followed by an Western HIV blot (HIV Blot 2.2 Western Blot Assay, MP Biomedicals, IllkirchCedex, France) in case samples had any of the antibody/antigen test reactive. In Hemorio donors were tested with HIV O PLUS (Abbott) and Vironostika HIVAg/Ab (BIOMERIEUX). In Hemope the donors were tested in the beginning of the study with HIV Ag/AB Bio-Rad and Murex HIV-1.2.0, followed by Architect System HIV Ag/Ab Combo and Murex-HIV 1.2.0 and then by HIV Combo Architect and HIV Ag/AbBiomerieux. In Hemominas the tests used were GenscreenPlus HIV Ag-Ab (BIORAD), Architect System HIV Ag/Ab Combo and Murex HIV-1.2.0.

### Statistical analysis

Data from the blood centers' operational and ACASI computer systems were extracted and compiled at the University of São Paulo then transferred to the REDS-II coordinating center in the United States (Westat, Rockville, MD) for analysis. We assessed frequencies and measures of central tendency by center. The principal outcome of interest was the presence of discordant disclosure of core risk factors for HIV acquisition between face-to-face and ACASI interviews. We assessed factors associated with discordant disclosure in bivariate analysis, using frequencies and proportions by Chi-square statistics. Sub-analyses were also conducted by blood center to assess discordance with deferral criteria unique to that center. Multivariable analysis using logistic regression was conducted to assess independent correlates of discordant disclosure for the four main specific risk behaviors identified: unprotected sex with an unknown or irregular partner, work exposure to blood and fluids or sex with a partner with work exposure, multiple sexual partners and male-male sexual behavior. Variables considered for inclusion in each multivariable model included: age, gender, marital status and blood center, and any variable which showed significance at the level of  $p < 0.05$  was included in the multivariable model.

### Results

A total of 901 HIV-negative blood donors were interviewed face-to-face and subsequent ACASI. One donor did not complete the entire questionnaire. 792 donors were recruited on-site (87.9%) and 109 (12.1%) off-site. 626 (69.5%) of the ACASI interviewed donors were male and 275 (30.5%) female. More were 40 years old (284 or 31.5%), white (450 or 49.9%) and were married or living together with a partner (511 or 56.7%). Most donors had an education level of 8 to 11 years of school (549 or 60.9%) and had never donated blood before (490 or 54.4%). The number of enrolled control donors was similar for each of the four blood centers (Table2).

Comparing the on-site versus off-site recruitment groups, we found that age was different among the two populations ( $p < 0.02$ ). On-site donors were mostly first-time donors (55.4%) whereas the majority of off-site donors were repeat donors (52.3%) ( $p < 0.007$ ). Hemorio had the highest proportion of on-site donors (26.3%), while FPS was the most frequent donation site for off-site donors (39.4%) ( $p < 0.014$ ). Regarding marital status, most on-site and off-site donors were living together with a partner or were married (56.2% and 60.5%, respectively;  $p < 0.015$ ), but a higher proportion of on-site donors were single and never married than in the off-site group (37.7% versus 26.6%, respectively). We found no difference regarding gender, education and ethnicity among the two groups (Table 2).

Considering undisclosed risk factors for HIV (Table 3), 120 (13.3%) of the 901 donors declared a risk factor on the ACASI interview that was not declared during the face-to-face donation eligibility assessment. In total, there were 152 affirmative answers to deferrable risk behavior questions, as many donors had declared more than one risk factor for HIV. Forty nine (5.4%) donors had had unprotected sex with an unknown or irregular partner during a predonation time period that would have resulted in deferral if disclosed. Professional exposure or sex with a person with potential exposure to blood or other biological fluids was a risk factor present in 26 donors (2.9%). Nineteen (2.1%) donors were classified as having multiple heterosexual partners, and ten male donors (1.1%) declared previous male-male sexual behavior. Eight (0.9%) donors declared having had sex with an HIV-positive person and seven (0.8%) declared having received a blood transfusion in the last 12 months or having sex with a partner who did so. Seven (0.8%) donors had sex with a sex worker and five (0.6%) male donors declared having a partner who is a male that had sex with another male (MSM) during the last 12 months. Five (0.6%) donors had sex with an inmate, while recent body piercing was declared by five (0.6%) donors. Recent acupuncture was reported by four (0.4%) donors, and tattoo was reported by three (0.3%) donors. Two donors (0.2%) used intravenous drugs and two (0.2%) were partners of intravenous drug users (IVDU).

Of the 120 donors with discordant disclosure for HIV risks one donor disclosed five risk factors; two donors declared 4 risk factors for HIV; four donors had 3 risk factors for HIV. Fourteen donors stated two risk factors and 99 declared one risk factor that had not been disclosed during the face-to-face interview. Donors with multiple HIV risk factors usually had a combination of sexual risk behaviors.

Donors recruited using on-site and off-site methods did not significantly differ in terms of overall undisclosed risks or specific risk behaviors, so they were considered as a whole for the multivariable analysis. In multivariable analysis (Table 4), independent factors associated with the disclosure of any risk factor for HIV were age (less likely among persons 40 years or older versus 18–25 years, Adjusted Odds Ratio, AOR=0.45; 95%CI 0.23–0.88;  $p<0.02$ ) and blood center (more likely among Hemope -versus Hemominas donors, AOR=2.51; 95%CI 1.42–4.44,  $p<0.002$ ). The factors associated with the disclosure of multiple sexual partners were gender (more likely among males versus females, AOR=8.35; 95%CI 1.04–66.74,  $p<0.04$ ) and marital status (more likely among single versus married donors, AOR=5.56; 95%CI 1.50–20.65,  $p<0.01$ ). The disclosure of unprotected sex with unknown or irregular partners was independently related to blood center (more likely among Hemope versus Hemominas donors, AOR=2.99; 95%CI 1.15–7.74;  $p<0.02$ ). Male-male sexual behavior disclosure was not significantly related to any variable, but was less likely among older donors (31–39 years old compared to 18–25 years old males, AOR=0.24; 95% CI 0.03–2.31; and 40 years or older compared to 18–25 years old males, AOR=0.25; 95% CI 0.01–4.63) and more likely among single compared to married donors (AOR=1.92; 95% CI 0.31–11.97). Sex with a partner exposed to blood and other fluids was significantly related to age (less likely among 40 years or older compared 18–25 years old donors, AOR=0.11; 95%CI 0.02–0.55;  $p<0.01$ ) and marital status (less likely among single versus married donors, AOR=0.19; 95%CI 0.06–0.72;  $p<0.01$ ).

Although motivations for donating are not asked in detail when prospective donors are questioned during eligibility assessment, in a further analysis we used ACASI responses to determine if specific motivations for donating were related to the odds of undisclosed risk factors. We found that positive answers to “I donated in response to a campaign on TV or radio”, “I think that I am doing something important for society” and “Blood banks always need blood and so donating is the right thing to do” were significantly associated with the

absence of an undisclosed HIV risk factor ( $p < 0.05$ ,  $p < 0.02$  and  $p < 0.02$ , respectively, data not shown).

## Discussion

By using ACASI, we found that one out of eight eligible blood donors had undisclosed risk factors for HIV that were omitted during the predonation interview, a crucial moment for blood collection and transfusion safety. This result is consistent with previous studies that have shown using ACASI technology improves disclosure on sensitive questions worldwide<sup>12-14</sup>.

Unprotected sex with unknown or irregular partners, professional exposure or sex partners with work-related exposure to blood/biological fluids, multiple sexual partners and male-male sexual relationships were the most common undisclosed behaviors among these donors. In Brazil we screen donors for a diversity of risk factors for HIV besides MSM because heterosexual transmission of HIV among our population has become an important exposure category since the mid-1990s, accounting for more than 60% of new cases in the general population<sup>20</sup>. We speculate that the predominance of sexual-related risk factors found in our study is due to more stigmatizing and socially sensitive questions, which the donors would prefer to answer in private rather than in a face-to-face interview. Alternately, depending on the donors' motivations, such as test seeking, donors may have known they would be deferred for these risks and opted to deny risks during the eligibility interview<sup>2</sup>. Younger donors and those who donated at Hemope (Recife, Pernambuco) had higher odds of undisclosed risk factors for HIV; we wonder if younger donors perceive the face-to-face interview as a judgmental situation in which potential age disparity between blood center staff and the prospective donors could play a role and therefore hide behaviors in order to answer the questions in ways they think interviewers find acceptable<sup>21</sup>. We also wonder if younger donors have reduced altruism compared to older donors as a consequence of differences among generations, but are uncertain if this would directly contribute to non-disclosure. An additional contextual factor may also be important. Hemope is located in the Northeast region of Brazil, with an overall lower socioeconomic status and an established sexual tourism industry. These social context factors may contribute to the higher prevalence of discordant disclosure of HIV risk factors among Hemope donors compared to the other blood centers. It is possible these donors are presenting as test-seekers. Future qualitative studies would be useful to ascertain the extent to which this may be true.

The motivation to donate findings added interesting information about blood donor behavior, as altruistic reasons to donate were correlated with not having an undisclosed risk factor. A future study focused on donors' motivation and psychological aspects of donation would bring insights into effective ways for recruiting safer donors. It is surprising that education level was not related to the discordant disclosure given previous studies. It is unknown if increasing donor knowledge through additional education about HIV acquisition and transmission will have a major impact to improve safety. Other research has shown that providing supplemental educational measures to blood donors did not increase blood transfusion safety<sup>22, 23</sup>. It may be that the educational materials that were used, such as pamphlets and posters, are not the most appropriate, and that video-based education may catch donors' attention more successfully.

While our study is one of the first to examine undisclosed risk factors identified through a computer-based questionnaire program in a population of Brazilian blood donors, it possesses some limitations. All donors had a fixed order to answer the questionnaires: first they underwent the face-to-face interview, second ACASI. For that reason, if donors were triggered to recall behaviors by the study design, the ACASI would obtain more complete

information than the face-to-face interviews. Note that particularly for the on-site recruited donors, ACASI was completed approximately 1 to 2 hours after the face-to-face interview, and so the risk of recall bias based on elapsed time was minimal, but present nonetheless. Discordant disclosure has been found even when using the same questioning method pre and post-donation. Post-donation health history interview typically yields more deferrable disclosure, presumably because at the post donation interview, donors usually focus more on the details of the questions and may also devote more time to consider each question more carefully before answering. One strategy to overcome the time-related recall bias would be to study the presence of undisclosed risk factors among donors randomly selected to answer a face-to-face interview, an ACASI interview, a face-to-face followed by ACASI or an ACASI followed by face-to-face interview, and compare the results of the different types and order of interviews. This comparison would help to clarify if the increased disclosure of risks were related to the donors being submitted to a second interview and being able to dedicate more time and attention to the same questions, or if really the modality of interview explains the difference.

Another limitation is that the face-to-face interview contained about 60 questions, while the ACASI had a higher number and more detailed questions. Even so, all the risk factors for HIV had at least one question on the face-to-face interview. We acknowledge that some risk factors are of more concern for HIV acquisition risk than others; for instance, multiple sexual partners carry a higher risk than tattoo or acupuncture. The “unprotected sex with an unknown or irregular partner” risk factor was created as part of the questionnaire design, but we did not validate these categories to establish for example that an anonymous partner is really different, or more risky, than a one-time encounter, or acquaintance with which the donor had sex more than once. In our study we found a higher frequency of these types of partnerships than we might have expected. It is noteworthy that heterosexual transmission of HIV plays an important role in the HIV epidemic in Brazil. Consequently, blood banks try to ascertain potential HIV risk factors among self-declared heterosexual donors during the predonation interview. All the categories included in our analysis as “unprotected sex with an unknown or irregular partner” would, if disclosed, disqualify a potential donor and in the Brazilian context are considered HIV risk factors.

Another potential limitation is that ACASI may be a challenge for some persons with lower educational attainment. We do not believe that respondents misunderstood the questions and reported risks that were not actually present, but we have no way of being able to assess if over or incorrect disclosure occurred. In the design of the study we sought to limit the chances of problems with ACASI and had study coordinators available to answer questions at any time during the ACASI interview.

In summary, we found through ACASI that failure of disclosure of HIV risk factors among blood donors is not a rare event. This information indicates that the standard face-to-face interview may need to be re-evaluated, and that feasibility studies utilizing ACASI as a possible alternative strategy are warranted. This study thus provides evidence that the blood donor questioning policies and practices need to be re-assessed at both local and national levels in Brazil.

## Acknowledgments

This study was funded in part by a research training grant from Blood Systems Research Institute, San Francisco, CA and by NHLBI Contract HHSN268200417175C.

The authors thank the Center for AIDS Prevention Studies (CAPS), San Francisco, CA, for their assistance in the preparation of this manuscript.



The **Retrovirus Epidemiology Donor Study-II (REDS-II)**, International Component (Brazil), is the responsibility of the following persons:

**Blood centers:**

Fundação Pró-Sangue/Hemocentro São Paulo (São Paulo): Ester C. Sabino, Cesar de Almeida Neto, Alfredo Mendrone Jr., Ligia Capuani, Nanci Salles

Hemominas (Belo Horizonte, Minas Gerais): Anna Bárbara de Freitas Carneiro-Proietti, Fernando Augusto Proietti, Claudia Di Lorenzo Oliveira, Carolina Miranda

Fundação Hemope (Recife, Pernambuco): Divaldo de Almeida Sampaio, Silvana Ayres Carneiro Leão, Maria Inês Lopes

Fundação Hemorio (Rio de Janeiro, RJ): Clarisse Lobo, Maria Esther Lopes, Silvia MF Carvalho

**Data warehouse:**

University of São Paulo (São Paulo): João Eduardo Ferreira, Márcio Oikawa, Pedro Losco Takecian

**US investigators:**

Blood Systems Research Institute and University of California San Francisco: M.P. Busch, E.L. Murphy, B. Custer, T. González

**Coordinating center:**

Westat, Inc.: J. Schulman, M. King, K. Kavounis

**National Heart, Lung, and Blood Institute, NIH:**

S.A. Glynn

## References

- Schreiber GB, Busch MP, Kleinman SH, Korelitz JJ. The risk of transfusion-transmitted viral infections. The Retrovirus Epidemiology Donor Study. *The New England journal of medicine*. 1996; 334(26):1685–90. [PubMed: 8637512]
- Gonzalez T, Sabino E, Sales N, et al. Human immunodeficiency virus test-seeking blood donors in a large blood bank in Sao Paulo, Brazil. *Transfusion*. 2010; 50(8):1806–14. [PubMed: 20456699]
- Gonzalez TT, Sabino EC, Murphy EL, Chen S, Chamone DA, McFarland W. Human immunodeficiency virus test-seeking motivation in blood donors, Sao Paulo, Brazil. *Vox sanguinis*. 2006; 90 (3):170–6. [PubMed: 16507016]
- de Almeida Neto C, McFarland W, Murphy EL, et al. Risk factors for human immunodeficiency virus infection among blood donors in Sao Paulo, Brazil, and their relevance to current donor deferral criteria. *Transfusion*. 2007; 47(4):608–14. [PubMed: 17381618]
- Maresch C, Schluter PJ, Wilson AD, Sleigh A. Residual infectious disease risk in screened blood transfusion from a high-prevalence population: Santa Catarina, Brazil. *Transfusion*. 2008; 48(2): 273–81. [PubMed: 18005323]
- O'Brien SF, Ram SS, Vamvakas EC, Goldman M. The Canadian blood donor health assessment questionnaire: lessons from history, application of cognitive science principles, and recommendations for change. *Transfusion medicine reviews*. 2007; 21(3):205–22. [PubMed: 17572260]
- Sabino EC, Gonzalez TT, Carneiro-Proietti AB, et al. Human immunodeficiency virus prevalence, incidence, and residual risk of transmission by transfusions at Retrovirus Epidemiology Donor Study-II blood centers in Brazil. *Transfusion*. 2012; 52(4):870–9. [PubMed: 21981109]
- Zou S, Dorsey KA, Notari EP, et al. Prevalence, incidence, and residual risk of human immunodeficiency virus and hepatitis C virus infections among United States blood donors since the introduction of nucleic acid testing. *Transfusion*. 2010; 50(7):1495–504. [PubMed: 20345570]

9. O'Brien SF, Yi QL, Fan W, Scalia V, Kleinman SH, Vamvakas EC. Current incidence and estimated residual risk of transfusion-transmitted infections in donations made to Canadian Blood Services. *Transfusion*. 2007; 47(2):316–25. [PubMed: 17302779]
10. Hourfar MK, Jork C, Schottstedt V, et al. Experience of German Red Cross blood donor services with nucleic acid testing: results of screening more than 30 million blood donations for human immunodeficiency virus-1, hepatitis C virus, and hepatitis B virus. *Transfusion*. 2008; 48(8):1558–66. [PubMed: 18466173]
11. Sellors JW, Hayward R, Swanson G, et al. Comparison of deferral rates using a computerized versus written blood donor questionnaire: a randomized, cross-over study [ISRCTN84429599]. *BMC Public Health*. 2002; 2:14. [PubMed: 12191432]
12. Katz LM, Cumming PD, Wallace EL. Computer-based blood donor screening: a status report. *Transfusion medicine reviews*. 2007; 21(1):13–25. [PubMed: 17174217]
13. Katz LM, Cumming PD, Wallace EL, Abrams PS. Audiovisual touch-screen computer-assisted self-interviewing for donor health histories: results from two years experience with the system. *Transfusion*. 2005; 45(2):171–80. [PubMed: 15660824]
14. Locke SE, Kowaloff HB, Hoff RG, et al. Computer-based interview for screening blood donors for risk of HIV transmission. *JAMA : the journal of the American Medical Association*. 1992; 268(10):1301–5. [PubMed: 1507376]
15. Pluhar E, McDonnell Holstad M, Yeager KA, et al. Implementation of audio computer-assisted interviewing software in HIV/AIDS research. *J Assoc Nurses AIDS Care*. 2007; 18(4):51–63. [PubMed: 17662924]
16. Estes LJ, Lloyd LE, Teti M, et al. Perceptions of audio computer-assisted self-interviewing (ACASI) among women in an HIV-positive prevention program. *PLoS one*. 2010; 5(2):e9149. [PubMed: 20161771]
17. Coordenação de Vigilância IeP-V. *Boletim Epidemiológico -Aids e DST*. Brazil: 2011.
18. Sabino EC, Salles NA, de Almeida-Neto C, et al. Performance of parallel screening of Brazilian blood donors with two human immunodeficiency virus immunoassays: implications for sequential immunoassay testing algorithms in other countries. *Transfusion*. 2011; 51(1):175–83. [PubMed: 20633245]
19. Saúde MdEd. Portaria MS no 1.353, de 13.06.2011 -DOU 1 de 14.06.2011. Brazil; 2011.
20. Bastos FI, Caceres C, Galvao J, Veras MA, Castilho EA. AIDS in Latin America: assessing the current status of the epidemic and the ongoing response. *International journal of epidemiology*. 2008; 37 (4):729–37. [PubMed: 18653508]
21. Davis RE, Couper MP, Janz NK, Caldwell CH, Resnicow K. Interviewer effects in public health surveys. *Health education research*. 2010; 25(1):14–26. [PubMed: 19762354]
22. Goncalves TT, Sabino EC, Salles NA, et al. The impact of simple donor education on donor behavioral deferral and infectious disease rates in Sao Paulo, Brazil. *Transfusion*. 2010; 50(4): 909–17. [PubMed: 20003056]
23. Rugege-Hakiza SE, Glynn SA, Hutching ST, et al. Do blood donors read and understand screening educational materials? *Transfusion*. 2003; 43(8):1075–83. [PubMed: 12869113]

**Table 1**

## Criteria for Blood Donation Deferral by Blood Center in Brazil

	<b>Fundação Pró-Sangue</b>	<b>Hemorio</b>	<b>Hemominas</b>	<b>Hemope</b>
Previous male-male sexual relationship	Yes, during the last 12 months	Yes (ever)	Yes, during the last 12 months	Yes, during the last 12 months
Female with sexual partner during the last 12 months who have had a male-male sexual relationship	Yes	Yes	Yes	Yes
Multiple heterosexual partners during the last 12 months (cutoff number of partners)	>6	>5	>2	>3
Previous intravenous drug use (ever)	Yes	Yes	Yes	Yes
During the last 12 months, had a sexual partner who is/was an intravenous drug user	Yes	Yes	Yes	Yes
Sex with an HIV seropositive partner during the last 12 months	Yes	Yes	Yes	Yes
During the last 12 months, sex with a previously transfused partner	Yes	Yes	Yes	Yes
During the last 12 months, sexual relationship with an inmate	Yes	Yes	Yes	Yes
Professional exposure to blood or human fluids or sex with a partner who had a professional exposure to blood or human fluids during the last 12 months	Yes	Yes	Yes	Yes
Unprotected sex with a previously unknown or irregular partner during the last 12 months	Yes	Yes	Yes	Yes
Sex with a sex worker during the last 12 months	Yes	Yes	Yes	Yes
Having a new tattoo or reapplied during the last 12 months	Yes	Yes	Yes	Yes
Ear or body piercing during the last 12 months	No	Yes	Yes	Yes
Acupuncture during the last 12 months	No	Yes	No	Yes

**Table 2**  
Demographics of On-site and Off-site HIV-negative blood donors, 2009–2011, Brazil (N=901)

Variable	On-site Donors		Off-site Donors		Total		p
	N	%	N	%	N	%	
<b>Gender</b>							
Male	557	70.3	69	63.3	626	69.5	0.136
Female	235	29.7	40	36.7	275	30.5	
Total	792		109		901		
<b>Age</b>							
18–25	189	23.9	22	20.2	211	23.4	0.023
26–30	130	16.4	19	17.4	149	16.5	
31–39	235	29.7	21	19.3	256	28.4	
40+	237	29.9	47	43.1	284	31.5	
Missing	1	0.1	0	0.0	1	0.1	
<b>Education</b>							
< 8 years	65	8.2	12	11.0	77	8.5	0.716
8 to 11 years	484	61.1	65	59.6	549	60.9	
> 11 years	240	30.3	32	29.4	272	30.2	
Missing	3	0.4	0	0.0	3	0.3	
<b>Marital status</b>							
Single	299	37.7	29	26.6	328	36.4	0.015
Married	445	56.2	66	60.5	511	56.7	
Separated	47	5.9	14	12.8	61	6.7	
Missing	1	0.12	0	0	1	0.1	
<b>Ethnicity</b>							
White	391	49.3	59	54.1	450	49.9	0.390
Black	134	16.9	18	16.5	152	16.8	
Mullatto	146	18.4	23	21.1	169	18.7	
Other/Refuse	120	15.1	9	8.2	129	14.3	
Missing	1	0.1	0	0	1	0.1	
<b>Donor status</b>							

Variable	On-site Donors		Off-site Donors		Total		p
	N	%	N	%	N	%	
First-time	439	55.4	51	46.8	490	54.4	0.007
Repeat	353	44.6	57	52.3	410	45.5	
Missing	0	0.0	1	0.9	1	0.1	
<b>Blood Center/location</b>							
Hemope – Recife	194	24.5	21	19.3	215	23.9	0.014
Hemominas – Belo Horizonte	194	24.5	21	19.3	215	23.9	
FPS – São Paulo	196	24.7	43	39.4	239	26.5	
Hemorio – Rio de Janeiro	208	26.3	24	22.0	232	25.7	

Table 3

ACASI Questions, Number of Donors with Positive Answers to Each Potential HIV Risk Factor and Percentage Over All Positive Answers

ACASI Question	Considered HIV risk factor if answer:	Number of Donors With the HIV Risk Factor	Percentage over all positive answers
What type of partner is your partner?	Anonymous (did not know, met for sex, never plan to see again), One time (already knew person, but had sex only once) or Acquaintance (had sex more than once but not regularly) AND Condom frequency of never or sometimes for that partner in the last 12 months	49	32.2
In the year before your last donation, have you had sex with anyone who had a job that involved exposure to blood or other body fluids or have you had a professional exposure to blood or body fluids?	Yes	26	17.1
(Ask of women only) How many different men have you had sex with during the last 12 months? (Ask of men only) How many different women have you had sex with during the last 12 months?	In Hemope >3 partners, in Hemominas >2 partners, in FPS >6 partners and in Hemorio >5 partners	19	12.5
(Ask of men only) How many different men have you had sex with since you first began having sex?	1	10	6.6
In the year before your last donation, have you had sex with anyone who tested positive for HIV?	Yes	8	5.3
In the year before your last donation, have you had sex with anyone who received a blood transfusion? Have you ever had a blood transfusion? If yes, when was the last year you received a transfusion?	Yes, during the previous 12 months	7	4.6
What type of partner is your partner?	Sex worker (money or other goods were exchanged for sex)	7	4.6
(Ask of men and women) In the year before your last donation, have you had sex with a man who has had sex with another man?	Yes	5	3.3
In the year before your last blood donation, have you had new ear or body piercings? Where did you get your most recent piercing?	Yes, I got it at home, a friends place, at parties/raves or jail. Deferral criteria for Hemominas, Hemope and Hemorio.	5	3.3
In the year before your last donation, have you had sex with anyone who has spent three or more nights in jail, prison, or a detention center?	Yes	5	3.3
In the year before your last blood donation, have you had acupuncture treatments?	Yes. Deferral criteria for Hemorio and Hemope.	4	2.6
In the year before your last blood donation, have you had a new tattoo or had one re-applied? Where did you get your most recent tattoo?	Yes, at home, a friends place, at parties/raves or jail. Deferral criteria for all blood centers.	3	2
Have you ever used or shot up injection drugs (examples include heroin, cocaine, and amphetamines)?	Yes	2	1.3
In the year before your last donation, have you had sex with anyone who was an intravenous drug user?	Yes	2	1.3
Total of positive answers		152	100%
Number of donors with HIV risk factors		120	13.3%

Table 4

Multivariable Analysis of Any Undisclosed Risk Factor for HIV and the Four Main Declared HIV Risk Factors versus Demographic Predictors, Among Blood Donors with Undisclosed Risk Factors, 2009–2011, Brazil (N=120)

Variables	Any Undisclosed Risk Factor		Multiple sexual partners		Unprotected sex with Unknown/Irregular Sexual Partner		MSM		Sex with a Partner With Professional Exposure or Own Work Exposure	
	N%	AOR [95%CI]	N%	AOR [95%CI]	N%	AOR [95%CI]	N%	AOR [95%CI]	N%	AOR [95%CI]
<b>Age (years)</b>										
18–25	38(31.7)	1	10(8.3)	1	16(13.3)	1	5(4.2)	1	7(5.8)	1
26–30	26(21.7)	1.04 [0.60–1.82]	5(4.2)	1.05 [0.35–3.21]	10(8.3)	1.02 [0.45–2.32]	3(2.5)	1.00 [0.21–4.75]	6(5)	0.75 [0.23–2.41]
31–39	34(28.3)	0.75 [0.43–1.32]	3(2.5)	0.52 [0.10–2.63]	15(12.5)	0.95 [0.40–2.23]	1(0.8)	0.24 [0.03–2.31]	10(8.3)	0.49 [0.17–1.42]
40+	22(18.3)	<b>0.45</b> <sup>†</sup> [0.23–0.88]	1(0.8)	0.38 [0.05–2.90]	8(6.7)	0.49 [0.18–1.31]	1(0.8)	0.25 [0.01–4.63]	3(2.5)	<b>0.11</b> <sup>†</sup> [0.02–0.55]
<b>Gender</b>										
Female	28(23)	1	18(15)	1					23(19.2)	1
Male	92(77)	1.47 [0.92–2.34]	1(0.8)	<b>8.35</b> <sup>†</sup> [1.04–66.74]					3(2.5)	3.11 [0.89–10.85]
<b>Marital Status*</b>										
Living together/Married	57(47.5)	1	3(2.5)	1	23(19.2)	1	3(2.5)	1	18(15)	1
Single, never married	55(46)	1.28 [0.80–2.04]	15(12.5)	<b>5.56</b> <sup>†</sup> [1.50–20.65]	24(20)	1.46 [0.78–2.75]	7(5.8)	1.92 [0.31–11.97]	4(3.3)	<b>0.19</b> <sup>†</sup> [0.06–0.72]
Separated/Divorced/Widow	7(6)	1.30 [0.56–3.04]	0		2(1.7)	0.91 [0.20–4.12]	0		4(3.3)	2.81 [0.95–8.34]
<b>Donor status</b>										
First-time					31(25.8)	1				
Repeat					18(15)	0.74 [0.39–1.40]				
<b>Blood Center</b>										
Hemominas	20(16.7)	1	4(3.3)	1	6(5)	1				
FPS	27(22)	1.28 [0.69–2.39]	1(0.8)	0.22 [0.02–2.08]	12(10)	1.97 [0.73–5.34]				
Hemorio	26(22)	1.39 [0.74–2.61]	0		12(10)	2.18 [0.78–6.06]				
Hemope	47(39.2)	<b>2.51</b> <sup>†</sup> [1.42–4.44]	14(11.7)	2.67 [0.82–8.65]	19(15.8)	<b>2.99</b> <sup>†</sup> [1.15–7.74]				

<sup>†</sup> p=0.01–0.04

<sup>‡</sup> p=0.002

\* Totals may be less due to missing values. All percentages are calculated over N=120.