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Moreno, Elizabeth
Sabino, Ester
Ferreira, Naura
et al.

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Self-reported Historic HIV Testing in a Brazilian Blood Donor HIV Case/Control Study

Roberta Bruhn[1], **Elizabeth Moreno**[2], **Ester C. Sabino**[3,4], **Naura Aparecida F. Ferreira**[5], **Anna Barbara F Carneiro-Proietti**[2], **Maria Esther D. Lopes**[5], **Divaldo Sampaio**[6], **Paula Loureiro**[6,7], **Brian Custer**[1], **Thelma T. Goncalez**[1], and **for the NHLBI Retrovirus Epidemiology Donor Study-II (REDS-II) International Component**

[1]Blood Systems Research Institute, Epidemiology, San Francisco, California, USA

[2]Fundação Hemominas/Hemocentro de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil

[3]Institute of Tropical Medicine, Universidade de São Paulo, São Paulo, SP, Brazil

[4]Department of Infectious Disease, Faculdade de Medicina, Universidade de São Paulo, São Paulo, Brazil

[5]Hemocentro do Rio de Janeiro, Rio de Janeiro, Brazil

[6]Fundação Hemope / Hemocentro de Pernambuco, Recife, Pernambuco, Brazil

[7]University of Pernambuco, FCM, Fundação Hemope, Recife, Pernambuco, Brazil

Abstract

BACKGROUND—There has been increased worldwide emphasis on the many benefits of HIV serostatus awareness for both infection prevention and improved treatment outcomes. Previous studies indicate that donors may use blood donation to be tested; the objectives of this analysis were to assess, among donors with previously undisclosed risk behavior in the 12 months before donation, the frequency of those who have previously been HIV tested and the demographic and behavioral factors associated with such testing.

STUDY DESIGN AND METHODS—In this secondary analysis from an HIV case-control study of blood donors in Brazil, we analyzed the response to the question: "Other than blood donation, have you ever been tested for HIV?" Demographic and disclosed risk behaviors associated with previous testing were determined.

RESULTS—The study included 341 HIV-positive cases and 791 HIV-negative controls (1:2 case/control ratio). Overall, 31% of blood donors (40% of cases and 26% of controls) reported having been tested for HIV outside of blood donation. History of HIV testing varied according to gender, HIV status, and reported sexual risk behavior.

CONCLUSION—While it is encouraging that previous testing was more frequent in donors with acknowledged sexual risk behavior in Brazil, 60% still had not been tested for HIV outside of the blood donation setting. Educating donors on the importance of not using blood centers as a means to get HIV tested in Brazil, especially if they engage in higher risk behaviors but rather seek alternate testing venues, could improve the safety of donated blood.

Keywords

blood donation; HIV testing

INTRODUCTION

HIV voluntary counseling and testing centers (VCT) are the portal to care as well as indirect prevention. Infected persons may reduce their risk of transmitting the virus to others through viral load suppression by antiretroviral therapy and behavior change. Persons testing negative receive referrals to other health and social services plus risk reduction counseling in order to remain uninfected.[1–5] Over the past three decades there has been expansion and improvement of facilities offering VCT services for vulnerable populations in many countries.[6, 7] Advances in HIV testing technologies have also made testing easier, faster and more accurate.

Brazil has the largest estimated HIV-infected population in South America[8] with a prevalence of 0.4% (0.3% women, 0.5% men).[9–11] The HIV/AIDS epidemic is urbanely concentrated with 10.5% prevalence among men who have sex with men (MSM), 5.9% among injection drug users (IDU), and 4.9% among sex workers. Reported risk behaviors vary according to gender; among women 86.8% of the cases reported in 2012 resulted from heterosexual contact with HIV-infected persons, while for men 43.5% were due heterosexual contact and 24.5% from homosexual contact.[9, 12] Similar to observations in the US,[7] Switzerland,[13] Belgium,[14] China,[15] Thailand,[16] and Central and South America, data from Brazil[9] suggest a particular resurgence in HIV incidence among young MSM.

Diagnosis of new HIV infections remains challenging in Brazil. Early in the epidemic, the Government of Brazil implemented programs to curb the growing number of infections; creating VCT and clinical care centers offering free services and providing technical and financial support to improve blood safety.[11, 17, 18] The VCT center has been a central component of Brazil's HIV prevention program for over 30 years.[11, 19, 20] A comprehensive network operating out of more than 400 public health facilities distributed across Brazil[11] provides the majority of HIV testing services in the country and facilitates access to free highly active antiretroviral therapy (HAART).[20, 21] Despite the broad availability of these programs, many HIV-infected and at-risk individuals do not use VCT services to determine HIV status, remaining untreated and potentially spreading infection.[1, 2, 22, 23] Lack of

serostatus awareness among HIV-positive individuals is a major contributing factor to HIV transmission within Brazil and worldwide.[6, 23–27].

Outside of the VCT setting, routine HIV testing is conducted on all donated blood, accounting for nearly one quarter of all HIV testing performed in Brazil[1, 28]. Blood donation policies are regulated by the Federal Government of Brazil and by the Blood Coordination Office (BCO) in the Ministry of Health.[30] Specific requirements are defined for donor recruitment, deferral criteria, laboratory testing, proper handling, and component preparation procedures. Each blood donor is interviewed face-to-face with questions that cover content required by law, including HIV risk behaviors and risk factors for other transfusion-transmissible infections (TTI). Previous studies identified blood centers as preferred HIV testing sites; more than one-third of male donors and 10% of donors overall acknowledged donating primarily to be tested for HIV.[1, 29] In 2012, from a population of 200 million inhabitants,[31] 3.6 million blood units were collected.[32] That many Brazilians are going to blood centers primarily for HIV testing poses a threat to the blood supply, as test-seekers frequently have higher rates of sexually transmitted infections[29].

This is a secondary analysis of an HIV risk factor study conducted from 2009 to 2011 as part of the National Heart, Lung and Blood Institute's Retrovirus Epidemiology Donor Study (REDS-II) International Brazil component. REDS-II was a multicenter program focused on improving blood safety (with emphasis on HIV and other TTI) and availability in the USA and internationally in Brazil and China.[33] This analysis assessed blood donors' previous HIV testing outside of the blood donation setting and associated demographic and behavioral factors.

MATERIALS AND METHODS

Study population

Study centers included Fundação Pró-Sangue (FPS) in São Paulo, Fundação Hemorio (Hemorio) in Rio de Janeiro, Fundação Hemominas (Hemominas) in Belo Horizonte, and Fundação Hemope (Hemope) in Recife. Donor eligibility rules were similar, except for the number of heterosexual partners in the previous 12 months; a donor was deferred if reporting >6 partners at FPS, >6 at Hemorio, >5 at Hemope, and >1 at Hemominas at the time of this study (2009–2011). Also, blood donation from MSM is allowed after 12 months of abstinence at FPS, Hemope, and Hemominas, but is a lifetime deferral at Hemorio. Blood donor eligibility are presented in the appendix.

In this secondary analysis from an HIV case-control study of approved blood donors in Brazil, we analyzed the response to the question: "Other than blood donation, have you ever been tested for HIV?" Demographic and disclosed risk behaviors associated with previous testing were determined. Cases were persons who returned to the blood center for counseling regarding donation testing results and were subsequently confirmed positive for HIV by Western blot on follow up sample. Controls were randomly selected immediately after blood donation and required subsequent negative test results for all TTI.[34] If any TTI screening test came back positive for a donor selected as a control their data were excluded.

Survey Instrument

The study questionnaire was administered via audio computer-assisted self-interview (ACASI) and included domains on socio-demographics, previous blood donation, HIV testing history, incentives and motivations to donate, sexual history, and sexual partner risk. [34] For our analyses, the primary outcome was the response to the question: "Other than blood donation, have you ever been tested for HIV?" Previous HIV testing was defined as "voluntary testing" for those who self-declared "I wanted to know my HIV status" and "routine testing" for those who tested due to pregnancy care, physician's order, routine medical care, hospitalization, surgery, or health insurance requirements. Individuals who answered 'Yes" to the question, "Did you donate blood because you wanted to be tested for HIV?" were classified as test-seekers. For this analysis, previously undisclosed risk was defined as any risk behavior reported on the ACASI questionnaire that would have resulted in deferral if it had been declared at the initial blood donor screening. This newly acknowledged risk was classified as sexual or non-sexual based on responses to questions within defined parameters. Sexual risk behaviors included sex with any of the following types of partners: anonymous, one time, or acquaintance partner with condom frequency of never or sometimes, an HIV-positive partner, MSM or partner of MSM, a partner with potential job exposure to bodily fluid, multiple partners in excess of center-specific deferral criteria, or being a sex partner of an IDU, sex worker, a transfusion recipient, a hemophiliac, or prison inmate. MSM activity in the 12 months before donation was also assessed by comparing the gender of the previous year's sexual partners with the gender of the respondent. Non-sexual risk behaviors included: IDU, injection of non-prescription substances, receipt of a blood transfusion, surgery or invasive dental procedures, three or more days incarceration, acupuncture treatment, tattoo application or reapplication, body piercing, accidental needle stick, and exposure to bodily fluid.

Statistical Analyses

Factors associated with previous HIV testing were evaluated using the likelihood ratio chi-squared statistic and considered statistically significant if the confidence interval did not include 1.0. Variables included gender, race, age, education, marital status, sexual orientation, donor presentation type (community/replacement [volunteer donation versus donating to help someone who required blood transfusion]), donation status (first time/ repeat), previously undisclosed risk (sexual/non-sexual), self-disclosed test seeking, and blood center location. StataMP version 12 (StataCorp, College Station, TX) was used for all analyses.

RESULTS

The parent study enrolled 1,132 participants: 341 HIV-positive cases and 791 HIV-negative controls. Table 1 summarizes HIV testing by gender, HIV status, and sexual risk behavior. Overall, 40% of participants reported a previous HIV test outside of blood donation. The highest proportions of voluntary HIV testing were found among male HIV-positive donors, both with and without reported sexual risk, 62.5% and 53.8%, respectively (p=0.4). HIV-positive male donors with sexual risk reported repeated testing most frequently (21.3%) followed by HIV-positive female donors with and without sexual risk (18.2% [p=0.7], 18.9%

[p=0.7]). Test-seeking behavior varied according to gender, HIV status, and risk behavior. Overall, test seeking was highest among male donors reporting sexual risk (19.7% HIV-positive, 14.3% HIV-negative, p=0.3). Females reporting sexual risk followed slightly behind in test-seeking rates (13.6% HIV-positive, 12.5% HIV-negative, p=0.9). The lowest rate of test seeking was observed among HIV-negative donors without sexual risk (3.8% male, 3.7% female, p=0.9). Test seeking did not vary by first-time/repeat donor status (19.6%, 18.4% [p=0.8]).

Subjects with reported sexual risk in 12 months before donation

There were 205 individuals (18.1%) in the HIV-positive with sexual risk group: 89.3% male, 58.0% MSM, 57.1% bisexual/homosexual, 45.4% had been previously tested for HIV, and 19.0% classified as test-seekers. By gender, 90.9% of females reported heterosexual orientation compared with 35.5% of males (p<0.0001). Males with MSM activity reported previous HIV testing proportionally more than did heterosexual males (51.3%, 29.7% [p=0.005], however, this was driven by the 25–29 age group (67.7%, 32.2%, [p=0.002]. More females reported previous HIV testing than did males (59.1%, 43.7%, p=0.2), but more males reported voluntary testing (62.5%, 53.6%, p=0.7) and while 40% of women in this group reported previous HIV testing as a result of pregnancy care, 7.4% of men did as well (p=0.01).

HIV-negative subjects with sexual risk represented 8.2% of participants (93 individuals), of which 82.8% were male, 87.1% heterosexual and 36.6% reported prior HIV testing. While 89.6% of males and 75.0% of females self-reported as heterosexual in this subgroup (p=0.1), 12.5% of females did not provide sexual orientation compared with 2.6% of males (p=0.08). Males reported MSM activity at 10.4%, test seeking at 14.3%, and HIV testing at 36.4% with 39.3% voluntary testing. Females reported similar test seeking (12.5% [p=0.9]) and testing (37.5% [p=0.9]) rates, however, the majority of previous HIV testing was for routine care (83.3%).

Subjects without reported sexual risk in 12 months before donation

The HIV-positive without sexual risk group comprised 12% of the study population (136 individuals): 72.8% male, 89.0% heterosexual, 32.4% tested previously, of which 45.5% indicated voluntary testing, and 10.3% classified as test-seekers. While not reporting sexual risk behavior, a small proportion reported a history of IDU (2/136) or injection of a non-illicit drug substance (13/136). Among males, 12.1% classified as test-seekers, 26.3% tested previously and of those, 53.9% reported voluntary testing. Both genders reported similar rates of heterosexuality (88.9% male, 89.0% female, p=1.0) but interestingly, 10.8% of women in this group did not report sexual orientation compared with 3.0% of men (p=0.07). While not self-reporting sex with a MSM, 6.1% of males were determined to have had MSM activity when gender of respondent was compared to gender of reported sexual partners in the previous 12 months (data not shown). Males reported higher rates of test seeking than did females (12.1%, 5.4% [p=0.3]), lower rates of HIV testing (26.3%, 48.7% [p=0.013]), and higher rates of voluntary testing (53.9%, 33.3% [p=0.2]).

The HIV-negative without sexual risk group comprised 698 individuals (61.7%). Two-thirds were male, 90.5% heterosexual and 25.1% had been tested before with 21.1% of those indicating voluntary testing. Within males, 4.2% refused to provide sexual orientation, 0.4% were determined to have MSM activity (not self-reported), 3.8% acknowledged test seeking, and 19.2% had been previously tested for HIV, of which 30.4% were voluntary. Within females, 88.1% reported heterosexuality and 6.9% refused to answer (p=0.1), 3.7% declared test-seeking (p=0.9), and 37.9% reported previous HIV testing (p<0.0001) with 10.8% voluntary (p=0.0015).

Odds of previous HIV testing among blood donors by gender, HIV status and sexual risk

Among males, HIV-positive participants with reported sexual risk were more likely to have a previous HIV test if they were age 25 to 29, OR 4.4 [95% CI 1.5–13.3], age 30 to 39, OR 3.6 [1.3–9.7] compared to 40–65 year old males, or self-identified as bisexual, OR 2.3 [1.1–4.9] compared to heterosexual males (Table 2). There were no significant associations for previous testing in HIV-positive male participants without reported risk. HIV-negative male participants with or without reported sexual risk were more likely to have a previous HIV test if they were age 30 to 39, OR 12.7 [1.1–152.7].

Among females, HIV-negative participants without reported sexual risk were the only group to have significant associations with previous HIV testing status (data not shown). Participants in this group were less likely to have a previous test if they reported mixed race compared to white (OR 0.3 [0.1–0.9]) or being replacement compared to community volunteer donor (OR 0.5 [0.3–0.9]. They were also more likely to have a previous test if they reported relationship status of unmarried cohabitating (OR 2.9 [1.3–6.7]) or married (OR 2.8 [1.4–5.4] compared to being single. The number of females in some strata was insufficient for statistical comparison.

Indications and locations for HIV Testing

Overall, women were less likely to have a previous voluntary HIV test, regardless of HIV status (HIV-positive OR 0.5 [0.2–1.2], HIV-negative OR 0.2 [0.1–0.5]) (Table 3). Pregnancy care was the foremost reason for testing in females (38.3%) while in males the primary reason was to determine their HIV status (45.1%). Omitting those whose previous HIV test was for pregnancy care, males compared to females did not differ in the probability of previous HIV testing (OR 1.2 [0.9–1.6] data not shown). There were no significant differences in HIV testing location by gender, HIV status, or sexual risk behavior.

DISCUSSION

Our study is the first to assess previous HIV testing among accepted donors who tested HIV-positive or HIV-negative in Brazil. Over 40% of HIV-positive and nearly 37% of HIV-negative at-risk (previously undisclosed sexual risk) donors had no previous HIV testing outside of blood donation. For those tested, females primary reason was pregnancy care while males was to determine HIV status. Females are more likely to have been tested than males[1, 18, 26, 35] most likely because females often require health services that include free

HIV testing, such as prenatal care.[19, 36] Males, however, may be motivated to seek testing due to risk.[28]

Donors who tested HIV-positive and reported sexual risk had the highest percentage of previous HIV testing, including voluntary and repeated testing; unfortunately, this included test seeking at blood centers (19.0%). This may indicate greater risk perception and increased awareness of the available resources for HIV testing and advantages of being tested.[24, 37, 38] Regional variations in the profiles of HIV test-seeking individuals have been described, but test-seeking in Brazil remains associated with male gender and low socioeconomics.[29] In Brazil, the demand for HIV testing is still low in most VCTs and, as in many other countries,[24, 25, 27, 35, 39] an incidental HIV diagnosis associated with other health events such as pre-natal care or blood donation is still more frequent than a diagnosis resulting from voluntary testing[17, 35]

Our results raise concerns because 62% of male and 47% of female HIV-positive donors had no prior HIV testing. High-risk individuals may underestimate or not understand their risk and do not feel the need for infectious disease testing at VCTs[40] or they are aware of their risk and actively seek testing at blood banks.[24, 41, 42] In the latter case, high-risk donors knowingly use blood centers as HIV testing sites.[42–45] In the former, donors also end up using blood centers as HIV testing sites but may be doing so unintentionally[35]. In both situations, donations from these high-risk donors pose a threat to blood safety.

An unacceptably high percentage of at-risk individuals with HIV-negative screening results (63.6% males, 62.5% females) had not had a previous HIV test. Those individuals who had not disclosed risk during donor screening but had done so during the study are most concerning for blood banks and public health. Whether this lack of disclosure is due to true lack of knowledge regarding HIV risk or to reluctance to acknowledge this risk, to themselves[46] or to blood centers, is unknown. This demonstrates that high-risk behavior does not always translate into voluntary testing[22, 27, 47, 48], and although perception of risk may be an important predictor of testing,[49] it does not necessarily lead to risk avoidance, [46, 50] and risk denial remains a major barrier to testing.[51, 52] Interestingly, HIV-negative blood donors with reported sexual risk comprised the only group where females did not demonstrate an increased likelihood of having been previously HIV-tested. These findings clearly indicate that despite the Brazilian government's programmatic efforts in promoting universal HIV testing, more needs to be done to reach this at-risk population.

Among HIV- negative donors without reported sexual risk, we found the lowest percentage of previous voluntary HIV testing; the majority reason was for routine healthcare-related testing.

The low HIV testing rate (27%) in younger blood donors (18–24) is worrisome. A recent UNAIDS report noted an 11% increase in HIV prevalence among MSM in this age group over the past eight years in Brazil.[21, 53] It is noteworthy that among the 75 HIV-positive male donors in the 18–24 age group, 60% self-reported being MSM or bisexual, yet only 42% reported a previous HIV test. We have not assessed deterrants to HIV testing, but perhaps this group feels no need for testing because they do not believe or are not aware they

have sexual risk factors. It has been speculated that this younger generation, because they have not experienced the deleterious chronic phase and high mortality rates of AIDS before the advent of HAART, might rationalize the risk of infection and forgo preventive measures. Increased rates of HIV prevalence in the MSM younger population have been observed in several countries worldwide[13, 54, 55], raising concern about the multiple challenges of HIV and AIDS prevention programs directed towards this younger population[55–57]. Low rates of HIV testing have been associated with concerns related to homophobia, loss of confidentiality, stigma, and discrimination with regard to testing and test results[27, 55, 58]. Nevertheless, efforts to increase voluntary testing may identify infection and stem the increasing rates of HIV in Brazilian youth.

Previous studies on HIV testing have been performed mainly among individuals attending the VCT centers, but no study has examined HIV testing prevalence among blood donors in Brazil. Although some may argue that the blood donor population does not accurately reflect the risk behavior in the general population or those who utilize the VCT centers, our results highlight the low HIV testing rate among high-risk blood donors. It may be that those blood donors do not self-acknowledge risk behavior to the extent that they would seek testing at a VCT[59], instead preferring to be tested during the process of donating blood, a non-stigmatizing testing venue, or they simply do not believe they need to be tested.

In addition, HIV-positive donors were interviewed, in some instances; months after being notified about their infection status could have resulted in recall bias in reporting of sexual risk behavior. HIV-negative donors were interviewed at the time of blood donation and their reporting of sexual risk may not have been as affected by recall bias. We also asked participants to report on the sexual activity of their partners, which may not have been disclosed to them. Finally, our results may not be generalizable to other countries or non-urban areas within Brazil.

Our results strengthen the need for a multidimensional approach to address HIV prevention and testing in Brazil. As HIV-positive donors reported no sexual risk behavior and HIV-negative donors reported sexual risk, it is clear that behavioral interventions are necessary to simultaneously reduce risk behavior and increase HIV testing. In the past few years the Brazilian government has expanded free HIV testing to the vast majority of public outpatient clinic networks[18] in addition to current VCT sites. This strategy encompasses several initiatives to promote universal HIV testing, simultaneously reducing undiagnosed prevalent HIV infections and preventing test-seeking behavior at blood centers. Likewise, continuous educational marketing campaigns focusing on HIV prevention in the young population are recommended. Of note, offering voluntary counseling and HIV testing at the time of donation at one large public blood center in Sao Paulo, Brazil, did not increase voluntary HIV testing and referral to care nor decrease the risk of HIV-infected donations in the blood supply.[60] Ultimately, these findings suggest a larger need for collaborative program development that includes VCTs and blood centers.

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Appendix

Brazil Blood Donor Deferral Codes by Hemocenter

(Grouping codes)	Sao Paulo (Specific codes)	Belo Horizonte (Specific codes)	Recife, Pernambuco (Specific codes)	Rio de Janeiro (Specific codes)
404 – STD exposure	Syphilis Other STD	Self-reported STD Has or had STD's	STD exposure	STD exposure [*]
403-HIV exposure or 501 – High risk (includes high risk sexual partner)	Exchange drugs or money for sex Sexual partner of hepatitis patient Sexual partner of blood recipient Sexual partner actually in prison or in the past Sexual partner of injection drug user Sexual partner of not injection drug user Bisexual partner High risk sexual relations= 6 or more sexual partners	Sexual partner of HIV suspicious Sex partner with unknown or casual one time partner, with or without condom Rape victims Sexual promiscuity Sexual partner of prostitute in the last 12 months Sexual partner of ex-inmate or convict <12 months Sexual partner of hemodialysis patient <12 months Sexual partner of blood	Sexual partner of HIV suspicious Unsafe sex with heterosexual partner <12 months Rape Sexual partner to a HIV risk person Prostitution Sexual partner to a HIV positive Sexual partner of prostitute <12 months High Risk suspicious Bisexual Promiscuous Sexual partner to a HTLV positive	Sexual partner of a HIV positive [*] Sex without condoms Sex for money Rape High risk sexual relations= 5 or more sexual partners [**] Sexual partner of a blood recipient [*] Sexual partner of prostitute <12 months Sexual partner of hepatitis carrier [**] Sexual partner of hemodialysis patient [**]

(Grouping codes)	Sao Paulo (Specific codes)	Belo Horizonte (Specific codes)	Recife, Pernambuco (Specific codes)	Rio de Janeiro (Specific codes)
	Sexual intercourse without a condom/ casual one time partner. Sexual partner of prostitute Promiscuous sexual partner Contact with Infectious Disease Carrier High risk sexual partner High Risk professional activity (prostitute, men and women dancers, rent boy, male hustler, etc) Sexual partner of hemodialysis patient Sexual partner of organ/tissue receiver	recipient <12 months Sexual partner of Hepatitis B, C Carrier < 12 months Sexual partner of any transfusion infection disease and HIV Exchange drugs or money for sex More than 1 sexual partner last year	Sexual partner to a HCV positive Sexual partner of ex-inmate or convict Bisexual partner High risk sexual relations= 6 or more sexual partners Sexual partner of blood recipient Sexual partner of injection drug user High Risk professional activity (prostitute, men and women dancers, rent boy, male hustler, etc)	Sexual partner of tissue or organ transplant High Risk professional activity (prostitute, men and women dancers, rent boy, male hustler, etc)[**] Sexual partner of injection drug user[**] Bisexual partner[**]
503 – Male who has sex with other males (MSM)	MSM/ Same Sex sexual relation Bisexual	MSM	MSM contact, just once MSM Bisexual	MSM
600 – Other deferral	Came to blood bank to get blood tests/also HIV test Drug user (ID user[**] not ID user[*]) Past Drug user (ID user not ID user[*])	Came to blood bank to get blood tests/also HIV test llegal drug user[**] Illegal no injected drug user[*]	Came to blood bank to get blood tests/also HIV test Drug user (ID user[**] not IDU[*])	HIV test seeker**** Inhaled Drug[*] Other drugs[*] (LSD, Ecstasy, etc) Drug User (IDU)[*]

[*] Temporary Deferral

[**] Permanent Deferral

Table 1

Previous HIV Testing and Donor Characteristics

	All Males	Males			
		Sexual Risk		No Sexual Risk	
		HIV+	HIV−	HIV+	HIV−
	N=838	N=183	N=77	N=99	N=479
HIV Testing History					
Never	72.6% (608/838)	56.3% (103/183)	63.6% (49/77)	73.7% (73/99)	80.0% (383/479)
Once	17.4% (146/838)	22.4% (41/183)	27.3% (21/77)	19.2% (19/99)	13.6% (65/479)
Repeated	9.5% (80/838)	21.3% (39/183)	9.1% (7/77)	7.1% (7/99)	5.6% (27/479)
Missing	0.5% (4/838)	-	-	-	0.8% (4/479)
Type of HIV Testing					
Voluntary	45.6% (103/226)	62.5% (50/80)	39.3% (11/28)	53.8% (14/26)	30.4% (28/92)
Routine	51.3% (116/226)	33.8% (27/80)	57.1% (17/28)	42.3% (11/26)	66.3% (61/92)
Pregnancy	6.7% (7/105)	7.4% (2/27)	5.9% (1/17)	-	6.6% (4/61)
Missing	3.5% (8/226)	3.8% (3/80)	3.6% (1/28)	3.8% (1/26)	3.3% (3/92)
Test Seeker					
Yes	9.2% (77/838)	19.7% (36/183)	14.3% (11/77)	12.1% (12/99)	3.8% (18/479)
No	90.8% (761/838)	80.3% (147/183)	85.7% (66/77)	87.9% (87/99)	96.2% (461/479)
Sexual Orientation					
Heterosexual	78.9% (661/838)	35.5% (65/183)	89.6% (69/77)	88.9% (88/99)	91.7% (439/479)
Bisexual	7.3% (61/838)	28.4% (52/183)	1.3% (1/77)	4.0% (4/99)	0.8% (4/479)
Homosexual	10.5% (88/838)	34.4% (63/183)	6.5% (5/77)	4.0% (4/99)	3.3% (16/479)
Missing	3.3% (28/838)	1.6% (3/183)	2.6% (2/77)	3.0% (3/99)	4.2% (20/479)
MSM					
Yes	16.1% (135/838)	65.0% (119/183)	10.4% (8/77)	6.1% (6/99)	0.4% (2/479)
No	83.9% (703/838)	35.0% (64/183)	89.6% (69/77)	93.9% (93/99)	99.6% (477/479)
Donation History					
First-time	30.4% (255/838)	48.6% (89/183)	26.0% (20/77)	58.6% (58/99)	18.4% (88/479)
Repeat	69.6% (583/838)	51.4% (94/183)	74.0% (57/77)	41.4% (41/99)	81.6% (391/479)

	All Females	Females			
		Sexual Risk		No Sexual Risk	
		HIV+	HIV−	HIV+	HIV−
	N=294	N=22	N=16	N=37	N=219
HIV Testing History					
Never	59.2% (174/294)	40.9% (9/22)	62.5% (10/16)	51.4% (19/37)	62.1% (136/219)
Once	27.2% (80/294)	40.9% (9/22)	31.3% (5/16)	29.7% (11/37)	25.1% (55/219)
Repeated	13.6% (40/294)	18.2% (4/22)	6.3% (1/16)	18.9% (7/37)	12.8% (28/219)
Type of HIV Testing					
Voluntary	18.3% (22/120)	53.8% (7/13)	-	33.3% (6/18)	10.8% (9/83)
Routine	75.0% (90/120)	38.5% (5/13)	83.3% (5/6)	55.6% (10/18)	84.3% (70/83)
Pregnancy	51.1% (46/90)	40.0% (2/5)	40.0% (2/5)	60.0% (6/10)	51.4% (36/70)
Missing	6.7% (8/120)	7.7% (1/13)	16.7% (1/6)	11.1% (2/18)	4.8% (4/83)
Test Seeker					
Yes	5.1% (15/294)	13.6% (3/22)	12.5% (2/16)	5.4% (2/37)	3.7% (8/219)
No	94.9% (279/294)	86.4% (19/22)	87.5% (14/16)	94.6% (35/37)	96.4% (211/219)
Sexual Orientation					
Heterosexual	87.8% (258/294)	90.9% (20/22)	75.0% (12/16)	89.0% (33/37)	88.1% (193/219)
Bisexual	1.4% (4/294)	4.5% (1/22)	-	-	1.4% (3/219)
Homosexual	3.7% (11/294)	4.5% (1/22)	12.5% (2/16)	-	3.7% (8/219)
Missing	7.1% (21/294)	-	12.5% (2/16)	10.8% (4/37)	6.9% (15/219)
Sex with MSM					
Yes	-	-	-	-	-
No	100% (294/294)	100% (22/22)	100% (16/16)	100% (37/37)	100% (219/219)
Donation History					
First-time	43.9% (129/294)	59.1% (13/22)	56.2% (9/16)	62.2% (23/37)	38.4% (84/219)
Repeat	56.1% (165/294)	40.9% (9/22)	43.8% (7/16)	37.8% (14/37)	61.6% (135/219)

Table 2

Odds of previous HIV testing among male blood donors by HIV status and sexual risk

| Characteristics | All Males 838 (%) | HIV+ | | | | | | HIV− | | | | | |
| | | Sexual Risk | | | No Sexual Risk | | | Sexual Risk | | | No Sexual Risk | | |
		Ever tested 80 (9.5%)	Never tested 103 (12.3%)	OR (95% CI)	Ever tested 26 (3.1%)	Never tested 73 (8.7%)	OR (95% CI)	Ever tested 28 (3.3%)	Never tested 49 (5.8%)	OR (95% CI)	Ever tested 92 (11.0%)	Never tested 383 (45.7%)	OR (95% CI)
Race													
White	374 (44.6)	30 (37.5)	50 (48.5)	1.0	11 (42.3)	29 (39.7)	1.0	17 (60.7)	24 (49.0)	1.0	38 (41.3)	175 (45.7)	1.0
Black	151 (18.0)	14 (17.5)	15 (14.6)	1.6 (0.7–3.7)	5 (19.2)	14 (19.2)	0.9 (0.3–3.3)	2 (7.1)	10 (20.4)	0.3 (0.1–1.5)	18 (19.6)	72 (18.8)	1.2 (0.6–2.2)
Mixed	176 (21.0)	15 (18.8)	21 (20.4)	1.2 (0.5–2.7)	6 (23.1)	18 (24.7)	0.9 (0.3–2.8)	5 (17.9)	9 (32.1)	0.8 (0.2–2.8)	24 (26.1)	76 (19.8)	1.5 (0.8–2.6)
Other	137 (16.3)	21 (26.2)	17 (16.5)	2.1 (0.9–4.6)	4 (15.4)	12 (16.4)	0.9 (0.2–3.4)	4 (14.3)	6 (21.4)	0.9 (0.2–3.9)	12 (13.0)	60 (15.7)	0.9 (0.5–1.9)
Age (in years)													
40–65	226 (27.0)	8 (10.0)	27 (26.2)	1.0	4 (15.4)	20 (27.4)	1.0	1 (3.6)	10 (20.4)	1.0	24 (26.1)	129 (33.7)	1.0
30–39	283 (33.8)	30 (37.5)	28 (27.2)	3.6 (1.3–9.7)	9 (34.6)	23 (31.5)	2.0 (0.5–7.5)	14 (50.0)	11 (39.3)	12.7 (1.1–152.7)	43 (46.7)	125 (32.6)	1.8 (1.1–3.2)
25–29	154 (18.4)	21 (26.2)	16 (15.5)	4.4 (1.5–13.3)	5 (19.2)	16 (21.9)	1.6 (0.4–7.0)	7 (25.0)	10 (20.4)	7.0 (0.6–82.4)	15 (16.3)	64 (16.7)	1.3 (0.6–2.6)
18–24	175 (20.9)	21 (26.2)	32 (31.1)	2.2 (0.8–5.9)	8 (30.8)	14 (19.2)	2.9 (0.7–12.0)	6 (21.4)	18 (36.7)	3.3 (0.3–34.1)	10 (10.9)	65 (17.0)	0.8 (0.4–1.8)
Education													
< Elementary	86 (10.3)	5 (6.0)	15 (14.6)	1.0	4 (15.4)	15 (20.5)	1.0	1 (3.6)	4 (8.2)	1.0	6 (6.5)	35 (9.1)	1.0
Elementary	166 (19.8)	10 (12.5)	21 (20.4)	1.4 (0.4–5.1)	7 (26.9)	19 (26.0)	1.4 (0.3–5.7)	3 (10.7)	9 (32.1)	1.3 (0.1–18.6)	11 (12.0)	85 (22.2)	0.8 (0.3–2.2)
High school	349 (41.6)	27 (33.8)	45 (43.7)	1.8 (0.6–5.6)	8 (30.8)	31 (42.5)	1.0 (0.2–3.8)	14 (50.0)	23 (46.9)	2.4 (0.2–25.1)	34 (37.0)	165 (43.1)	1.2 (0.5–3.1)
College or more	232 (27.7)	37 (46.2)	22 (21.4)	5.0 (1.5–17.0)	7 (26.9)	7 (9.6)	3.8 (0.7–19.0)	10 (35.7)	13 (26.5)	3.1 (0.3–34.8)	40 (43.5)	96 (25.1)	2.4 (0.9–6.3)
Sexual Orientation													
Heterosexual	661 (78.9)	22 (27.5)	43 (41.7)	1.0	23 (88.5)	65 (89.0)	1.0	23 (82.1)	46 (93.9)	1.0	82 (89.1)	355 (92.7)	1.0
Bisexual	61 (7.3)	28 (35.0)	24 (23.3)	2.3 (1.1–4.9)	1 (3.8)	3 (4.1)	0.94 (0.1–9.6)	1 (3.6)	0 (0.0)	–	1 (1.1)	3 (0.8)	1.4 (0.1–14.1)
Homosexual	88 (10.5)	30 (37.5)	33 (32.0)	1.8 (0.9–3.7)	1 (3.8)	3 (4.1)	0.94 (0.1–9.6)	4 (14.3)	1 (2.0)	8.0 (0.8–82.5)	4 (4.3)	12 (3.1)	1.4 (0.5–4.6)
Missing	28 (3.3)	0 (0.0)	3 (2.9)	–	1 (3.8)	2 (2.7)	1.4 (0.1–16.6)	0 (0.0)	2 (4.1)	–	5 (5.4)	13 (3.4)	1.7 (0.6–4.8)
Marital Status													
Single	349 (41.6)	55 (68.8)	66 (64.1)	1.0	15 (57.7)	27 (37.0)	1.0	9 (32.1)	23 (46.9)	1.0	28 (30.4)	125 (32.6)	1.0
Cohabitating	132 (15.8)	15 (18.8)	12 (11.7)	1.5 (0.6–3.5)	5 (19.2)	20 (27.4)	0.5 (0.1–1.5)	8 (28.6)	8 (28.6)	2.6 (0.7–9.3)	10 (10.9)	54 (14.1)	0.8 (0.4–1.8)
Married	301 (35.9)	7 (8.8)	15 (14.6)	0.6 (0.2–1.5)	4 (15.4)	19 (26.0)	0.4 (0.1–1.4)	9 (32.1)	12 (24.5)	1.9 (0.6–6.3)	47 (51.1)	186 (48.6)	1.1 (0.7–1.9)
Separated/Divorced/Widowed	55 (6.6)	3 (3.8)	10 (9.7)	0.4 (0.1–1.4)	2 (7.7)	7 (9.6)	0.5 (0.1–2.9)	1 (3.6)	6 (21.4)	0.4 (0.04–4.2)	7 (7.6)	18 (4.7)	1.7 (0.7–4.6)
Donation History													
First time	255 (30.4)	35 (43.8)	54 (52.4)	1.0	15 (57.7)	43 (58.9)	1.0	4 (14.3)	16 (32.7)	1.0	15 (16.3)	72 (18.8)	1.0
Repeat	583 (69.6)	45 (56.2)	49 (47.6)	1.4 (0.8–2.6)	11 (42.3)	30 (41.1)	1.1 (0.4–2.6)	24 (85.7)	33 (67.3)	2.9 (0.8–10.1)	77 (83.7)	311 (81.2)	1.2 (0.6–2.2)

Characteristics	All Males 838 (%)	HIV+						HIV−					
		Sexual Risk			No Sexual Risk			Sexual Risk			No Sexual Risk		
		Ever tested 80 (9.5%)	Never tested 103 (12.3%)	OR (95% CI)	Ever tested 26 (3.1%)	Never tested 73 (8.7%)	OR (95% CI)	Ever tested 28 (3.3%)	Never tested 49 (5.8%)	OR (95% CI)	Ever tested 92 (11.0%)	Never tested 383 (45.7%)	OR (95% CI)
Donor Type													
Replacement	253 (30.2)	21 (26.2)	24 (23.3)	1.0	9 (34.6)	32 (43.8)	1.0	10 (35.7)	14 (28.6)	1.0	25 (27.2)	118 (30.8)	1.0
Community	585 (69.8)	59 (73.8)	79 (76.7)	0.9 (0.4–1.7)	17 (65.4)	41 (56.2)	1.5 (0.6–3.8)	18 (64.3)	35 (71.4)	0.7 (0.3–2.0)	67 (72.8)	265 (69.2)	1.2 (0.7–2.0)
Self-reported Non-Sexual Risk													
No	625 (74.6)	45 (56.2)	61 (59.2)	1.0	17 (65.4)	54 (74.0)	1.0	19 (67.9)	39 (79.6)	1.0	69 (75.0)	318 (83.0)	1.0
Yes	212 (25.3)	35 (43.8)	42 (40.8)	1.1 (0.6–2.0)	9 (34.6)	19 (26.0)	1.5 (0.6–4.0)	9 (32.1)	10 (20.4)	1.8 (0.6–5.4)	23 (25.0)	65 (17.0)	1.6 (0.9–2.8)
Self-reported Test-seeking													
No	761 (90.8)	59 (73.8)	88 (85.4)	1.0	24 (92.3)	63 (86.3)	1.0	25 (89.3)	41 (83.7)	1.0	88 (95.7)	369 (96.3)	1.0
Yes	77 (9.2)	21 (26.2)	15 (14.6)	2.1 (1.0–4.4)	2 (7.7)	10 (13.7)	0.5 (0.1–2.6)	3 (10.7)	8 (16.3)	0.6 (0.1–2.6)	4 (4.3)	14 (3.7)	1.2 (0.4–3.7)

Totals may not =100% due to rounding or missing values.

Confidence intervals that do not include 1.0 are in bold.

Table 3

Gender distribution of demographic and behavioral characteristics among Brazilian blood donors reporting previous HIV testing outside of blood donation

Characteristics		Previous HIV-test(1) 346 (%)	HIV+			HIV−		
			Male(2) 106 (30.6%)	Female 31 (9.0%)	OR (95% CI)	Male(2) 120 (34.7%)	Female 89 (25.7%)	OR (95% CI)
Race								
	White	168 (48.6)	41 (38.7)	14 (45.2)	1.0	55 (45.8)	58 (65.2)	1.0
	Black	58 (16.8)	19 (17.9)	9 (29.0)	1.4 (0.5–3.8)	20 (16.7)	10 (11.2)	0.5 (0.2–1.1)
	Mixed	60 (17.3)	21 (19.8)	4 (12.9)	0.6 (0.2–1.9)	29 (24.2)	6 (6.7)	0.2 (0.1–0.5)
	Other	60 (17.3)	25 (23.6)	4 (12.9)	0.5 (0.1–1.6)	16 (13.3)	15 (16.9)	0.9 (0.4–2.0)
Age (in years)								
	40–65	67 (19.4)	12 (11.3)	8 (25.8)	1.0	25 (20.8)	22 (24.7)	1.0
	30–39	143 (41.3)	39 (36.8)	9 (29.0)	0.3 (0.1–1.1)	57 (47.5)	38 (42.7)	0.8 (0.4–1.5)
	25–29	69 (19.9)	26 (24.5)	7 (22.6)	0.4 (0.1–1.4)	22 (18.3)	14 (15.7)	0.7 (0.3–1.8)
	18–24	67 (19.4)	29 (27.4)	7 (22.6)	0.4 (0.1–1.3)	16 (13.3)	15 (16.9)	1.1 (0.4–2.7)
Education								
	Less than elementary	27 (7.8)	9 (8.5)	5 (16.1)	1.0	7 (5.8)	6 (6.7)	1.0
	Elementary school	55 (16.0)	17 (16.0)	9 (29.0)	1.0 (0.2–3.8)	14 (11.7)	15 (16.9)	1.3 (0.3–4.7)
	High school	130 (37.6)	35 (31.1)	14 (45.2)	0.7 (0.2–2.6)	48 (40.0)	33 (37.1)	0.8 (0.2–2.6)
	College or more	132 (38.2)	44 (41.5)	3 (9.7)	0.1 (0.02–0.7)	50 (41.7)	35 (39.3)	0.8 (0.3–2.7)
Sexual Orientation								
	Heterosexual	253 (73.1)	45 (42.5)	27 (87.1)	1.0	105 (87.5)	76 (85.4)	1.0
	Bisexual	33 (9.5)	29 (27.4)	1 (3.2)	0.1 (0.01–0.5)	2 (1.7)	1 (1.1)	0.7 (0.1–7.8)
	Homosexual	44 (12.7)	31 (29.2)	1 (3.2)	0.05 (0.01–0.5)	8 (6.7)	4 (4.5)	0.7 (0.2–2.4)
	Missing	16 (4.6)	1 (0.9)	2 (6.5)	3.3 (0.3–39.8)	5 (4.2)	8 (9.0)	2.2 (0.7–7.1)
Marital Status								
	Single	154 (44.5)	70 (66.0)	16 (51.6)	1.0	37 (30.8)	31 (34.8)	1.0
	Cohabitating	63 (52.5)	20 (18.9)	7 (22.6)	1.5 (0.5–4.3)	18 (15.0)	18 (20.2)	1.2 (0.5–2.7)
	Married	106 (30.6)	11 (10.4)	3 (9.7)	1.2 (0.3–4.8)	56 (46.7)	36 (40.4)	0.8 (0.4–1.5)
	Separated/Divorced/Widowed	22 (6.4)	5 (4.7)	5 (16.1)	4.4 (1.1–17.7)	8 (6.7)	4 (4.5)	0.6 (0.2–2.2)

Characteristics		Previous HIV-test(1) 346 (%)	HIV+			HIV−		
			Male(2) 106 (30.6%)	Female 31 (9.0%)	OR (95% CI)	Male(2) 120 (34.7%)	Female 89 (25.7%)	OR (95% CI)
Donation History								
	First time	125 (36.1)	50 (47.2)	17 (54.8)	1.0	19 (15.8)	39 (43.8)	1.0
	Repeat	221 (63.9)	56 (52.8)	14 (45.2)	0.7 (0.3–1.6)	101 (84.2)	50 (56.2)	0.2 (0.1–0.5)
Donor Type								
	Replacement	117 (33.8)	30 (28.3)	11 (35.5)	1.0	35 (29.2)	41 (46.1)	1.0
	Community	229 (66.2)	76 (71.7)	20 (64.5)	0.7 (0.3–1.7)	85 (70.8)	48 (53.9)	0.5 (0.3–0.9)
Self-reported Non-Sexual Risk								
	No	234 (67.6)	62 (58.5)	19 (61.3)	1.0	88 (73.3)	65 (73.1)	1.0
	Yes	112 (32.4)	44 (41.5)	12 (38.7)	0.9 (0.1–0.6)	32 (26.7)	24 (27.0)	1.0 (0.5–1.9)
Self-reported Sexual Risk								
	No	219 (66.2)	26 (24.5)	18 (58.1)	1.0	92 (76.7)	83 (93.3)	1.0
	Yes	127 (36.7)	80 (75.5)	13 (41.9)	0.2 (0.1–0.6)	28 (23.3)	6 (6.7)	0.2 (0.1–0.6)
Self-reported Test-seeking								
	No	312 (90.2)	83 (78.3)	29 (93.5)	1.0	113 (94.2)	87 (97.8)	1.0
	Yes	34 (9.8)	23 (21.7)	2 (6.5)	0.2 (0.05–1.2)	7 (5.8)	2 (2.2)	0.4 (0.1–1.8)
Frequency of HIV Testing								
	1 time	226 (65.3)	60 (56.6)	20 (64.5)	1.0	86 (71.7)	60 (67.4)	1.0
	2 or more times	120 (34.7)	46 (43.4)	11 (35.5)	0.7 (0.3–1.7)	34 (28.3)	29 (32.6)	1.2 (0.7–2.2)
Voluntary HIV Testing								
	No	205 (59.2)	38 (35.8)	15 (48.4)	1.0	77 (64.2)	75 (84.3)	1.0
	Yes	125 (36.1)	64 (60.4)	13 (41.9)	0.5 (0.2–1.2)	39 (32.5)	9 (10.1)	0.2 (0.1–0.5)
	Missing	16 (4.6)	4 (3.8)	3 (9.7)	1.9 (0.4–9.7)	4 (3.3)	5 (5.6)	1.3 (0.3–5.0)
Reason for Previous HIV Testing								
	Pregnancy care	53 (15.3)	2 (1.9)	8 (25.8)	1.0	5 (4.2)	38 (42.7)	1.0
	Health insurance	23 (6.6)	5 (4.7)	2 (6.5)	0.1 (0.01–1.5)	9 (7.5)	7 (7.9)	0.1 (0.02–0.5)
	Physician order/Medical care/Hospitalization/Surgery	114 (32.9)	28 (26.4)	5 (16.1)	0.04 (0.01–0.4)	52 (43.3)	29 (32.6)	0.1 (0.02–0.2)
	I wanted to know my HIV status	125 (36.1)	64 (60.4)	13 (41.9)	0.05 (0.01–1.2)	39 (32.5)	9 (10.1)	0.03 (0.01–0.2)
	Other reason	31 (9.0)	7 (6.6)	3 (9.7)	0.1 (0.01–1.2)	15 (12.5)	6 (6.7)	0.05 (0.01–0.3)
HIV Testing Location								

Characteristics	Previous HIV-test[1] 346 (%)	HIV+			HIV−		
		Male[2] 106 (30.6%)	Female 31 (9.0%)	OR (95% CI)	Male[2] 120 (34.7%)	Female 89 (25.7%)	OR (95% CI)
Private lab	144 (41.6)	45 (42.5)	13 (41.9)	1.0	42 (35.0)	44 (49.4)	1.0
Public lab/Health Department	115 (33.2)	42 (39.6)	11 (35.5)	0.9 (0.4–2.3)	33 (27.5)	29 (32.6)	0.8 (0.4–1.6)
Hospital	64 (18.5)	16 (15.1)	5 (16.1)	1.1 (0.3–3.5)	30 (25.0)	13 (14.6)	0.4 (0.2–0.9)
Missing	23 (6.6)	3 (2.8)	2 (6.5)	2.3 (0.3–15.7)	15 (12.5)	3 (3.4)	0.2 (0.05–0.7)

[1] All participants=1132; All with previous HIV Test=346; Totals may not =100% due to rounding or missing values.

[2] Reference group