

## Blood discard rate and the prevalence of infectious and contagious diseases in blood donors from provincial towns of the state of Paraná, Brazil

Sueli Donizete Borelli<sup>1</sup>  
 Jocimara Costa Mazzola<sup>1</sup>  
 Alessandra Cristina Gobbi Matta<sup>1,2</sup>  
 Angélica Yukari Takemoto<sup>3,4</sup>  
 Marta Bértoli<sup>1</sup>

<sup>1</sup>Universidade Estadual de Maringá - UEM, Maringá, PR, Brazil

<sup>2</sup>Faculdade Ingá, Maringá, PR, Brazil

<sup>3</sup>Faculdade Guairacá, Guarapuava, PR, Brazil

<sup>4</sup>Faculdade Campo Real, Guarapuava, PR, Brazil

**Background:** So that an improvement in the selection of donors can be achieved and the risk to the recipient of transfused blood can be reduced, prospective donors are submitted to clinical and serological screening.

**Objective:** This study investigated the blood discard rate and the rate of infectious and contagious diseases in blood donors from provincial towns of the state of Paraná, Brazil.

**Methods:** This study was an exploratory cross-sectional descriptive investigation with a quantitative approach of donations between January and December 2011.

**Results:** In the study period the Regional Blood center in Maringá, Brazil received 8337 blood donations from people living in the city and neighboring towns. However, 278 (3.33%) donations were discarded during serological screening owing to one or more positive serological markers. A total of 46.4% of the discarded blood units were confirmed positive by serology with anti-HBc being the most common (66.7%), followed by syphilis (22.5%), HBsAg (4.7%), anti-hepatitis C virus (3.1%), human immunodeficiency virus (1.5%) and Chagas' disease (1.5%). The rate of infectious-contagious diseases that can be transmitted by blood transfusions was 1.55% (129/8337) of the donor population with a frequency of 1.03% for anti-HBc and 0.35% for syphilis.

**Conclusion:** This study demonstrates a high prevalence of the anti-HBc marker in prospective blood donors from provincial towns in the state of Paraná, Brazil.

**Keywords:** Hemotherapy service; Serology; Blood bank; Quality control; Blood donors/statistics & numerical data; Blood safety; Hepatitis C/blood; Biological markers; Brazil

### Introduction

Blood donation is one of the noblest gestures a human can make when its purpose is to save lives<sup>(1)</sup>. Although blood transfusions were seen as a mere transmission of physiological material, changes occurred that made the screening of donors highly relevant to the quality of blood. Since the start of the practice, blood donation in Brazil has changed from donors being paid to life-saving volunteers<sup>(2)</sup>.

Blood donation in Brazil is currently regulated by the Health Ministry through the National Health Surveillance Agency (ANVISA) by Resolution number 57 of the Collegiate Directory published on December 16<sup>th</sup>, 2010 and by Decree 1353 of the Health Ministry of June 13<sup>th</sup>, 2011 that standardize the technical norms for procedures in blood centers. These regulations support all the activities of blood centers in Brazil according to the principles and guidelines of the Brazilian policy for the transfusion of blood, components and blood-derived compounds. In fact, the regulations aim to protect donor and recipient, control collection, processing, storage, distribution and the transfusion of blood and its components and derivatives of human venous and arterial blood and establish essential institutional norms for the adequate execution of these activities<sup>(3)</sup>. So that an improvement in the selection of donors can be achieved and the risk to the recipient of transfused blood can be reduced, prospective donors are submitted to clinical and serological screening<sup>(4-6)</sup>.

The Brazilian Health Ministry determined that all blood centers must apply highly sensitive tests for transmissible infections to decrease the risk of disease and to maintain the quality of donated blood. The laboratory tests that should be performed are for syphilis, Chagas' disease, hepatitis B virus (HBV), hepatitis C virus (HCV), acquired immunodeficiency syndrome (AIDS) and human T cell lymphotropic virus (HTLV) types I and II<sup>(6)</sup>.

The blood unit discard rate in Brazil ranges between 10 and 20%. Infectious diseases are the main cause of this high percentage, which exceeds that of developed countries<sup>(7,8)</sup>. The current research investigated the frequency of discarded blood and the prevalence of infectious-contagious diseases identified by positive serological markers in blood donors of the Regional Blood center in Maringá, Paraná, Brazil in 2011.

### Methods

The current cross-sectional descriptive investigation with a quantitative approach collected data from the HEMOVIDA system which is used to store all the information about donated blood. Data were collected between 1st January and 31st December 2011. The variables

Conflict-of-interest disclosure:

The authors declare no competing financial interest

Submitted: 9/24/2012

Accepted: 12/18/2012

#### Corresponding author:

Sueli Donizete Borelli  
 Universidade Estadual de Maringá – UEM  
 Departamento de Ciências Básicas da Saúde  
 Av Colombo, 5.790 – Bloco T-20 – Sala 108  
 A, Jd. Universitário  
 87020-900 Maringá, PR, Brazil  
 Phone: 55 44 3011-5388  
 sdborelli@uem.br

www.rbhh.org or www.scielo.br/rbhh

DOI: 10.5581/1516-8484.20130126

investigated were age, gender, ethnic group, schooling, marital status, place of residence, profession and the serological tests for infectious diseases as defined by the Brazilian Health Ministry<sup>(6)</sup>.

Within the context of serological screening by the Blood Center, Decree 153/2011 of the Health Ministry states that each donation must be evaluated using highly sensitive tests for determined serological markers that would impair the health of the recipient. These tests include markers that detect the HBV surface antigen (HBsAg) and antibodies against HBV capsid (anti-HBc - IgG or IgG + IgM), HCV markers that identify antibodies against HCV or detect the antibody and antigen combined and two distinct tests are made for AIDS, one to detect the antibody against HIV I and II and the other to detect the antibody against HIV and the p24 antigen. Moreover, the test for the anti-*Trypanosoma cruzi* antibody which causes Chagas' disease is carried out as are tests for syphilis to determine the anti-*Treponema pallidum* antibody or non-treponemal antibody and tests to detect antibodies against HTLV-I and -II. All methods of serological screening followed the manufacturer's instructions.

Table 1 - Method, manufacturer and assay used for to identify serological markers used in the Regional Blood center of Maringá, 2011

Marker	Method	Manufacturer	Assay
HBsAg	ELISA	Biokit	Bioelisa HBsAg 3.0
	MEIA	Abbott (AxSYM)	HBsAg (V2)
	CMIA	Abbott (Architect)	HBsAg qualitative
Anti-HBc	MEIA	Abbott (AxSYM)	Core
	CMIA	Abbott (Architect)	Anti-HBc II
Anti-HCV	ELISA	Beijing United	HCV Ultra
	ELISA	Biomedical	Hepanostika
		Abbott/Murex	Anti-HCV 4.0
Anti-HIV types I and II	ELISA	Biomerieux	HIV Uniform II
	ELISA	Biomerieux	Ag/Ab
	ELISA	Abbott/Murex	Vironostika HIV
			Ag/Ab combination
Anti-HIV types I and II	MEIA	Abbott (AxSYM)	HIV Ag/Ab Combo
	CMIA	Abbott (Architect)	HIV Ag/Ab Combo
Anti-HTLV-I and -II	ELISA	Abbott/Murex	HTLV I/II
Chagas' disease	ELISA	Abbott/Grupo Bios	Test Elisa Chagas III
Syphilis	ELISA	Biomerieux	Trepanostika TP recombinant

HCV: Hepatitis C virus; HIV: Human immunodeficiency virus; HTLV: Human T cell lymphotropic virus

The inclusion criterion for the current study was all discarded blood due to confirmed positive markers during serological screening. Serology with undetermined results and the absence of the donor for a repeat collection of blood to confirm initially positive serological tests were valid criteria for sample exclusion.

Data was collected between January and February 2012. Data were organized on a Microsoft Office Excel sheet in tables.

This study was developed according to the Decree of the National Health Council 196/1996, after approval of the Commission that Regulates Academic Activities in the *Hospital Regional de Maringá* and of the Ethics Committee on Research on Human Beings of the *Universidade Estadual de Maringá* (UEM: # 211/2011).

## Results

The Blood center of Maringá received 8337 blood donations from people living in the city of Maringá and in neighboring towns between 1<sup>st</sup> January and 31<sup>st</sup> December 2011. However, 278 blood units (3.33%) failed serological screening as they were positive for one or more serological markers. Data were collected at two distinct stages, namely, selection and confirmation of exclusion as shown in Tables 2 and 3.

Table 2 - Blood discard due to positive serology of blood donors at the Regional Blood center of Maringá, Maringá, Paraná, Brazil in 2011

Serological marker	Discarded blood units (n)	Discarded blood units/ total donations (%)	Discarded blood units per serological marker (%)
Anti-HBc	146	1.75	52.50
HBsAg	10	0.12	3.60
Anti-HCV	39	0.46	14.00
HIV	16	0.19	5.80
Chagas' disease	6	0.07	2.10
Syphilis	58	0.70	20.90
HTLV	3	0.04	1.10
Total	278	3.33	100.0

HCV: Hepatitis C virus; HIV: Human immunodeficiency virus; HTLV: Human T cell lymphotropic virus

Table 3 - Discarded blood unit confirmation due to positive serological type and infectious-contagious diseases in blood donors at the Regional Blood center of Maringá, 2011

Serological marker	Discarded blood units	Confirmed serology		Positivity per marker	Prevalence of infectious-contagious diseases
	(n)	(n)	(%)	(%)	(%)
Anti-HBc	146	86	58.90	66.7	1.03
HBsAg	10	6	60.00	4.7	0.07
Anti-HCV	39	4	10.25	3.1	0.04
HIV	16	2	12.50	1.5	0.02
Chagas	6	2	33.30	1.5	0.02
Syphilis	58	29	50.00	22.5	0.35
HTLV -I and -II	3	0	0.00	0.00	0.00
TOTAL	278	129	22495	100	1.55

HCV: Hepatitis C virus; HIV: Human immunodeficiency virus; HTLV: Human T cell lymphotropic virus

During the screening stage, the Anti-HBc marker was the cause of 52.5% of the discarded blood units during serological screening, followed by syphilis (20.9%), anti-HCV (14.0%), HIV (5.80%), HBsAg (3.60%), Chagas' disease (2.10%) and HTLV-I and -II (1.10%). The confirmation of exclusion due to serological results was based on specific criteria listed in Decree 1353/2011 of the Brazilian Health Ministry<sup>(6)</sup>.

Table 3 shows the absolute frequency of confirmed serological types, the positivity of the marker and the prevalence of infectious-contagious diseases of blood donors.

This analysis shows that 129 (46.4%) out of 278 discarded blood units were confirmed positive by serology. Anti-HBc (66.7%) was the greatest cause of discard followed by syphilis (22.5%), HBsAg (4.7%), anti-HCV (3.1%), HIV (1.5%) and Chagas' disease (1.5%).

The prevalence of infectious and contagious diseases among donors of the Regional Blood Center was 1.55% (129/8337).

Table 4 - Epidemiological data of donors (n = 122) with positive serology in the Blood center of Maringá, Maringá, Paraná, Brazil in 2011

Variable	n	%
<b>Gender</b>		
Male	66	54.1
Female	56	45.9
<b>Marital Status</b>		
Single	53	43.4
Married	52	42.6
Divorced/widower	17	13.9
<b>Ethnicity</b>		
Caucasian	109	89.3
Afro-descendent	10	8.2
Oriental	3	2.5
<b>Schooling</b>		
Not given	1	0.8
Illiterate	1	0.8
Basic education	40	32.8
High school	51	41.8
College degree	29	23.8
<b>Age (years)</b>		
19-21	6	4.9
22-32	34	27.9
33-43	32	26.3
44-54	30	24.6
55-65	20	16.4
<b>Town</b>		
Maringá	60	49.2
Paçandu	7	5.7
Floraí	2	1.6
Iguaraçu	1	0.8
Sarandi	12	9.8
Itambé	3	2.5
Ivatuba	1	0.8
Mandaguaçu	4	3.3
Mandaguari	4	3.3
Colorado	2	1.6
Marialva	7	5.7
Itapetinga	1	0.8
Astorga	3	2.5
Apucarana	1	0.8
Atalaia	3	2.5
Cruzeiro do Oeste	1	0.8
California	2	1.6
Munhoz de Melo	1	0.8
Nova Esperança	3	2.5
Ourizona	1	0.8
Paranacity	1	0.8
Santo Inácio	1	0.8
São José dos Pinhais	1	0.8

The epidemiological profile of donors with positive serology was evaluated after confirmation (Table 4). The data relate to 122 donors, but there were 129 confirmed positive serology tests as more than one positive blood sample was submitted by some donors.

## Discussion

The Regional Blood center of Maringá is part of the state of Paraná's network of blood centers called HEMEPAR. It collects blood from the 30 towns of the 15<sup>th</sup> Regional Health Area. The serology laboratory tests approximately 12,000 donors per year: 8500 donors are seen in the Blood Center and 3500 donors are seen in the Blood Collection and Transfusion Service of Cianorte. On average, some 100,000 tests/year are carried out (70,000 at the Regional Blood Center of Maringá and 30,000 at the Cianorte unit).

As blood centers have, as a rule, great difficulties in maintaining an ideal blood stock for emergencies and blood specificities, they adopt strategies to recruit donors<sup>(9)</sup>. Consequently, it is very important to know the profile of people who donated blood but were considered inappropriate for donation so that blood donation safety is ensured. In fact, such knowledge is the basis to develop specific strategies to improve the technology in the selection of donors and to improve blood quality<sup>(10)</sup>.

It is mandatory that blood centers have pre-transfusion strategies for the proper conditioning of blood products to reduce health risks to both donors and recipients alike<sup>(7)</sup>.

According to ANVISA, the serological screening of potential blood donors is mandatory due to the great variety of transmittable pathogens<sup>(11)</sup>. The current study shows that 52.5% of discarded blood units during the serological screening process were positive for the Anti-HBc serological marker with 66.7% of these being confirmed. In fact, according to one study, a blood center in the state of Acre, Brazil also had a high prevalence for HBV. In this particular study, reactivity to anti-HBc reached 54.8% of discarded blood units which confirms the high prevalence of the virus in the population<sup>(12)</sup>. This fact has been corroborated by a similar study in the Blood Center of Campo Mourão, Paraná, Brazil in which the serological rate for HBV (anti-HBc) reached 71.3% of discarded blood units<sup>(13)</sup>.

Of the 129 confirmed serology tests, 4.7% were positive for HBsAg giving a prevalence of 0.07% in the population. This result fails to corroborate studies performed in the states of Rio Grande do Sul<sup>(14)</sup> and Maranhão, Brazil<sup>(15)</sup>, with prevalences of 0.18% and 0.24%, respectively.

The prevalence of syphilis at the Regional Blood center of Maringá was 0.35%, lower than the mean of 0.65% in Caxias do Sul, Rio Grande do Sul, Brazil<sup>(14)</sup>. Similar results were found in towns of the same state; Cruz Alta<sup>(16)</sup> and Santa Maria<sup>(17)</sup> with prevalences of 0.3% and 0.48%, respectively. The positivity rate for the pathology in Guarapuava, Paraná<sup>(18)</sup> according to the immune-enzyme test was 2.1%, thus a higher rate than that reported in the current study. Research in blood centers of other states also showed a high positivity rate for syphilis tests, such as those in the Brazilian states of Amazonas<sup>(19)</sup>, São Paulo<sup>(7)</sup> and Sergipe<sup>(20)</sup>.

The prevalence of anti-HCV was 0.04% in current study similar to that found by Perz<sup>(21)</sup> in the UK and Scandinavia (between 0.01% and 0.1%) and less than that reported in Rio de Janeiro (0.7%)<sup>(22)</sup>.

The risk of HIV transmission by transfusion in Brazil has decreased from 4.4% at the start of the epidemic to 2.7% in 1992 to 0.4% in 2007<sup>(23)</sup>. The positivity rate in the current analysis was 0.02% for the same year as that of the study at the Regional Blood Center of Pelotas, Rio Grande do Sul, Brazil (HEMOPEL) at 0.08% between 2004 and 2007<sup>(24)</sup>.

The prevalence for Chagas' disease among donors was relatively low (0.02%) when compared to the 0.31% reported by Moraes-Souza<sup>(25)</sup>. This rate was corroborated by investigators in other regions of Brazil that demonstrated significant progress in the control of Chagas' disease from transfusions over the last forty years. The prevalence of donors with Chagas' disease in the 1970s reached 11.08%; it decreased to 7.03% in the 1980s, to 0.73% in 2000 and to 0.17% in 2010<sup>(6)</sup>.

Serological screening for HTLV-I and -II at blood centers became mandatory only in 1993 due to great risks of transmission by blood transfusions<sup>(26)</sup>. No positivity occurred in the current study and it should be emphasized that infection by the virus is in sharp decline according to studies of blood donors in Uberaba, Minas Gerais which assessed the prevalence of HTLV-I and II between 1995 and 2008. The prevalence for 1995-2000 was 0.6%, whereas it declined to 0.1% during the 2002-2008 period<sup>(27)</sup>.

## Conclusions

In conclusion, the frequency of discarded blood units due to positive serology is important to transfusion services as it allows the profiling of donors and identifies the prevalence of infectious diseases in a particular region. This study demonstrates the need for strict quality control that is able to minimize costs and increase the quality of services provided.

## Acknowledgements

The authors would like to thank the University Hospital of Maringá, the Regional Blood center of Maringá, *Conselho Nacional de Desenvolvimento Científico e Tecnológico* and *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*.

## References

- Gomes FV, Eleutério Junior J. HTLV-II in blood donors at the Blood Center Net of Ceará - HEMOCE. *Rev Assoc Med Bras*. 2011;57(3):309-12.
- Almeida Neto C, Mendrone Júnior A, Salles NA, Chamone DA, Sabino EC. The role of the doctor in the reduction of residual risk of the virus transmission of human immunodeficiency (HIV) for blood transfusion and blood constituent. *Diagn Tratamento*. 2009;14(2):57-61.
- Brasil. Ministério da Saúde. Agência Nacional de Vigilância Sanitária. Resolução - RDC nº 12, de 2 de janeiro de 2001. Aprova o regulamento técnico sobre padrões microbiológicos para alimentos [Internet]. Brasília; ANVISA; 2001. [cited 2001 Mar 3]. Available from: [http://www.anvisa.gov.br/legis/decretos/3990\\_01.html](http://www.anvisa.gov.br/legis/decretos/3990_01.html)
- Carrazzone CF, Brito AM, Gomes YM. The importance of pre-transfusional serological screening in blood transfusion recipients. *Rev Bras Hematol Hemoter*. 2004;26(2):93-8.
- Caram C, Monteiro-de-Castro MS, Caiaffa WT, Oliveira CD, Proietti AB, Almeida MC, et al. [Spatial-temporal distribution of potential blood donors at the Hemominas Foundation, Belo Horizonte, Minas Gerais State, Brazil, in 1994 and 2004]. *Cad Saude Publica*. 2010;26(2):229-39.
- Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Coordenação-Geral de Sangue e Hemoderivados. Sangue e hemoderivados: produção hemoterápica [Internet]. 5th ed. Brasília; MS; 2011. [cited 2012 Mar 21]. Available from: [http://bvsms.saude.gov.br/bvs/publicacoes/caderno\\_informacao\\_sangue\\_hemoderivados\\_2011.pdf](http://bvsms.saude.gov.br/bvs/publicacoes/caderno_informacao_sangue_hemoderivados_2011.pdf)
- Salles NA, Sabino EC, Barreto CC, Barreto AM, Otani MM, Chamone DF. [The discarding of blood units and the prevalence of infectious diseases in donors at the Pro-Blood Foundation/Blood Center of São Paulo, São Paulo, Brazil]. *Rev Panam Salud Publica*. 2003;13(2-3):111-6. Portuguese.
- Valente VB, Covas DT, Passos AD. [Hepatitis B and C serologic markers in blood donors of the Ribeirão Preto Blood Center]. *Rev Soc Bras Med Trop*. 2005;38(6):488-92. Portuguese.
- Rodrigues RS, Reibnitz KS. [Strategies for attracting blood donors: an integrative literature review]. *Texto Contexto Enferm*. 2011;20(2):384-91. Portuguese.
- Rohr JI, Boff D, Lunkes DS. [Profile of ineligible candidates for blood donation in the hemotherapy service of Santo Ângelo Hospital, RS, Brazil]. *Rev Patol Trop*. 2012;41(1):27-35. Portuguese.
- Brasil. Ministério da Saúde. Agência Nacional de Vigilância Sanitária. Resolução - RDC Nº 57, de 16 de dezembro de 2010. Determina o regulamento sanitário para serviços que desenvolvem atividades relacionadas ao ciclo produtivo do sangue humano e componentes e procedimentos transfusionais [Internet]. Brasília: Ministério da Saúde; 2010 [cited 2012 Mar 13]. Available from: [http://bvsms.saude.gov.br/bvs/saudelegis/anvisa/2010/res0057\\_16\\_12\\_2010.html](http://bvsms.saude.gov.br/bvs/saudelegis/anvisa/2010/res0057_16_12_2010.html)
- Silva Rdo S, Ribeiro SA, Silveira RP, Freitas Mdos S. [Evaluation of the serologic pre-selection for the hepatitis B virus marker (total anti-HBc) in candidates to blood donation in the State of Acre, 2002]. *Rev Soc Bras Med Trop*. 2006;39(2):179-82. Portuguese.
- Ramos VF, Ferraz FN. Perfil epidemiológico dos doadores de sangue do hemonúcleo de Campo Mourão-PR no ano de 2008. *SaBios: Rev Saúde Biol*. 2010;5(2):14-21.
- Rodriguez MD, Lara GM, Lazzarotto AR, Michelim L, Fracasso J, Lovatel R, et al. The prevalence of serologic markers at the Caxias do Sul Blood Center. *Rev Panam Infectol*. 2008;10(3):32-5.
- Viana GM, Diniz Neto JA, Binda Júnior JR, Rabelo EM, Costa MH, Sousa JG, et al. Hepatitis B and C serological markers in blood donors from Maranhão State, Brazil. *Rev Panam Infectol*. 2009;11(1):20-4.
- Boff D, Lunkes DS, Kunzler A, Rohr JI. Prevalência de VDRL reagente em doadores do hemocentro regional de Cruz Alta- RS, Brasil no período de 2003 a 2009. *Rev Patol Trop*. 2011;40(2):179-84.
- Machado MM, Zuravski L. Soroprevalência em doadores de sangue do Hospital Universitário de Santa Maria/RS no ano de 2005. *NewsLab*. 2007;80:108-12.
- Oliveira VM, Verdasca IC, Monteiro MC. Detecção de sífilis por ensaios de ELISA e VDRL em doadores de sangue do Hemonúcleo de Guarapuava, Estado do Paraná. *Rev Soc Bras Med Trop*. 2008;41(4):428-30.
- Ferreira CM, Ferreira WA, Motta CL, Vasquez FG, Pinto AF. Reatividade do teste VDRL em bolsas de sangue da Fundação de Hematologia e Hemoterapia do Amazonas- HEMOAM, os custos decorrentes do descarte e estimativa de prevalência de sífilis em doadores de sangue do Estado do Amazonas. *DST - J Bras Doenças Sex Transm*. 2006;18(1):14-17.
- Santos EA, Marcellini PS, Ribeiro JP. Avaliação epidemiológica das rejeições dos doadores de sangue no HEMOLACEN/SE no período de 2004 a 2006. *Rev Bras Anal Clin*. 2008;40(4):251-6.
- Perz JF, Farrington LA, Pecoraro C, Hutin YJF, Armstrong GL. Estimated global prevalence of hepatitis C virus infection. In: 42nd Annual Meeting of the Infectious Diseases Society of America; 2004 Sept 30-Oct 3; Boston.

22. Barcelos MW, Araujo L, Paula VS, Villar LM. Prevalência de anticorpos contra o vírus da Hepatite C e da imunodeficiência humana no Norte do Estado do Rio de Janeiro. *NewsLab*. 2010;102:90-3.
23. Brasil. Ministério da Saúde. Boletim Epidemiológico AIDS e DST [Internet]. Brasília: MS; 2007. [cited 2012 Dec 21]. Available from: [http://bvsmms.saude.gov.br/bvs/periodicos/Boletim2007\\_internet090108.pdf](http://bvsmms.saude.gov.br/bvs/periodicos/Boletim2007_internet090108.pdf)
24. Araújo AB, Nachtigal GC, Cerqueira MS, Ferreira AP, Almeida SE, Silva CM. Blood donors HIV prevalence in southern of Rio Grande do Sul, Brazil. *Rev Panam Infectol*. 2011;13(1):19-22.
25. Moraes-Souza H, Martins PR, Pereira GA, Ferreira-Silva MM, Abud MB. Serological profile concerning Chagas' disease of blood donors at Uberaba Blood Center. *Rev Bras Hematol Hemoter*. 2006;28(2):110-14.
26. Brasil. Ministério da Saúde. Normas técnicas para coleta, processamento e transfusão de sangue, componentes e derivados. Brasília: Secretaria de Assistência à Saúde; 1994. 77 p.
27. Lima GM, Eustáquio JM, Martins RA, Josahkian JA, Pereira GA, Moraes-Souza H, et al. Declínio da prevalência do HTLV-1/2 em doadores de sangue do Hemocentro Regional da cidade de Uberaba, Estado de Minas Gerais, 1995 a 2008. *Rev Soc Bras Med Trop*. 2010;43(4):421-4.