
HEPATITIS C: GEOGRAPHICAL DIVERSITY AND TEMPORAL TRENDS OF SEROPOSITIVITY IN BRAZILIAN BLOOD DONORS FROM MINAS GERAIS STATE, BRAZIL

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ABSTRACT

Introduction: Hepatitis C virus (HCV) is transmissible through blood products and is a public health problem in Brazil. Monitoring blood donors may help to understand its trends in the general population. The evolution of HCV antibody prevalence in blood donors from Minas Gerais, south-eastern Brazil, and its distribution in first-time donors are shown. *Methodology:* From 1993 to 2007, 3,249,944 blood donors were screened for HCV-Ab with ELISAs. *Results:* Of the donors tested, 8,107 were reactive for HCV-Ab (0.25% CI=0.2441-0.2549). The total prevalence decreased from a maximum of 0.91% in 1993 to 0.098% in 2007. Among 1,283,970 first-time donors in the 2003 to 2007 period, there were 1,792 (0.51%) reactive for HCV-Ab. The cities of Sete Lagoas and Passos had the highest prevalence (0.76%), followed by Uberaba (0.62%) and Belo Horizonte (0.60%). Betim, Diamantina and Ituiutaba had the lowest rates (< 0.4%). *Discussion:* The decrease in the prevalence of HCV-Ab in blood donors may be due to improved tests, better donor selection and deferral of the repeat donors. The asymmetrical distribution may reflect different profiles of exposure to HCV and may help elicit public health measures that, in turn, will help foster a safer donor population.

KEY WORDS: HCV; prevalence; epidemiology; blood donors; Brazil.

RESUMO

Hepatite C: diversidade geográfica e tendências temporais da reatividade sorológica em doadores de sangue de Minas Gerais, Brasil.

Introdução: O vírus da hepatite C (HCV) é transmissível por meio de produtos sanguíneos e consiste em um problema de saúde pública no Brasil. O monitoramento de doadores pode contribuir para o entendimento da tendência desta infecção na população geral. Neste estudo, mostramos a evolução

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da prevalência de HCV em doadores de Minas Gerais, no sudoeste do Brasil e sua distribuição em doadores de primeira vez, que apresentam maior semelhança com a população. *Metodologia:* De 1993 a 2007, 3.249.944 doadores de sangue foram triados para HCV usando a metodologia de ELISA. *Resultados:* Dos doadores testados, 8.107 foram reativos para HCV (0,25% CI=0,2441-0,2549). A prevalência total caiu de um máximo de 0,91% em 1993 para 0,098% em 2007. Dentre os 1.283.970 doadores de primeira vez no período de 2003 a 2007 havia 1.792 (0,51%) indivíduos reativos para HCV. As cidades de Sete Lagoas e Passos tiveram a prevalência mais elevada (0,76%), seguidos por Uberaba (0,62%) e Belo Horizonte (0,60%). Betim, Diamantina e Ituiubá apresentaram as taxas mais baixas (< 0,4%). *Discussão:* Redução da prevalência de HCV em doadores é significativa para a segurança do estoque de sangue e pode ser devida à melhoria dos testes, à melhor seleção de doadores e a retirada do grupo de doadores daqueles de repetição que ainda não haviam sido testados. A distribuição assimétrica no estado pode refletir os diferentes perfis de exposição ao HCV e podem auxiliar na elaboração de medidas de saúde pública que poderão, por sua vez, contribuir para uma população de doadores mais saudável.

DESCRIPTORES: HCV; prevalência; epidemiologia; doadores de sangue; Brasil

INTRODUCTION

Although the accurate number of HCV seropositive individuals in various regions is difficult to calculate, the World Health Organization (WHO) reported in 1999 that 169.7 million people were HCV infected worldwide and that 13.1 million were in the Americas (WHO: Hepatitis C- Global Prevalence, 1999). The HCV prevalence in Brazil was 2.6% and the rates were variable according to geographical area, which was attributed to economic conditions and to local and individual risk factors. The prevalence was higher in Africa, the Eastern Mediterranean, south-western Asia and Occidental Pacific Region and lower in industrialized countries. A subsequent 2004 study found a 2.2% global HCV prevalence accounting for 130 million seropositive individuals worldwide (The Global Burden Of Hepatitis C Working Group, 2011).

Alter (2007) divided countries into high, average and low prevalence for HCV, according to the predominant type of exposure in these populations. The types of exposures considered were: illegal intravenous drug use, untested transfusion, therapeutic injections with reusable material, occupational exposure, perinatal transmission and risky sexual behaviors. The country with the highest prevalence was Egypt (18%), with most exposures coming through untested transfusions and therapeutic injections with reused material. In countries with lower prevalence exposure was predominantly through intravenous drug use and untested transfusions. Countries with moderate prevalence had an intermediate pattern. In Egypt, the high number of cases was attributed to *S. mansoni* treatment with intravenous medication during the 1950s and 1960s. At that time, the dangers of exposure to human blood were unknown and disposable needles and syringes were not available, leading to an expansion of HCV infection in that country (Strickland, 2006).

Studies on HCV prevalence in Brazilian blood donors showed variable prevalences from 0.45% in Cascavel City, Paraná State (Carvalho & Dias, 1995), 2.89% in Rio de Janeiro (Patino-Sarcineli et al., 1994), to 5.9% prevalence in the Amazon region (Da Fonseca & Brasil, 2004). Catalan-Soares and co-workers found that the city of Manhuaçu in Minas Gerais State (Andrade et al., 2006) had HCV prevalence in blood donors of 0.57%.

Although blood donors are not representative of the general population, they serve as a surrogate population to point to the trends of an infection or health condition. This is especially true for first-time blood donors, which invariably have test markers for infectious diseases higher than repeat donors. On the other hand, it is important to know the geographic distribution of infected people to allocate resources for health care and education and therefore studies of prevalence are important in public health.

The aim of this study was to estimate the evolution of prevalence of anti-HCV (HCV-Ab) and its associated demographic variables in blood donors at the Hemominas Foundation, from 1993 to 2007, and to estimate HCV-Ab prevalence and geographic distribution in first-time donors from 2003 to 2007.

METHODS

During the time of the study, the Hemominas Foundation had 18 blood collecting sites, collected an average of 250,000 whole blood units/year and was responsible for covering 92% of Minas Gerais' transfusion needs. Since 1993 the Hemominas Foundation has tested blood donor candidates for hepatitis C by an ELISA method. The supplier of the tests varied during the period, according to the company that won the bidding. The test used over the past 5 years is from Ortho® (USA).

If reactive, the test is repeated for the same sample, and if it again shows reactivity, the blood donor is invited by letter to draw a second sample. This new sample is retested and, if reactivity is confirmed, the donor is counseled and referred to a public treatment center for further testing and follow-up.

Data from blood donors from the Hemominas Foundation units all over the State are compiled and published monthly in a statistical bulletin.

The analyzed demographic variables were sex, age, skin color (as surrogate for race), and city of residence. The variable color until the year of 2007 was defined by the clerk attending the registration, as white, black, and mixed. After 2007, the skin color was self-declared.

The absolute numbers of reactive cases from the 18 units in the period from 1993 to 2007 were used for geographic distribution evaluation. This distribution was assessed by the TABWIN 32® version 3.5 software. The odds ratio (OR) and 95% confidence interval (CI) were used to evaluate variable associations with HCV infection. Statistical calculations were made with the software EPIINFO® version 6.2.

The studied population consisted of blood donors from 18 regional centers of the Hemominas Foundation in the State of Minas Gerais. For total prevalence and seropositive profile the data used were collected from 1993 to 2007. For first-time donor prevalence the data used was collected from 2003 to 2007. Donations were considered first donations if blood donors so informed, and if no previous registration in the database of the Hemominas Foundation had been identified. Prevalence in first time donors was defined as the number of seroreactive donations occurring in first-time donors for every 100,000 first-time donors. The difference in prevalence between two localities was considered significant if the 95% CI did not overlap.

The 18 units of the Hemominas Foundation are identified as: BET- Betim; DIA-Diamantina; DIV- Divinópolis; GOV- Governador Valadares; HBH- Hemocentro Belo Horizonte; HJK- Hospital Júlia Kubitschek; ITU- Ituiutaba; JFO- Juiz De Fora; MCU- Manhuaçu; MOC- Montes Claros; PAL- Pouso Alegre; PAS- Passos; PMI- Patos de Minas; PNO- Ponte Nova; SJR- São João del Rei; SLA- Sete Lagoas; UDI- Uberlândia; URA- Uberaba.

RESULTS

Between 1993 and 2007, 3,249,944 blood donors considered acceptable in the donor selection examination were screened for anti-HCV (HCV-Ab) using ELISAs. Of these, 8,107 tests were reactive for HCV-Ab (0.25% CI=0.2441-0.2549).

The total prevalence of HCV-Ab in this population has declined from 0.91% in 1993 to 0.098% in 2007 as seen in Figure 1. The decline was steady, except for a considerable peak in 1999, followed by a smaller one in 2001.

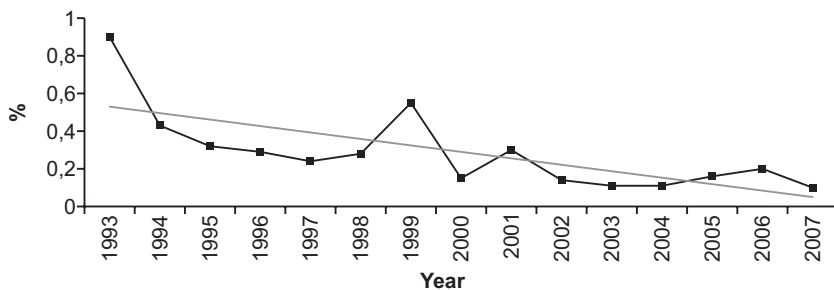


Figure 1. Trends of HCV screening test (ELISA) reactivity in blood donors, Minas Gerais, Brazil.

HCV-Ab seroreactive donors were predominantly males (74.26%), with age ranging from 18 to 29 years (49.47%) and of mixed skin color (52.18%), as shown in Table 1.

Table 1. Demographic variables in blood donors found to be reactive in the HCV screening test (ELISA), Minas Gerais, Brazil.

Variables	HCV reactive	
	N	(%)
Age range (years)	18-29	4001 (49.47)
	30-39	2317 (28.62)
	40-49	1323 (16.34)
	50-65	446 (5.51)
Gender	Male	6014 (74.26)
	Female	2084 (25.74)
Skin colour	White	3101 (38.29)
	Mixed	4221 (52.18)
	Black	504 (6.22)

Missing data on age in 11 donors. Missing data on skin color in 272 donors.
Source: Statistical Bulletin, Hemominas Foundation, 1993-2007.

In the 2003-2007 period, 1,283,970 donors were considered acceptable and donated blood in 18 centers of the Hemominas Foundation throughout Minas Gerais State (Figure 2). 347,451 (27.06%) were first-time donors and among them 1,792 (0.51%) were seroreactive for HCV-Ab.

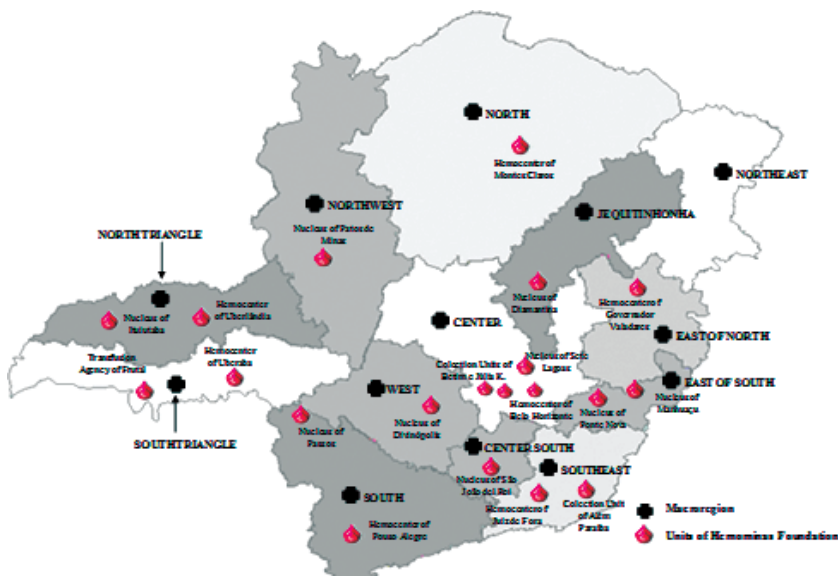


Figure 2. Minas Gerais State with the geographical macroregions and the distribution of the centers of the Hemominas Foundation.

Between 2003 and 2007, only three repeat donors were reactive for HCV-Ab, out of 936,519 donations.

The serological reactivity for HCV-Ab in first-time donors varied in the 18 different centers, as seen in Table 2. The regional centers with the highest HCV-Ab prevalence were Sete Lagoas and Passos (0.76%), followed by Uberaba (0.62%) and Belo Horizonte (0.60%). Betim, Diamantina and Ituiutaba had lower prevalences (< 0.4%), as seen in Figure 3.

Table 2. First-time donor reactivity on the HCV screening test (ELISA) at the Hemominas Foundation, Minas Gerais, Brazil.

Unit	Year					
	2003	2004	2005	2006	2007	2003-2007
Betim	0.18%	0.26%	0.67%	0.41%	0.19%	0.33%
Diamantina	0.37%	0.37%	0.39%	0.34%	0.20%	0.33%
Divinópolis	0.44%	0.27%	0.69%	1.02%	0.33%	0.55%
Gov. Valadares	0.43%	0.49%	0.46%	0.63%	0.37%	0.48%
HBH	0.44%	0.43%	0.82%	0.93%	0.42%	0.60%
Hospital JK	0.11%	0.28%	0.52%	0.45%	0.21%	0.31%
Ituiutaba	0.61%	NA	NA	0.81%	0.37%	0.34%
Juiz de Fora	0.39%	0.49%	0.57%	0.99%	0.35%	0.55%
Manhuaçu	0.41%	0.59%	0.41%	0.44%	0.21%	0.42%
Montes Claros	0.26%	0.24%	0.70%	0.62%	0.24%	0.40%
Pouso Alegre	0.58%	0.58%	0.53%	0.52%	0.50%	0.54%
Passos	0.61%	0.64%	0.78%	1.09%	0.69%	0.76%
Patos de Minas	0.39%	0.24%	0.40%	0.79%	0.40%	0.45%
Ponte Nova	0.29%	0.42%	0.45%	0.62%	0.28%	0.40%
São João Del Rei	0.12%	0.46%	0.35%	0.89%	0.29%	0.41%
Sete Lagoas	0.64%	0.74%	0.87%	1.08%	0.48%	0.76%
Uberlândia	0.54%	0.42%	0.56%	0.58%	0.42%	0.50%
Uberaba	0.38%	0.66%	1.12%	0.50%	0.42%	0.62%
Total	0.39%	0.42%	0.64%	0.75%	0.36%	0.51%

NA= not available. Source: Statistical Bulletin, Hemominas Foundation, 2003-2007.

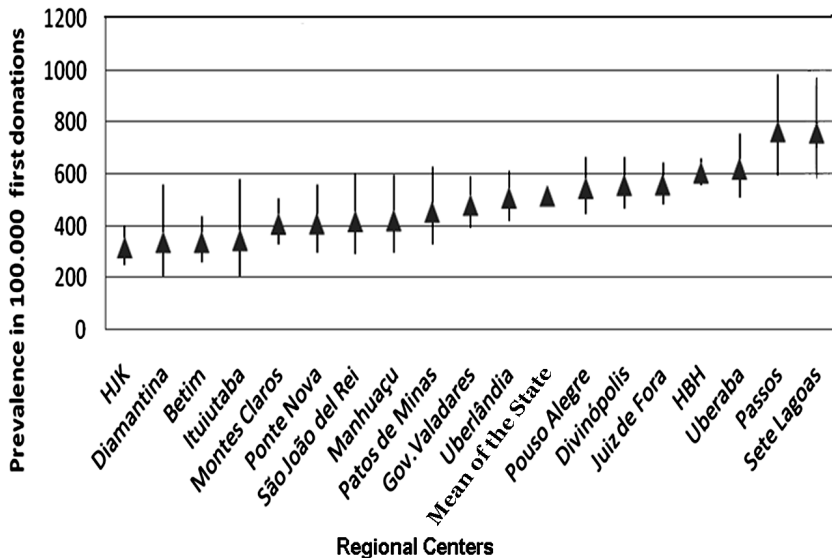


Figure 3. HCV seroprevalence in 100,000 first donations in 18 regional centers of the Hemominas Foundation, Minas Gerais, Brazil, 2003 - 2007.

DISCUSSION

A considerable decline in the reactivity of the HCV-Ab screening test in blood donors in the Hemominas Foundation between 1993 and 2007 was observed. The mean HCV-Ab reactivity in this period (0.25% CI=0.2441-0.2549) was also significantly lower than those found in Rio de Janeiro (1988 to 2005 - 0.9%) (Andrade et al., 2006), in Santa Catarina (0.34%) (Rosini et al., 2003), in Manhuaçu by Catalan-Soares and co-workers in 1997 (0.57% CI=0.3695-0.895) and in blood donors in the Amazon region of Brazil (0.79% in 1999), whereas the mean for the country was 0.88% (Bensabath et al, 2003). In a blood center in Paraná lower percentages were found in the period of 2004 to 2007 (0.06-0.31%) (Silva, 2007).

Among the possible explanations for the decline in the HCV-Ab reactivity among blood donors could be its reduction in the general population, the exclusion of the pool of positive donor candidates at the beginning of testing, improvement of ELISA tests with reduction of false positives, and an increase in the number of repeat donors.

The decline of prevalence in the general population may result from mandatory blood testing in Brazilian blood banks since 1993, which certainly led to a reduction of transfusions related to HCV infections. Substitution of reusable syringes for disposable ones also may have played an important role.

The sanitary control of beauty parlors in some cities could also have played a role in the reduction of HCV-Ab reactivity in the State. International studies show the importance of cosmetic procedures in transmission. A 2004 Italian study showed that 11.5% of all acute HCV cases were due to cosmetic procedures (tattooing, piercing, manicure, pedicure and hairdressing) (Mariano et al., 2004). A study in Pakistan, where the prevalence of HCV-Ab was 6% and the use of barber shops is common practice, attributed HCV transmission to the employment of reusable razors in barber shops. In this study, the risk factors associated with HCV were: unsafe injections used inside and outside a hospital setting, untested transfusions and the use of public barbers (Raja & Janjua, 2008). In Brazil, where the use of manicures and pedicures is a common practice a study showed that, from a sample of 100 manicurists in the city of São Paulo, 8% were Hepatitis B (HBV) positive and 2% were HCV positive. This study showed that manicurists were unfamiliar with hepatitis transmission routes and adherence to biosafety norms was low and inadequate (Oliveira & Focaccia, 2009).

In the United States the annual number of new cases of HCV infection has dropped from 180,000 cases in 1980 to 8,000 in 1995, probably due to the exclusion of positive individuals from the pool of donors in the screening process. In Brazil the reduction of cases among intravenous drug users may also have taken place, due to “damage reducing” programs.

As in 1996 the majority of HCV infected people were aged between 30 and 49 years, the number of deaths from liver cancer is expected to rise in the next 20 to 30 years when this group will have reached an age when liver complications generally occur (National Toxicology Program, 2004), and decline thereafter.

Considering first donations, the prevalence found in Minas Gerais between 2003 and 2007 (0.5158% CI 0.4925 - 0.5401) was significantly higher than the prevalence described by Zou and co-workers (2004) in American blood donors (0.3044% CI 0.2961-0.313), but similar to that found in blood donors by the Retrovirus Epidemiology Donor Study (REDS) between 1992 and 1996, in which, a decline prevalence among first time donors, from 0.63% in 1992 to 0.40% in 1996, was observed (Glynn et al., 2000). A remarkable difference was found in the multicentric REDS study in Brazil, where the prevalence of HCV-AbAg in first time donors in three blood centers (São Paulo, Recife and Belo Horizonte) was 190/10⁵ donors and dropped to 2.2/10⁵ in repeat donors. (Sabino EC, personal communication).

We found that there is a significant difference between the cities with higher prevalence (Sete Lagoas and Passos, prevalence of 0.76%) and those with lower prevalence (Betim, Diamantina, Ituiutaba and HJK, prevalence under 0.4%). The asymmetrical distribution may reflect different HCV exposure profiles and may help guide public health measures that, in turn, will help foster a safer donor population. Since 2011 Hemominas is utilizing combined AbAg ELISA tests, with very good results.

In conclusion, the progressive decrease observed in the prevalence of HCV in blood donors may be a result of improved screening tests, better donor selection, eliminating conditions and behaviors that place the blood supply at risk, and deferral of HCV reactive individuals who were repeat donors.

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