

Seroprevalence of Transfusion Transmitted Infections among Blood Donors in Burundi

Epipode Ntawuyamara and Cai Daxing*

Department of Dermatology, Qilu Hospital, Shandong University, Jinan, China

*Corresponding Author: Cai Daxing, Department of Dermatology, Qilu Hospital, Shandong University, Jinan, China.

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Abstract

Background: Burundi is an east African country with about 12 million inhabitants. Prevalence of transfusion transmitted infections among blood donors is not known in this country.

Objective: The aim of this study is to determine the seroprevalence of four Transfusion Transmitted Infections namely Human Immunodeficiency Virus, Hepatitis B Virus, Hepatitis C Virus, and syphilis, among blood donors in Burundi.

Methods: We conducted a cross-sectional study of consecutive blood donors 'records covering the period between July 2019 and June 2020 in Burundi. We determined among blood donors of Burundi, the seroprevalence of human immunodeficiency virus, hepatitis C virus, hepatitis B surface antigen and syphilis by type of blood donors. Data used in this study were collected from National Blood Transfusion Center database. It was entered and analysed using Microsoft excel 2013 and R software.

Results: In this study 90852 blood samples were screened for four transfusion transmitted infections. Of all blood donors 59126 (65.08%) were males and 31726 (34.92%) were females. On screening, 5395 blood samples (5.94%) were seropositive for at least one transfusion transmitted infection. This seroprevalence was higher in first time blood donors (8.27%) than in repeat time blood donors (5.10%). The seroprevalence rate of human immunodeficiency virus, hepatitis C virus, hepatitis B virus and syphilis among blood donors was 0.72%, 1.68%, 2.82% and 0.72% respectively.

Conclusion: The found seroprevalence of transfusion-transmitted infections in this study call for mandatory and continuous screening of human immunodeficiency virus, hepatitis C virus, hepatitis B virus and syphilis among blood donors in Burundi to ensure the safety and quality of blood transfusion.

Keywords: *Transfusion Transmitted Infections; Seroprevalence; Blood Donors; Burundi*

Abbreviations

+:Positive; CNTS: National Center of Blood Transfusion; HBV: Hepatitis B Virus HCV: Hepatitis C Virus; HIV: Human Immunodeficiency Virus; N: Number of blood donors; P: Percentage; T: Total; TTIs: Transfusion Transmitted Infections; WHO: World Health Organization

Introduction

Transfusion-transmitted infections (TTIs) are infections resulting from the introduction of a pathogen into a person through blood transfusion. Infectious agents involved are very diverse and include hepatitis B (HBV), hepatitis C (HCV), human immunodeficiency (HIV-1/2), human T-cell lymphotropic (HTLV-I/II), Cytomegalo- (CMV), Parvo- B19, West Nile (WNV) and Dengue viruses. Trypanosomiasis, malaria, and Transmissible Spongiform Encephalopathy (TSE) also belong to TTIs [1].

Blood transfusion is a life-saving intervention and millions of lives are saved each year globally through this procedure [2]. About 118.4 million blood donations are collected worldwide. 40% of these are collected in high-income countries, home to 16% of the world's population [1].

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However, transfusion carries the risk of adverse events including errors, transfusion reactions and transmission of infections [3]. WHO recommends that all blood donations should be screened for infections prior to use. Screening for HIV, hepatitis B, hepatitis C, and syphilis should be mandatory [1].

HIV continues to be a major global public health issue. WHO estimates that in 2020, 680 000 [480 000 - 1.0 million] people died from HIV-related causes globally. There were approximately 37.7 million people living with HIV at the end of 2020 with 1.5 million people becoming newly infected with HIV in 2020 globally. The WHO African region is the most affected region, with 25.4 million people living with HIV and the prevalence 3.6% in 2020 [4]. Also, the African region accounts for almost 60% of the global new HIV infections [5]. HIV infection in Burundi takes the form of a generalized epidemic with a prevalence rate of 0.7 percent in general population [6].

HBV is one of the most common infectious diseases of the world [7]. In 2019, WHO estimates 296 million [228 - 423 million] people living with chronic hepatitis B virus infection with the prevalence of 3.8% [3.0 - 5.5%] in the general population globally. In African Region, prevalence of hepatitis B infection among the general population in 2019 was 7.5% [4,8]. In Burundi, the national Hepatitis B surface antigen prevalence in 2013 was 4.6% [9] and the prevalence of HBV among blood donors of CNTS was 1.04% in 2018 [10].

Hepatitis C is a global health problem. In 2019, WHO estimates 290,000 [230,000 - 580,000] people dying from hepatitis C-related with the prevalence of 0.8% [0.6 - 1.0%] in the general population. Prevalence of hepatitis C infection among the general population in African Region was 0.8% [4]. In Burundi, the global prevalence of HVC antibodies in 2014 was 8,2% [11] and 1.12% among blood donors at CNTS in 2018 [10].

Syphilis is a major public health problem worldwide. In 2016, syphilis global prevalence was 0.5% with the incidence of 6.3 million syphilis cases. In Africa region, this prevalence was 1.6% [12]. We didn't find any publication about the prevalence of syphilis in general population or among blood donors in Burundi.

In Burundi, blood safety is one of the concerns of the Ministry of Public Health and Fight against AIDS under the direct coordination of National Transfusion Blood Center. To this end, all donor blood bags must be screened for HIV, hepatitis B and C, and Syphilis. As we know, only one study has been published on TTIs among blood donors in Burundi [10].

Aim of the Study

The aim of this study is to determine the prevalence of four TTIs namely HIV, HBV, HCV, and syphilis, among blood donors in Burundi. This will permit an assessment of the occurrence of infections in the blood donors' population and consequently the safety of the collected donations. It will also give an idea of the prevalence of the TTIs among blood donors which allows for assessment of epidemiology of these infections in the community. All that will help the policy makers in public health to know which TTI has high prevalence for effective action.

Materials and Methods

Study design and duration

We conducted a national based retrospective and descriptive study. The study was conducted on a period of twelve months from July 2019 to June 2020.

Data sources

Data used in this study were collected from National Blood Transfusion Center (CNTS) database. The information collected concerned sociodemographic characteristics of blood donors and serological results from blood samples. This national center compiles its blood donors' data as well as those of seven other centers across the country. CNTS has in charge control and coordination of all activities related to blood transfusion in Burundi.

Blood collection

A total of 90852 units of blood donation were collected from donors in Burundi from July 2019 to June 2020. Blood collection was performed in two centers located in the main city of Burundi (Bujumbura) and six centers located upcountry. Before blood collection, donors were selected by taking history, clinical examination and following strict donor's selection criteria. Every blood donor had a file which was

completed for screening and on which decision of acceptance or refusal of donor was taken. All blood units collected during the period of study were included in this study and no one was excluded from the report.

Laboratory test

Blood sample was collected and tested in each blood collection center. Every sample was tested for HIV, Hepatitis B and C and syphilis using ARCHITECT i2000SR immunoassay analyzer with following reagents:

- Genscreen ULTRA HIV Ag-Ab (Bio-Rad, France), screening kit for the detection of HIV P24 antigen and antibodies to HIV -1 and HIV-2 in human serum/plasma by enzyme immunoassay.
- Monolisa HBs Ag ULTRA (Bio-Rad, France) for the detection of the surface antigen of the Hepatitis B virus (HBs Ag) in human serum or plasma.
- INNOTEST HCV Ab IV (Fujirebio Europe N.V, Technologiepark 6, Belgium) for the qualitative detection of antibodies to HCV in human serum or plasma.
- Rapid Plasma Reagin-Carbon (RPR-Carbon, Cypress Diagnostics, Langdorp, Belgium) for the detection of syphilis.

Once a sample is reactive it’s labelled seropositive and respective blood unit was discarded.

Statistical analyses

Data analysis was done in two different steps. In the first step, a descriptive analysis was done and results were presented in tables. We analysed sociodemographics characteristics of blood donors. We also calculated prevalence of TTIs among blood donors by types of donors. Prevalence for each TTI was defined as the proportion of blood donations confirmed as seropositive from a total number of blood donations. In the second step we compared prevalence of TTI according to the types of blood donors. The difference was statistically significant for p-value under 0.05. For both data analysis and data processing, the R software and Microsoft were used.

Ethical approval and consent to participate

Authorization to carry out this study was obtained from the high authority of CNTS with certificate N°634/1195/CNTS/2020. The study protocol was approved by Kamenge Teaching Hospital affiliated to University of Burundi ethical Committee and further received certificate referenced FM/CE/01/08/2021. Because of the retrospective nature of the study, informed consent was not obtained from blood donors but data collected did not contain any personal identifiable information.

Results

Demographic characteristics of blood donors

We analyzed data from 90852 blood samples of blood units collected from July 2019 to June 2020 nationwide. Of these, 65.085% of donors were males and 34.92% were females. The proportion of voluntary blood donors was 90844 (99.99%) and very few 8 (0.01%) were from family replacement donors. There were 240086 first-time donors (26.51%) and 66766 repeat donors (73.49%). A great number of blood donors (55.87%) were between 18-24 years old (Table 1).

Variable	Number of blood donors	Frequency
Total	90852	100
Gender		
Male	59126	65.08
Female	31726	34.92
Types of donors		
First-time donors	24086	26.51
Repeat donors	66766	73.49
Status of donors		
Volunteer	90844	99.99
Family replacment	8	0.01
Age groups		
Under 18 years	4419	4.86
18 - 24 years	50759	55.87
25 - 44 years	31664	34.85
45 - 64 years	4004	4.41
64 years over	6	0.01

Table 1: Sociodemographic characteristics of blood donors in Burundi.

Prevalence of transfusion-transmissible infections (TTIs)

On screening, of 90852 blood samples, 5395 (5.94%) were seropositive for at least one transfusion transmitted infection. 1991 (8.27%) were from first-time blood donors and 3404 (5.10%) from repeat time blood donors blood units. 2561 (2.82%) were found seropositive for HCV, 1526 (1.68%) for HBV, 656 (0.72%) for HIV and 652 samples (0.72%) were positive for syphilis (Table 2).

	N	HIV+	Syphilis+	HBV+	HCV+	T+	P+	P Value
First time donors	24086	272 (1.13%)	21 (0.88%)	603 (2.50%)	903 (3.75%)	1991	8.27	< 0.001
Repeat donors	66766	384 (0.57%)	439 (0.66%)	923 (1.38%)	1658 (2.48%)	3404	5.10	
Total	90852	656 (0.72%)	652 (0.72%)	1526 (1.68%)	2561 (2.82%)	5395	5.94	

Table 2: Prevalence of TTIs among blood donors by types of donors.

Discussion

In our study, blood donors were males at 65.08% and females for the remaining percentage (34.92%). The male predominance in blood donation in this study may be explained by the fact that there is a general belief that men are healthier than women, and thus are more suitable for blood donation [12,17]. It can be also explained in part by some physiological status of women like menstruation, pregnancy and breast feeding, which prohibited the females from the blood donation temporarily [14]. Moreover, women have lower haemoglobin levels and a higher number of vasovagal reactions. This may cause a high rate of refusal for women donors [15]. This participation of women is high in Burundi when compared to that of Y. Mohammed., *et al.* 2% [2], M.B. Nagalo., *et al.* 24.38% [16], D. M. Doungous., *et al.* 3.9% [17], Abebe., *et al.* 29.9% [18]. This might due to the high inclusion of women in all national activities in Burundi (30% in the government) what encourage them to participate massively even in blood donation.

The group age of 18 - 24 years is constitute the first represented group at 55,87% followed by 24 - 44 years (34.85%). This is in accordance with the figures published by the World Health Organization (WHO) which reported that 45% of donors were aged 25 or less [19].

In this study, 99.9% of donors were voluntary, unpaid donors. We didn't find paid donors. According to WHO, there are 3 types of blood donors: voluntary unpaid, family/replacement and paid. An adequate and reliable supply of safe blood can be assured by a stable base of regular, voluntary, unpaid blood donors. These donors are also the safest group of donors as the prevalence of blood borne infections is lowest among this group. Data reported to WHO show significant increases of voluntary unpaid blood donations in low- and middle-income countries [1].

This study showed that 5.94% of blood donors were seropositive for at least one of the screened transfusion-transmitted infection. Our finding was lower when compared to study done by Manzoor., *et al.* 9.9% [20], Tessema., *et al.* 9.5% [21], Baye., *et al.* 6.2% [22], Waheed., *et al.* 14.34% [23], A. Dessie., *et al.* in Northwest Ethiopia 43.2% [24], Nwankwo., *et al.* in Nigeria (19.3%) [25]. The reason for the lower rate of prevalence of TTI in our study compared with other studies may be due to the efficacy of the screening technique used before blood taking and also may be because of existence of different magnitude of risk factor for contracting transfusion transmitted infection.

The prevalence of TTIs was higher than the findings from N. Fessehayee., *et al.* 3.8% [26], TTI in Brunei Darussalam., *et al.* 1.49% [19], Yemen by Saghir., *et al.* 2.35% [27], among blood donors in Kassala, eastern Sudan by Abdallah and Ali 3% [28]. The higher prevalence in our case may be due to the difference in the health care system in different study setting.

Moreover, the prevalence of TTIs is high in first time donors compared to repeat donors (p value < 0.001). This is because many of the voluntary first time donors don't known their serological status. They prefer to donate blood as a free opportunity to know their serology for TTIs, blood group and rhesus.

In our study the overall prevalence of HIV among blood donors is 0.72% which is similar to HIV prevalence in Burundi [6]. This prevalence is higher than those found by S. Attaullah., *et al.* [29] in Pakistan in 2012 (0,06%) and T. Chandra., *et al.* [7] in India in 2009 (0.23%).

This is because even the prevalence of HIV in these countries is lower than in Burundi [21,22]. According to 2020 Spectrum modeling, Burundi's HIV prevalence is 0.7 percent. Among adults over age 15, prevalence is 1.3 percent. Prevalence varies according to age group. The most affected age group is 40 - 49 years old among both males and females (3.0 percent). Comparatively, prevalence for those 30-39 years is 1.4 percent, and for those 20 - 29 years is 0.5 percent. Overall, there is a trend toward urbanization (2.2 percent in Bujumbura Mairie versus 0.8 percent in Bujumbura Rural) and feminization of the epidemic (1.1 percent in women versus 0.8 percent in men) among those in the age range 15 - 49 years [6]. No published article on prevalence of HIV among blood donors in Burundi found.

In this study, the prevalence of HBV among blood donors is 1.68%. This prevalence is close to that found by A.M. René Kwizera, *et al.* 1.04% [10] in 2018 and A. Arshad, *et al.* 1.84% [31]. R. Ntagirabiri, *et al.* in their study estimated the prevalence of HBsAg in general population at 4.6% in Burundi [9]. Even if blood donors do not constitute a sufficient representative population for estimation of the prevalence of HBV in general population, this study shows that there is good progress in fighting against HBV. This is also a good prediction of the importance of blood donors selection before blood collection.

The present study shows that the prevalence of HCV among blood donors in Burundi is 2.82%. This prevalence is different to that found by A.M. René Kwizera, *et al.* in 2018 who said that HCV prevalence among blood donors at CNTS was 1.12% [10]. This is due to the fact that our study was nationwide where some studies are in accordance that the prevalence of HCV in Burundi is one of the highest rates in Africa. Anti-HCV antibodies is estimated to 8,2% in 2018 [11].

The prevalence of syphilis among blood donors in our study is 0.72%. No any study have been done to evaluate the prevalence of syphilis among neither blood donors nor general population in Burundi. The prevalence we found is lower than 0.9% by D. Od., *et al.* in Nigeria [32], 3.96% in Burkina Faso [16], 4.7% in Tanzania [33], 3.7% and 1.4% in neighbouring country of Democratic Republic of Congo [34,35]. It is also lower than the prevalence of syphilis of 1.6% in general population in Africa WHO region [12]. All that show the progress of Burundi in fighting sexually transmitted infection.

Conclusion

Blood safety must be guaranteed for patients in need of transfusion. Even if in this study, prevalence of TTIs among blood donors in Burundi (5,94%) is not alarming compared to other countries, strict selection of blood donors using comprehensive screening is highly advisable and recommended to ensure safety of blood to recipients and the community. A high participation of voluntary and female blood donors must be maintained. Our study showed the high prevalence of HCV among blood donors. The government must increase effort to prevent its transmission. There is lack of studies published on infectious diseases in general, transfusion transmitted infections in particular. We suggests further studies to identify key risk factors for blood-borne infections in Burundi.

Competing Interests

The authors declare that they have no competing interests.

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