

Research Article

A Study Of Infectious Markers Of Human Immunodeficiency Virus, Hepatitis B Virus, Hepatitis C Virus And Treponema Pallidum In Blood Donations At The Blood Bank Of The Banfora Regional University Teaching Hospital (Burkina Faso).

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Abstract

Introduction: Regular and ongoing screening of blood donors for transfusion-transmissible infectious agents is essential to ensure transfusion safety. The objective was to study the infectious markers sought in blood donations at the Banfora Regional Teaching Hospital Blood Bank.

Patients and methods: This was a cross-sectional descriptive study on the search for infectious markers such as Agp24/anti-HIV1/2 Ab, HBsAg, anti-HCV Ab and anti-Treponema pallidum Ab in the serum of donors at the blood bank of the Banfora Regional Teaching Hospital from January 1, 2021 to December 31, 2023. The donors' blood samples were analyzed using Rapid Diagnostic Tests (RDT) according to the national screening algorithm in force for the search for the four infectious markers during the study period.

Results: A total of 10,443 blood donations were recorded and analyzed for markers. All donors (100%) were volunteers, mostly young (94.27%). Males were the majority, with 73.58%. The overall seroprevalence of infectious markers was 14.80%. The average specific seroprevalence over three years was 1.65% (Ag p24/anti-HIV Ab); 8.70% (HBsAg); 2.14% (anti-HCV Ab); and 2.31% (anti-T. pallidum Ab). The prevalence of HBsAg and anti-T. pallidum Ab coinfection was 0.33%.

Conclusion: Serosurveillance of infections transmitted by blood transfusion in donors must be strengthened and the national transfusion policy must focus on voluntary and regular blood donation and the use of automated and efficient tests.

Keywords : blood donation, infectious markers.

INTRODUCTIONS

Blood transfusion therapy is an essential component of modern medical practice. According to the World Health Organization (WHO), 112.5 million units of blood are collected worldwide each year, with nearly 50% of these donations collected in low- and middle-income countries [1]. For centuries, it has been known that blood transfusions can have serious, even fatal, consequences if not performed according to established standards. The WHO and the United

Nations AIDS Control Organization (UNAIDS) estimate that 8 to 16 million hepatitis B virus (HBV) infections and 2 to 4.7 million cases of hepatitis C virus (HCV) infections are due to transfusions of risky products each year. Thus, WHO has adopted a number of resolutions urging Member States to organize their blood transfusion services in such a way as to minimize the occurrence of these adverse effects while ensuring an adequate and safe blood supply for their populations [2].

These measures include the search for transfusion-

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transmissible infectious agents (TTIs) by appropriate means. The main infectious agents that can be transmitted during transfusion are HIV, HBV and HCV, as well as *Treponema pallidum pallidum* [3]. The WHO recommendation is therefore to carry out mandatory screening of all blood donations using appropriate techniques for these pathogens [4]. Despite considerable progress in reducing the residual risks of blood transfusion, studies have described multifactorial difficulties that compromise transfusion safety in sub-Saharan African countries [4,5]. These factors include the low percentage of voluntary donors, who constitute the safest category for safe blood donation, and the high prevalence in the general population of various infections, some of which are TTIs [6]. The prevalence of TTIs is lower in high-income countries than in low- and middle-income countries. In 2023, it ranged from less than 0.001% to 0.01% in high-income countries, 0.03% to 0.62%, and 0.28% to 1.60% in middle- and low-income countries, respectively [7,8]. The highest prevalences in the world (TTIs) are recorded in the African continent, ranging from 4 to 25% for HBV, from 0.5 to 8% for HCV and from 1 to 20% for HIV [2].

In Burkina Faso, with respective national prevalences of 9.1%, 3.6% and 0.8% for HBV, HCV and HIV (2015) and 1.7% for Syphilis in 2020, these infections remain major public health problems [9,10]. The National Blood Transfusion Center (CNTS) has implemented effective blood transfusion safety since 2000, which is based on systematic screening for major pathogens such as HIV, HBV, HCV and *Treponema pallidum* on all donations using enzyme-linked immunosorbent assay (EIA) and/or chemiluminescent immunoassay (CLIA) [11,12]. Two previous studies conducted in blood banks in Burkina Faso have highlighted a residual risk of approximately 0.3%, 0.5% and 0.07% respectively for HBV, HCV and HIV. This risk is more significant when using RDTs for screening donations [12,13]. With more than 4000 blood bags collected in 2022, the blood bank of the Banfora Regional Teaching Hospital (RTH) is one of the blood banks that carries out large blood collections [11]. However, screening of donations is carried out using RDTs which are not recognized as a confirmatory test. This is how the present study was initiated, the main objective of which is to study the prevalence of infectious markers sought in donations to the blood bank of the Banfora RTH. This was done with the aim of proposing measures to improve donation screening techniques and minimize the risks of infections linked to blood transfusions.

MATERIALS AND METHODS

Study Setting

The study was conducted at the Banfora Regional Teaching Hospital (RTH) located in the Cascades region, specifically at the blood bank.

Type and Period of Study

This was a cross-sectional study with retrospective data collection that focused on blood donations from January 2021 to December 2023.

Study Population

This population consisted of blood donors registered at the Banfora RTH blood bank from January 2021 to December 2023.

Inclusion Criteria

This population included all blood donors registered in the Banfora RTH blood bank registry and in whom the four infectious markers were screened after a blood donation during the study period.

Sampling

The sampling was exhaustive and included only blood donors who met the inclusion criteria. The Banfora Blood Bank of the RTH was chosen because it is one of the blood banks that conducts large blood collections, and the Cascades region is one of the areas with high endemicity for TTIs in Burkina Faso.

Variables

Sociodemographics; number of donations; donor type; donor serology results: HIV, HBV, HCV, and *Treponema pallidum*.

Data Collection Tools and Techniques

An individual form was developed for this purpose and served as a data collection tool. It consisted of collecting information from the blood collection register and the blood bank's laboratory analysis register.

Laboratory Analysis

HIV Screening: Two rapid immunochromatographic tests were performed, using serum migration on a support coated with recombinant antigens. HIV-1 and HIV-2 antibodies appear 20 to 45 days after infection, and P24 Ag appears 15 to 30 days.

Hepatitis B screening: This is based on the detection of the HBV surface antigen, which is the first marker to appear and is detectable as early as the first or second week after infection. Two types of tests are used for HBV screening: the Standard Q HBsAg Test and the HBsAg Combo OnSite Rapid Test, both of which are lateral flow chromatographic immunoassays that allow the qualitative detection of HBsAg.

Hepatitis C screening: The Standard Q HCV Test, which identifies anti-HCV Ab antibodies, was used. Antibody identification is possible through the localization of the antigenic bands: Core, NS3, NS4, and NS5.

Syphilis screening: The Standard Q Syphilis Ab Test was used. In fact, 10µL of serum/plasma (20µL of whole blood) is taken and introduced into the sample well, then 3 drops of buffer

solution are added. The result is read 5 minutes later but not beyond 20 minutes.

Data Processing and Statistical Analysis

The collected data were processed using Epi-info software version 7.2.5. Microsoft Office (Word 2019 and Excel 2019) was used for text entry and graphic design.

Ethical and Professional Considerations

The study received data collection authorization from the Regional Director of the Banfora University Hospital and the head of the blood bank department. The anonymity and confidentiality of the collected data were respected.

RESULTS

A total of 10,443 blood donors were registered during the 3 years of collection, distributed as follows: 3,035 (29.06%) in 2021; 3,580 (34.28%) in 2022 and 3,828 (36.65%) in 2023. /

Sociodemographic Characteristics

Donors ranged in age from 18 to 60 years, with an average age of 27.34. The 18-24 age group was the most represented, with 6,085 (58.27).

Table I shows the distribution of donors by sociodemographic characteristics.

Table I. Distribution of donors by sociodemographic characteristics and number of donations (n=10,443).

Donneurs	Nombre	(%)
Tranche d'âge		
[18 – 24]	6085	58,27
[25 – 44]	3759	36,00
[45 – 64]	429	4,11
ND	170	1,63
Total	10 443	100
Sexe		
Masculin	7684	73,58
Féminin	2759	26,42
Total	10 443	100
Nombre de dons antérieurs		
0	4 904	46,96
1	989	9,47
2	1 546	14,80
3	884	8,47
>3	2 120	20,30
Total	10 443	100

Seroprevalence of HIV, HBV, HCV, and *Treponema pallidum* markers.

Table II presents the prevalence of anti-HIV Ag/Ab, HBsAg; anti-HCV Ab and anti-T. pallidum Ab for 3-year-olds

Table II. Prevalence of anti-HIV Ag/Ab, HBsAg; anti-HCV Ab and anti-T. pallidum Ab n= 10,443.

Markers	Number of positives	%
Anti-HIV Ag/Ab	172	1.65
HBsAg	909	8.7
Anti-HCV Ab	224	2.14
Anti-T. pallidum Ab	241	2.31
Total	1 546	148

Séroprévalence des marqueurs du VIH, VHB, VHC et *Treponema pallidum*

Seroprevalence of HIV, HBV, HCV, and *Treponema pallidum* markers by sociodemographic characteristics

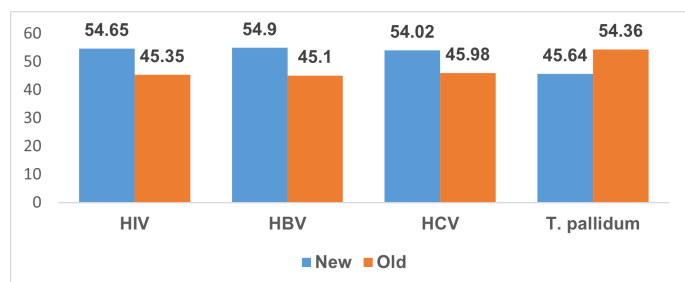
Among those seropositive for the various markers, the 18-24 age group was the most represented, with a prevalence of 1.95%; 8.92%; 2.18%; and 2.17%, respectively, for HIV Ag/Ab, HBsAg, HCV Ab, and T. pallidum Ab. HIV seroprevalence was higher among women than among men. Table III presents the seroprevalence of infectious markers by sociodemographic characteristics

Table III. Seroprevalence of infectious markers according to socio-demographic characteristics

Positive infectious markers	HIV N (%)	HBV N (%)	HVC N (%)	T.pallidum N (%)	Number
Age group					
18-24	119 (1.95)	543 (8.92)	133 (2.18)	132 (2.17)	6 085
25-44	46 (1.22)	313 (8.32)	71 (1.89)	100 (2.66)	3 759
45-64	6 (1.40)	36 (8.39)	15 (3.50)	8 (1.86)	429
ND	1(1.43)	17 (10)	5 (2.94)	1(0.58)	170
Gender					
Male	122 (1.59)	743 (9.67)	167 (2.17)	198 (2.58)	7684
Female	50 (1.81)	166 (6.02)	57 (2.06)	43 (1.56)	2 759

Frequency of infectious markers by donor type

New donors constituted more than 50% of individuals infected with HIV, HBV, and HCV. **Figure 1** shows the frequency of infectious markers by donor type.

Figure 1. Frequency of infectious markers by donor type

Frequency of infectious markers by year.

The year 2022 saw more HIV, HCV, and T. pallidum infections.

The table shows the frequency of markers by year.

Table IV. Frequency of markers by year

Infectious markers	HIV Ag/Ac	HBsAg	Anti-HCV Ab	Anti-T. pallidum Ab
Years				
2021	52 (30.23)	272 (29.92)	63 (28.13)	56 (23.24)
2022	62 (36.05)	302 (33.22)	89 (39.73)	108 (44.81)
2023	58 (33.72)	335 (36.85)	72 (32.14)	77 (31.95)
Total	172 (100)	909 (100)	224 (100)	241 (100)

Risk Factors

Regarding these risk factors (?), an association was noted between patient age and HIV infection (OR = 1.61 [1.14 – 2.26]); while an association was recorded between sex and HBV infection (OR = 1.67 [1.40 – 1.99]).

There was no demonstrated relationship between HCV infection and parameters such as age, sex, and year. However, there was an association between sex (OR = 1.67 [1.19 – 2.33]), year of testing (OR = 1.65 [1.19 – 2.29]) and Treponema pallidum infection.

Table V. Frequencies of co-markers of infectious agents in blood donations from 2021 to 2023.

Co infections	Number	percentage
HIV-HBV	16	0,15
HIV -HCV	3	0,03
HIV-T.pallidum	9	0,09
HBV-HCV	17	0,16
HBV-T.pallidum	34	0,33
HCV-T.pallidum	5	0,05
HIV -HBV- T.pallidum	3	0,03
HBV- HCV- T.pallidum	1	0,01

DISCUSSION

In this study, the majority of donors (94.27%) were aged 18 to 44. Other studies, including those conducted by Traoré et al. in Bamako in 2019 [14] and Tessema et al. in 2010 in Ethiopia

[15], have found similar data. Indeed, this age group includes young adults considered to be in good physical health, and therefore more suitable for blood donation; thus, the majority of blood donations take place among schoolchildren, students, and youth associations [16]. This study showed that males constituted the majority of the blood donor population, with 73.58% of all donors. This result is comparable to that observed by Ye et al. in 2010 in Ouagadougou [17], Nagalo et al. in 2009 in Koudougou [18], and that of Gadji et al. in 2023 in Senegal [19]. Indeed, the low representation of female donors observed in the present study would be linked to the particular situation of women, unlike men [16, 20] such as physiological constraints like pregnancy, breastfeeding, menstruation and regulations which limit the number of annual donations to 3 for women against 4 for men.

This study found a predominance of first-time donors (nearly 47%) compared to a low rate (29%) of people who gave blood 3 or more times at CRTS/Banfora. These data are similar to those of other studies conducted in Burkina Faso among blood donors, such as that of Nagalo et al. in 2012; and that of Simporé et al. in 2014 [21, 22].

However, these data are not consistent with WHO recommendations for regular donation [23]. This type of donation would be safer to use than that of first-time donors. It is therefore important to develop blood donor retention strategies to increase the rate of regular donors in Burkina. The study found overall seroprevalences of 1.65% (HIV), 8.7% (HBV), 2.14% (HCV) and 2.31% (anti-Tpallidum Ab) among donors. These data were higher than those of 0.8% for HIV according to national statistics from 2023 in the general population aged 15 to 49 years [24]. They were also higher than that by Belkacemi et al in 2015 in Algeria [25] who found 0.1% and that of Babokh et al in 2021 in Morocco [26], who observed 0.7%. Indeed, this region of Burkina is full of important artisanal mining sites as well as industrial sites which constitute settings for sex trade where very often the people who live there are exposed to risks of sexually transmitted infections (STIs). Like HIV, the prevalence of syphilis (2.31%) was higher than that observed at the national level (0.7%) [27]. These high STIs among blood donors in Banfora could be linked on the one hand to insufficient information research among donors before donating blood and on the other hand to the use of rapid diagnostic tests (RDTs) on blood donations which can lead to a significant number of false positives or false negatives.

It is therefore important to review the medical file for the selection of blood donors in Burkina Faso, in order to better identify behaviors at risk of transmitting infections and to exclude these donors but also the procedure for screening for infectious markers in blood donations by requiring the use of internationally accepted techniques (Elisa, PCR). Finally, an association was noted between the age of donors and HIV

infection given that young people aged 18 to 24 are more frequent in the HIV-positive group (69.59%) than in the HIV-negative group (59.06%) so that the risk of contracting HIV infection if one is in this age group is 1.6 times higher (OR = 1.61 [1.14 – 2.26]) than for those aged 25 to 44. Several authors have reported [28,29] that young people are more sexually active and are not aware of the means of protection against STIs such as HIV. In addition, they are more likely to adopt risky behaviors such as injecting drugs, piercing and tattooing [28,30]. Unlike HIV and syphilis, the HBV and HCV seroprevalences in the present study were lower than those reported in the general population, 9.41% and 3.6% respectively [31].

This finding corroborates with those reported by the team of Pillonel et al. in 2012 [32] which showed low seroprevalences among donors compared to those of the general population. In the present study, it was found that the seroprevalences of HIV, HBV and HCV markers were higher among new donors respectively (54.65%), (54.90%), (54.02%) than among former donors. This observation was made by Bawè et al in 2018 in Togo [33], as well as Goita et al in 2019 in Mali [34]. This confirms that to guarantee transfusion safety, priority should be given to the category of former and regular and voluntary donors, because this group, being more aware of the risks of infections, would protect their health and avoid risky behaviors [18]. The seroprevalence of HBV (8.7%) is higher than that of other markers in the study. This predominance of HBV in blood donors reflects the epidemiology of HBV in the general population of Burkina Faso, which is estimated at 9.41% [31].

This decline could be explained by the impact of awareness campaigns organized within the population on the modes of transmission of these viruses as well as on preventive measures such as vaccination against HBV. An association between sex and HBV infection was noted, given that men are more frequent in the HIV-positive group (81.74%) than in the HIV-negative group (72.80%), so that the risk of contracting HBV infection if one is a man is 1.7 times higher (OR = 1.67 [1.40 – 1.99]) compared to women. This high risk of hepatitis B in men could be linked to certain practices during sexual intercourse. Indeed, several studies, notably those of Béhanzin et al, Chevaliez et al., have shown that Men who have Sex with Men (MSM) have a higher risk of contracting hepatitis B [37; 38].

The overall seroprevalence of anti-HCV Ac was 2.14%. This result is comparable to that of blood banks in health facilities in 2022, i.e. 2.25% [39]. It is also similar to that found in Mali by Jary et al, i.e. 2.32% [40]. This observation shows that seroprevalence (2.14%) remains high among blood donors. This could be explained by the lack of vaccination against this virus. The prevalence of anti-T. pallidum Ac was 2.31%; this result is comparable to that of Wongjarupong et al in Burkina

Faso in 2021 [36], i.e. 2.43%, and to that of Uwingabiye et al in Morocco in 2016, i.e. 2.45% [41]. It is lower than that of Batiana et al in 2007 in the DRC, i.e. 3.7% [6] and that of Coulibaly et al in 2017, i.e. 7.36% [42]. However, this result is higher than that of Jary et al, i.e. 0.04% [41] and that of Diarra A et al in Mali in 2009, i.e. 0.3% [43]. These differences in seroprevalence could be explained by the geographical distribution of the disease and the sensitivity of the tests used (ELISA or rapid tests).

An association was noted between sex and *Treponema Pallidum* infection, such that the risk of contracting *Treponema* infection if one is a man is 1.7 times higher (OR = 1.67 [1.19 – 2.33]) compared to women. There is also an association between this marker and the year of the test (OR = 1.65 [1.19 – 2.29]). The male predominance could be explained by multiple partnerships, exposure in mining sites in the area and lack of awareness of the risks of syphilis. Generally speaking, it was in 2022 that there were more infections of blood donations by the markers studied. Indeed, “the very high risk of rebound” of HIV in Burkina Faso, in 2022 with an exponential increase in the prevalence rate among MSM was highlighted by Ferrarini H et al. [44]. In addition, the study reported several types of co-infections in blood donors. These include HBV-T pallidum (0.33%), HBV-HCV (0.16%), HIV-HBV (0.15%) co-infections. These co-infections are frequently encountered because the three viruses share common transmission routes [45].

CONCLUSION

The study showed that the prevalence of TTIs remains high among blood donors at CRTS/Banfora. This poses a threat to transfusion safety. To ensure optimal transfusion safety, it is therefore necessary to develop complementary strategies to prevent transfusion-related infectious risks, such as strengthening the prevention of TTIs among young people, retaining blood donors, replacing RDTs with more sensitive and specific automated methods for pathogen screening, raising awareness among the general population about the risks of transmissible infections, and ongoing epidemiological surveillance of these TTIs.

Current State of Knowledge on the Subject

- This work highlighted the high prevalence of TTIs among blood donors at CRTS/Banfora.
- To ensure optimal transfusion safety, it is therefore necessary to develop complementary strategies to prevent transfusion-related infectious risks.

Contribution of our study to knowledge:

- This study demonstrated that young donors and new donors constitute the most affected populations and the use of RDTs as a screening technique for blood donations.
- This finding should encourage the strengthening of TTI prevention among young people, blood donor retention,

and the replacement of RDTs with more sensitive and specific automated methods for pathogen screening.

Conflicts of Interest

The authors declare no conflicts of interest.

Author Contributions

Évodie KAMA: Collected the data and wrote the body of the article. Absatou BA/KY: Principal investigator who edited the article. Issa Tondé: Edited the article. Seimbou ZALLA: Co-initiator, edited the article; Arnaud Diendere: Edited the article. Idriss Traore: Edited the article. Salimata Diallo: Participated in data collection; Issoufou Ouédraogo: Participated in data collection. Idrissa Sanou: Edited the article.

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