

Seroprevalence of Viral Hepatitis B among Blood Donors in Mbuji Mayi, Democratic Republic of the Congo

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Abstract

Background: Viral hepatitis B is a major and growing public health problem worldwide, potentially causing severe complications ranging from chronicity to liver cirrhosis, hepatocellular carcinoma, and death. However, its frequency remains poorly documented in most developing countries, particularly in the DRC. This study aimed to determine the seroprevalence of hepatitis B among the blood donor population in Mbuji Mayi, to provide local evidence that could inform appropriate public health measures. **Methods:** A cross-sectional, analytical, and retrospective study was conducted, involving 806 blood donors who received from January 2020 to December 2024 in the blood bank of two healthcare facilities in the city of Mbuji Mayi. Data collected via a Kobocollect electronic questionnaire were copied into Excel software and then imported for analysis in Stata 15. A logistic regression model was used to identify factors associated with HBsAg positivity. **Results:** HBsAg seroprevalence was 14.3% over 5 years, or 115 cases out of 806 blood donors. Among the 806 registered blood donors, 78.5% were male with a mean age of 31 years. 3% of donors reported a history of hepatitis B, and nearly 40% had previously received a blood transfusion. Only 4.3% of donors tested positive for STIs. The majority of donors (88.3%) reported having received a hepatitis B vaccination. Logistic regression revealed that vaccination was a major protective factor (aOR = 2.3; 95% CI: 1.2 - 4.4), and those with a history of hepatitis B had a significantly increased risk (aOR = 4.4; 95% CI: 2.7 - 6.9). **Conclusion:** Viral hepatitis B is still a reality in our communities; preventive measures such as vaccination, systematic screening campaigns, and health education are crucial to improving transfusion safety.

Keywords

Seroprevalence, Viral Hepatitis B, Blood Donors, Mbuji Mayi

1. Introduction

Hepatitis B is a liver-tropic viral infection that can cause both acute and chronic illness. The disease is spread through contact with body fluids such as blood, saliva, vaginal secretions, or semen, and can also be transmitted from mother to infant [1].

Blood transfusion, a medical therapeutic procedure that involves the transfer of blood or one of its cellular or plasma derivatives from one or more donors to a sick recipient, saves millions of lives worldwide each year. However, despite significant advances in transfusion safety over the past two decades, the risk of transmitting infections through blood transfusion persists, exposing patients to potentially serious complications [2]. To limit this risk, the World Health Organization (WHO) recommends routine screening for human immunodeficiency virus (HIV), hepatitis B (HBV), hepatitis C (HCV), and syphilis for all blood donors [3].

Hepatitis B is a major public health problem worldwide. The WHO estimates that more than 254 million people are living with chronic hepatitis B and that there will be 1.2 million new infections each year, as well as 1.1 million deaths, mainly due to cirrhosis or hepatocellular carcinoma (primary liver cancer) in 2022 [4].

In sub-Saharan Africa, 65 million people are chronically infected [3]. HBV endemicity varies across the world. The seroprevalence of HBV markers has been assessed in various ways among blood donors worldwide: 20% in Tanzania, 14% in Nigeria, 10.01% in Equatorial Guinea, 10.0% in Cameroon, 4.7% in Ethiopia, 2.8% in Rwanda, 1.2% in Nepal, 1.1% in India, and 0.6% in Namibia, etc. [5].

In the Democratic Republic of Congo, the seroprevalence of HBV among blood donors varies from 1.6% to 8.01%, depending on the region: Lubumbashi 6.8% [6] and 8.01% [7], Bukavu 4.2% [8], Moba 3.9% [5], Kamina 1.6% [9], and Kisangani 6.0% [10]. There are no local data available on the prevalence of HBV, either in the city of Mbuji Mayi or in the entire province of Kasai Oriental.

The objective of this study is to determine the seroprevalence of viral hepatitis B among blood donors in Mbuji Mayi, to identify the risk factors associated with HBs antigen carriage, and to compare the annual variations in seroprevalence among blood donors from 2020 to 2024 in order to provide local data to guide appropriate public health measures.

2. Materials and Methods

2.1. Study Design and Setting

The study was conducted in the city of Mbuji Mayi, the capital of Kasai-Oriental Province, in the Democratic Republic of Congo. Specifically, our study was conducted in two medical facilities in Mbuji Mayi: the Bonzola Higher Medical Cen-

ter and the Mbuji Mayi Pediatric Clinic.

The Bonzola Higher Medical Center, a public institution and private entity owned by the Bakwanga Mining Company (MIBA), was established in 1964 to ensure the health of MIBA workers. It is located at 1 Avenue des Hôpitals, Kashala Bonzola district, in the commune of Kanshi, specifically in the Bonzola health zone. It is the largest healthcare facility in the city, with an orthopedic surgery department that requires a lot of blood transfusions.

And the Mbuji Mayi Pediatric Clinic, a new hospital established in 2015, is located at 27 Kasengulu Avenue, Masanka district, in the commune of Diulu, specifically in the Diulu health zone. One of its missions is to provide medical support and assistance to people with sickle cell disease. This results in high consumption of blood products.

The study ran from January 2020 to December 2024, a period of five years.

2.2. Study Type and Target Population

This was a retrospective registry-based study. The target population consisted of blood donors aged 18 to 65 who had made at least one blood donation to the Bonzola Higher Medical Center Blood Bank and the Mbuji Mayi Pediatric Clinic during the study period. This was a retrospective analytical cross-sectional study, limited to two healthcare facilities.

2.3. Sampling Method

The minimum statistical sample size was 422 blood donors who had made at least one blood donation to the Bonzola Higher Medical Center blood bank and the Mbuji Mayi Pediatric Clinic during the study period.

We used the Schwartz formula:

$$n = \frac{z^2 \times p(1-p)}{m^2}$$

n: Minimum sample size;

z: Confidence level according to the standard normal distribution (the typical value for a 95% confidence level is 1.96);

p: Estimated prevalence;

m: Tolerable margin of error (5%).

Since community prevalence was not documented in our setting, we set a prevalence of 50% to maximize statistical power due to the absence of local prevalence data for Mbuji Mayi at the time of study design. As a result, we obtained a minimum sample size (n): 384 participants. An additional 10% of participants were added to compensate for non-response and incorrect responses: $384 + 38 = 422$ participants. By applying a design effect of 2, the final minimum number of subjects to be included was 844.

2.4. Inclusion Criteria

The study included eligible blood donors registered in the various blood bank reg-

istries during the study period. The eligibility of blood donors is defined by the Ministry of Health's blood transfusion manual, which requires the following conditions: 1) Be between 18 and 65 years of age; 2) Be in good health; 3) Weigh more than 50 kg; 4) Not engage in risky behavior that could lead to contamination by a blood-borne disease [11].

2.5. Exclusion Criteria

The study excluded donors registered in the blood bank registries, but without complete or usable data for statistical analysis.

2.6. Study Variables

The qualitative variables were sex or gender, municipality of residence, occupation, religion, marital status, donor type, medical history, serological tests, medical team decision, and referral. The only quantitative variable was the age of the blood donors.

2.7. Data Collection Materials

Data were collected using blood donor registries, KoboCollect electronic survey questionnaire, Android phone with the KoboCollect app, and laptop with Excel and Stata software. Data were collected using a structured electronic questionnaire, developed on KoboCollect and administered via Android smartphones. This questionnaire was pre-tested and administered by three third-year biomedical science students, trained for this purpose and under the supervision of an academic research physician. The survey covered both laboratories of the two hospitals selected above and consisted of extracting data from blood donor registries.

A one-day pre-test was conducted, collecting data from years prior to the study period (not included in the main study) at both hospitals. This pre-test aimed to assess the clarity of our questionnaire and the suitability of the interviewers.

Before fieldwork, all interviewers received one day of training covering: 1) Research ethics; 2) Registry processing techniques; 3) The use of the KoboCollect application.

2.8. Statistical Analyses

Data collected via a Kobocollect electronic questionnaire (KoboToolBox) were copied into Excel software (Microsoft Corporation, USA, 2013), then imported into the Analysis module of Stata-64 software (Stata Corp LLC, version 15.0, Texas, USA, 2017) for analysis.

The results are presented in the form of tables, figures, numbers (n), proportions (%), or position parameters (median, percentage (%)), and dispersion parameters (interquartile range (IQR) and confidence interval (CI)). Comparisons of proportions were performed using the Pearson Chi-square test. Furthermore, a logistic regression model was fitted to assess the factors associated with HBsAg positivity. The variables with $p \leq 0.20$ in bivariate analysis were included in mul-

tivariate logistic regression models to adjust for potential confounders. Age was selected a priori as a potential confounding factor, while marital status and occupation were excluded for reasons of collinearity and model stability.

2.9. Challenges Encountered

In addition to financial difficulties, we had great difficulty accessing all donor files, as they did not include all references, making their use impossible for our statistical analysis.

2.10. Ethical Considerations

For our study, we received written authorization for fieldwork from the authorities of the Faculty of Medicine, Pharmacy, and Public Health/University of Mbuji Mayi and from the authorities of the Bonzola Higher Medical School and the Mbuji Mayi Pediatric Clinic to access donor files. The study was conducted in compliance with the fundamental principles of scientific research ethics, namely participant anonymity. The data extracted from the registers were stored securely, and the encoding on KoboCollect was anonymous. Ethical approval was obtained from the Institutional Ethics Committee of the University of Mbuji Mayi (Approval No. 002/CEI/UM/2023).

3. Results

During our study period (2020-2024), 806 subjects underwent serological testing as blood donors, of whom 115 tested positive for HBsAg, representing a prevalence of 14.3% over the 5 years (**Figure 1**).

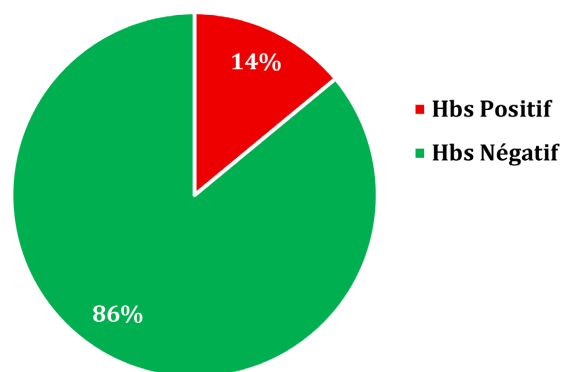


Figure 1. Prevalence of Hepatitis B.

A graphical distribution of HBsAg seropositivity from 2020 to 2024 demonstrated a fluctuating trend with an abnormal peak in 2023, but an overall decline over the five years. This merits a thorough analysis of the contextual factors of each year, especially 2023, to understand the underlying causes of these variations and to strengthen preventive measures (**Figure 2**).

Table 1 presents the characteristics of blood donors from both healthcare facilities during the study period.

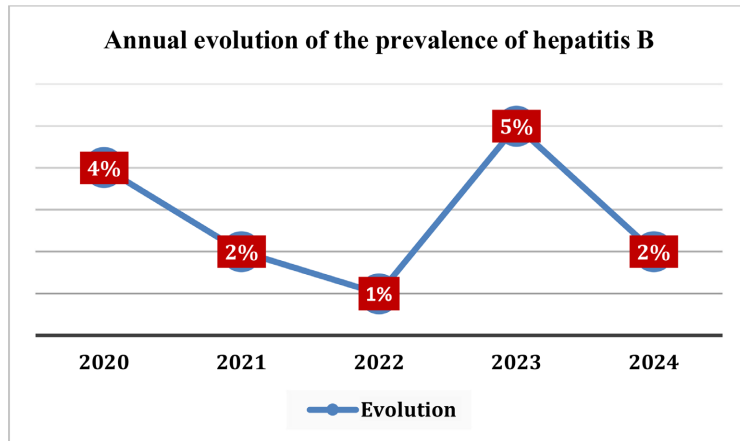


Figure 2. Graphical distribution of HBsAg seropositivity from 2020 to 2024.

Table 1. Distribution of the study population according to sociodemographic characteristics (n = 806).

Variables	n (806)	%	Med (IQR)
Age (years)			
[18 - 35]	570	70.7	31 (9)
[36 - 45]	210	26.1	
>46	26	3.2	
Gender			
Female	173	21.5	
Male	633	78.5	
Municipality of residence			
Bipemba	96	11.9	
Dibindi	155	19.2	
Diulu	162	20.1	
Kanshi	242	30.0	
Muya	151	18.7	
Occupation			
Trader	124	15.4	
Teacher	77	9.6	
Farmer	16	2.0	
Official	138	17.1	
Pastor	28	3.5	
Health personnel	97	12.0	
Artisanal miner	52	6.5	
Unemployed	274	34.0	

Continued

Religion		
Christian*	723	89.7
Muslim	49	6.1
Without religion	34	4.2
Marital status		
Lives without a spouse**	364	45.2
Married	442	54.8

*Christians, including Protestants, Catholics, and Kimbanguists. **Lives without a spouse, including single people, widowers, and divorcees.

It appears that most donors (70.7%) were between 18 and 35 years old, with a median age of 31 years and an interquartile range of 9 years. A male predominance (78.5%), which could reflect cultural norms or greater male participation in blood donation, is observed in the study region. The communes of Kanshi (30%) and Diulu (20.1%) were the most represented, which is explained by the geolocation of these two hospitals (one in Kanshi commune and the other in Diulu commune). Thirty-four percent of donors were unemployed, and the majority of subjects were Christian (86.7%), likely reflecting the local religious context. More than half of donors (54.8%) were married (Table 1).

Table 2 shows that 3.0% of donors reported a history of hepatitis B. Nearly 40% of donors had previously received a blood transfusion. Only 4.3% of donors tested positive for sexually transmitted infections (STIs). 88.3% of donors reported having received a hepatitis B vaccination (Table 2).

Table 2. Distribution of the study population according to donor medical history (n = 806).

Variables	n	%	Med (IQR)
History of hepatitis B			
Yes	24	3.0	
No	782	97.0	
To have been transfused			
Yes	315	39.1	
No	491	60.9	
History of an STI			
Yes	35	4.3	
No	771	95.7	
Hepatitis B vaccination			
Yes	712	88.3	
No	94	11.7	

This figure shows that 73.6% of donors were family donors, a common practice in some contexts where donations are motivated by specific needs, and family members are tested first before looking elsewhere (Figure 3).

The prevalence of hepatitis B was 14.3% (115 cases out of 806) among blood donors during the period. Other infections: 5.2% positivity for HCV and 2.6% for syphilis (RPR+), indicating significant co-infection. 23.4% of donations were rejected mainly due to HBs positivity, and 23.3% were referred for counseling, which is crucial for monitoring infected cases (Table 3).

In the bivariate analysis, the trafficking profession ($p = 0.000$), sex ($OR = 1.97$; $p = 0.018$), history of hepatitis B ($OR = 172.5$; $p < 0.001$), history of transfusion

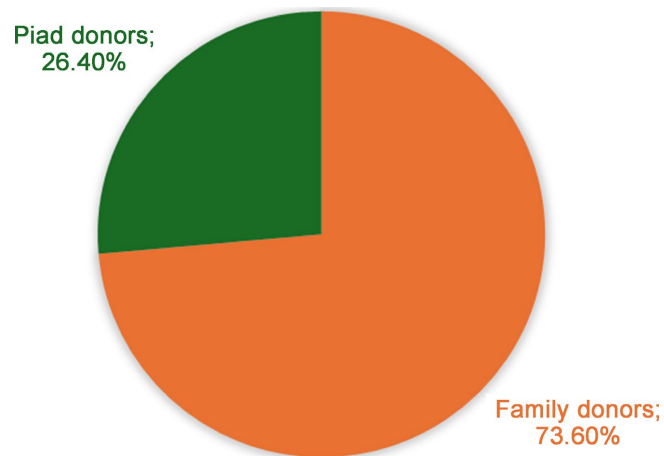


Figure 3. Distribution according to donor types.

Table 3. Distribution of the study population according to medical outcomes and decisions (n = 806).

Variables	n	%	Med (IQR)
Results of other serological tests carried out			
HCV+	42	5.2	
RPR+	21	2.6	
HIV+	16	2.0	
HBs TDR results			
Positive	115	14.3	
Negative	691	85.7	
Medical team decision			
Blood collected	617	76.6	
Uncollected blood (downgraded)	189	23.4	
Donor orientation			
Residence	618	76.7	
Towards counseling	188	23.3	

(OR = 3.37; $p < 0.001$), and history of STI (OR = 9.49; $p < 0.001$) revealed a positive association by increasing the risk of HBsAg RDT being positive. In addition, a significant association between non-vaccination against hepatitis B and HBsAg RDT positive result ($\text{Chi}^2 = 50.2320$; $p = 0.000$) demonstrated that HBsAg positivity is more increased in unvaccinated people than in vaccinated people; the more people are vaccinated, the more negative they will be for HBsAg, and the less they are vaccinated, the more positive they will be for HBsAg (Table 4). The logistic regression model revealed that vaccination was a major protective factor (ORa = 2.3; 95% CI: 1.2 - 4.4) and people with a history of hepatitis B had a very strongly increased risk (OR = 4.4; 95% CI: 2.7 - 6.9) (Table 4).

Table 4. Distribution of donors according to characteristics that influence HBsAg.

Settings	AgHBs		OR (IC)	P-Value
	Negative	Positive		
Age				
18 - 35	485	85	2.10 [0.49 - 9.06]	0.319
36 - 45	182	28	1.85 [0.41 - 8.24]	0.422
>45	24	2	1-	-
Commune				
Bipemba	82	14	1-	-
Dibindi	125	30	1.41 [0.70 - 2.81]	0.335
Diulu	145	17	0.69 [0.32 - 1.46]	0.331
Kanshi	202	40	1.16 [0.60 - 2.25]	0.660
Muya	137	14	0.60 [0.27 - 1.32]	0.203
Occupation				
Trader	102	22	1.52 [0.85 - 2.73]	0.158
Teacher	72	5	0.49 [0.18 - 1.30]	0.152
Farmer	16	0	1-	-
Official	121	17	0.99 [0.53 - 1.85]	0.979
Pastor	27	1	0.26 [0.03 - 1.99]	0.195
Health personnel	85	12	1.00 [0.49 - 2.01]	0.992
Artisanal miner	28	24	6.05 [3.15 - 11.62]	<0.001
Unemployed	240	34	-	-
Religion				
Christian	621	102	1-	-
Muslim	41	8	1.19 [0.53 - 2.65]	0.67
Without religion	29	5	1.05 [0.14 - 1.95]	0.93

Continued

Marital status					
Lives without a spouse	300	64	1	-	
Married	391	51	0.61 [0.41 - 0.90]	0.01	
Sex					
Female	158	15	1	-	
Male	533	100	1.97 [1.17 - 3.49]	0.018	
Donor type					
Family	503	90	0.74 [0.46 - 1.19]	0.218	
Paid	188	25	1	-	
History of hepatitis B					
No	690	92	1	-	
Yes	1	23	172.5 [23.023 - 1292.91]	<0.001	
To have been transfused					
No	450	41	1	-	
Yes	241	74	3.37 [2.23 - 5.09]	<0.001	
History of an STI					
No	676	95	1	-	
Yes	15	20	9.49 [4.69 - 19.16]	<0.001	
Hepatitis B vaccination					
No	58	36	1	-	
Yes	633	79	4.9 [2.9 - 8.2]	<0.001	

The results in brackets () are either Chi² or Exact file, depending on the conditions of applicability.

Table 5 presents the results of the multivariate analysis of factors associated with HBsAg positivity among blood donors in the two healthcare facilities during the study period.

In multivariate analysis, the factors independently associated with HBsAg positivity were a history of hepatitis B (ORa = 4.4; 95% CI [2.7 - 6.9]) and lack of hepatitis B vaccination (ORa = 2.3; 95% CI [1.2 - 4.4]). Sex, age, and history of transfusion were not independently associated after adjustment.

4. Discussion

This study assessed the seroprevalence of hepatitis B surface antigen (HBsAg) among blood donors in Mbuji Mayi over a five-year period (2020-2024) and identified factors associated with HBsAg positivity. The overall prevalence of 14.3% observed in this population is markedly higher than the global estimate for hepatitis B reported by the World Health Organization and exceeds the pooled prevalence

Table 5. Logistic regression.

Settings	AgHBs		OR brut [IC95%]	P	OR adjusted [IC95%]	P
	Negative	Positive				
Sex						
Female	158	15	1*	-	-	-
Male	533	100	1.97 [1.17 - 3.49]	0.018	1.3 [0.2 - 1.0]	0.17
History of hepatitis B						
No	690	92	1*	-	-	-
Yes	1	23	172.5 [23.02 - 1292.91]**	<0.001	4.4 [2.7 - 6.9]**	0.00
To have been transfused						
No	450	41	1*	-	-	-
Yes	241	74	3.37 (2.23 - 5.09)	<0.001	0.8 [0.5 - 1.4]	0.00
Hepatitis B vaccination						
No	58	36	4.9 (2.9 - 8.2)	<0.001	2.3 [1.2 - 4.4]	0.01
Yes	633	79	1*	-	-	-
Age						
≤45 ans	667	113	2.0 (0.4 - 17.9)	0.32	0.2(0.03 - 1.7)	0.13
>45 ans	24	2	1*			

*The reference categories were female for gender; no negation for History of hepatitis B, History of transfusion, and vaccination against hepatitis B. **The large crude OR reflects an unadjusted association, while the reduced adjusted OR reflects confounding control in the multivariate model.

among African blood donors, estimated at approximately 6.9% [12] [13]. This finding confirms that hepatitis B remains highly endemic in this setting and represents a significant public health concern, particularly in the context of blood transfusion safety.

When compared with other regions of the Democratic Republic of the Congo (DRC), the prevalence observed in Mbuji Mayi is higher than those reported in Lubumbashi, where prevalences of 6.8% and 7.9% were documented in different study periods [14] [15], as well as most reports from Kinshasa, where HBsAg prevalence among blood donors ranged from approximately 2.8% to 11.4% depending on the study design, donor profile, and screening methods used [16] [17]. These differences suggest substantial geographical heterogeneity in HBV epidemiology within the country and underscore the importance of generating local data to inform targeted prevention strategies.

At the sub-Saharan African level, wide variability in HBsAg prevalence among blood donors has also been described. Studies from Ghana have reported a declining trend in HBsAg prevalence over time [18], while persistently high prevalence among first-time donors has been reported in Burkina Faso [19]. In contrast,

Rwanda has documented considerably lower prevalence levels, particularly in settings with a high proportion of regular voluntary donors and improved screening algorithms [20] [21]. In Senegal, repeated blood donation has been associated with a marked reduction in HBsAg prevalence, reaching approximately 1% among regular donors [22]. In Angola, recent data indicate a prevalence close to 10%, with an increasing trend between 2018 and 2022 [23]. These observations collectively indicate that donor composition, frequency of donation, and the quality of screening systems strongly influence reported seroprevalence rates.

In the present study, multivariate analysis identified a history of hepatitis B infection and lack of hepatitis B vaccination as independent factors associated with HBsAg positivity. These findings are consistent with existing literature and highlight the protective role of vaccination against HBV infection [12]. Although male sex, history of blood transfusion, and history of sexually transmitted infections were associated with HBsAg positivity in bivariate analysis, these factors were not independently associated after adjustment, suggesting that their effects may be mediated through other exposures or confounding variables. The interpretation of these associations should nevertheless be cautious, as vaccination status and medical history were self-reported and could not be verified through serological markers such as anti-HBs or anti-HBc antibodies.

Beyond the detection of HBsAg, recent studies in Africa have demonstrated the presence of occult hepatitis B infection (OBI) among HBsAg-negative blood donors, characterized by detectable HBV DNA [24] [25]. Although OBI was not assessed in the present study, its potential contribution to residual transfusion risk in high-endemicity settings such as Mbuji Mayi cannot be excluded. This highlights the limitations of relying solely on HBsAg rapid diagnostic tests for donor screening and supports the inclusion of additional serological markers, particularly anti-HBc antibodies, and molecular testing strategies when resources allow.

The high prevalence observed in this study is also likely influenced by specific operational characteristics of the two health facilities included. Both institutions serve as major referral centers with high transfusion demand, particularly for surgical cases and patients with sickle cell disease, which may increase reliance on family or replacement donors. Indeed, nearly three-quarters of donors in this study were family donors, a group consistently reported to have higher rates of transfusion-transmissible infections compared with voluntary regular donors. Furthermore, the predominant use of rapid diagnostic tests for HBsAg screening, although pragmatic in resource-limited settings, may be associated with lower sensitivity compared with ELISA or chemiluminescence-based assays.

This study has several strengths, including a relatively large sample size, a five-year observation period, and the provision of the first local data on hepatitis B seroprevalence among blood donors in Mbuji Mayi. However, several limitations must be acknowledged. The retrospective and cross-sectional design precludes causal inference, and the restriction to two health facilities limits the generaliza-

bility of the findings. In addition, incomplete donor records may have introduced selection or information bias, and the absence of a complete serological panel prevented differentiation between active, resolved, and occult infections.

Despite these limitations, the findings have important implications for public health and transfusion practice in Mbuji Mayi and similar settings. Strengthening hepatitis B vaccination coverage, particularly among high-risk groups, improving donor selection and retention strategies to increase the proportion of voluntary regular donors, and upgrading screening algorithms are critical steps to reduce the burden of HBV and improve blood safety. Future prospective multicenter studies incorporating comprehensive serological and molecular testing are needed to better characterize the epidemiology of hepatitis B in the Kasai-Oriental Province and to guide evidence-based prevention and control policies.

5. Limitations of the Study

This study has several limitations that must be considered when interpreting the results. First, its retrospective and cross-sectional design, based on data from only two health facilities in Mbuji Mayi, limits the external validity of the results; the estimated prevalence and associated factors cannot be generalized to all blood donors in the province or to the general population. Second, the use of blood bank registries and the exclusion of incomplete or unusable records may have introduced selection and information biases, as some donors with different risk profiles may have been omitted or misclassified. Third, although logistic regression was used to explore factors associated with HBsAg positivity, residual confounding bias cannot be ruled out, and the cross-sectional design does not allow for causal inference; therefore, the observed associations should be interpreted as correlations rather than determinants. Finally, some relevant variables, such as detailed vaccination history, behavioral risk factors, or clinical data, were not systematically documented in the registries, which may have limited the scope of the analysis.

6. Conclusion

This retrospective cross-sectional study conducted in two blood banks in Mbuji Mayi revealed a high seroprevalence of hepatitis B surface antigen (HBsAg) among blood donors between 2020 and 2024, highlighting a persistent risk to transfusion safety in this context. Several donor characteristics were statistically associated with HBsAg positivity, suggesting that certain subgroups may require particular attention in screening and prevention strategies, although no causal relationship could be established. These findings confirm the need to strengthen routine screening of blood donors, promote and verify the effectiveness of hepatitis B vaccination, and improve information and counseling for infected donors. Further studies, using probabilistic sampling and more comprehensive data on risk factors, are needed to better characterize the epidemiology of hepatitis B in the population of Mbuji Mayi and the province of Kasai-Oriental.

Ethics Approval and Consent of Study Participants

Regarding our study, we received written authorization for fieldwork from the authorities of the Faculty of Medicine, Pharmacy and Public Health/University of Mbuji Mayi, and from the authorities of Bonzola Hospital and Clinic Mbuji Mayi Pediatrics to access donor records. The study was conducted in accordance with the fundamental principles of scientific research ethics, namely participant anonymity.

Consent for Publication

All co-authors have read and approved this study prior to publication.

Availability of Data and Materials

All data generated during this study are included in the published article.

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This study was funded by the co-authors' own funds.

Authors' Contributions

André K.K. and Darla N.C. wrote the study protocol and conducted the data analysis. Joris L.L. guided the writing of the entire study and conducted the data analysis. Claude M.M., André K.K., Stéphanie M.K., Nadine K.K., and Evariste T.K. completed the study. All authors and co-authors contributed to the revision and approval of the final manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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List of Abbreviations

DNA	Deoxyribonucleic Acid
HBsAg	Hepatitis B Surface Antigen
STI	Sexually Transmitted Infection
WHO	World Health Organization
DRC	Democratic Republic of the Congo
RPR	Rapid Plasma Reagin
RDT	Rapid Diagnostic Test
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
UM	University of Mbuji Mayi
DRC	Democratic Republic of the Congo
SDG	Sustainable Development Goals
UNIKIS	University of Kisangani