



# **Hepatitis B Virus Surface Antigen Carriage among Volunteer Blood Donors in Kisangani, Democratic Republic of Congo: Prevalence and Associated Factors**

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## **Authors' contributions**

*This work was carried out in collaboration between all authors. Author JOB designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors FLM, GMB, STW, CRAB and CKT managed the analyses of the study. Author JLL managed the literature searches and contributed to revising and reviewing the paper. All authors read and approved of the final draft before submission.*

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## ABSTRACT

**Introduction:** Blood safety is a serious public health concern for health authorities in sub-Saharan African countries. Blood transfusion is a major mode of transmission of viral hepatitis B. The objective of this study is to determine the prevalence of carriage of HBs antigen among volunteer blood donors (VBD) in Kisangani.

**Methods:** This is a retrospective study conducted in Provincial Blood Transfusion Center in Kisangani from 1<sup>st</sup> January to 31<sup>st</sup> December 2015, involving 2,298 volunteer blood donors. Data were collected anonymously from blood donor records and registers taking into account the following variables: age, sex, occupation, educational level, donor status, and residential setting. The HBs antigen was demonstrated by the Alere Determine test. Other markers of viral hepatitis B have not been sought among VBD because they are not available in National Blood Transfusion Program of the Democratic Republic of Congo.

**Results:** The prevalence of HBs antigen was 6.5% among volunteer blood donors in Kisangani. It was higher in subjects who 20 to 29 years old, males, without a profession, low education, new donors, predominantly living in the Mangobo and Kabondo communes. This high prevalence was significantly associated with sex, profession, level education and status donor.

**Conclusion:** The prevalence of HBs antigen was relatively low in VBD in Kisangani (6.5%). But this rate remains high in this group of donors yet renowned less risky. To reduce this risk of transfusion and further secure blood recipients, policymakers should strengthen the education of the population and the technical capacities of the Provincial Blood Transfusion Center for hepatitis B screening. Immunisation against hepatitis B should be systematic across the country, targeting, in particular, the young people who constitute the majority of VBD in our country.

**Keywords:** Prevalence; carriage; HBs antigen; blood donor; Kisangani.

## 1. INTRODUCTION

Hepatitis B virus (HBV) is a public health problem and a major cause of mortality and morbidity [1]. Hepatitis B infection is one of the commonest viral hepatitis throughout the globe and has infected about two billion people, including an estimated 350 million chronically infected persons [2]. Hepatitis B virus (HBV) is the major cause of viral hepatitis with associated clinical manifestations such as hepatomegaly, cirrhosis, and hepatocellular carcinoma [3]. An enveloped partial ssDNA virus infects the liver, causing hepatitis B infection [4,5]. The virus replicates in the hepatocytes causing impairment in the liver functions [6]. The inflammation and damage of the liver arise as a consequence of the immune response to the virus in the liver cells [7]. Hepatitis B is a contagious disease. Transfusion-transmitted HBV infection has become a major mode of transmission of HBV in high prevalence areas in sub-Saharan Africa [8]. Blood safety is a serious public health concern for health authorities in sub-Saharan African countries. For this reason, much effort has given for developing measures to reduce the risk of transmission of infectious agents by blood transfusion [9]. With a prevalence of asymptomatic HBV carriage estimated at 3-22% in blood donors, viral hepatitis B screening is performed on less than

50% of blood bags in most African countries [10,11]. The Democratic Republic of Congo is located in the highly hepatitis B endemic area . Blood transfusion constitutes consequently a serious threat to blood recipients. The results of previous studies relating to this topic across the country among blood donors of all categories (family, paid, volunteer) showed prevalence ranging between 5.4% and 9.2% [12-14]. However, there is little data available on a specific group, the only group of volunteer blood donors, considered to be less risky. This study was conducted in this context. It aims to determine the prevalence of carriage of HBs antigen in volunteer donors of blood (VBD) in our country that has undergone demographic changes following the wars and after many interventions in terms of supply of reagents in capacity building of staff [14,15].

## 2. METHODS

### 2.1 Study Design and Setting

This was a retrospective study conducted in Provincial Center for Blood Transfusion (PCBT) in the city of Kisangani. Its mission is to ensure a safe, stable and cost-effective supply of blood products and to ensure the proper use of products in hospitals in the city and the rest of

the province. The study population was composed of all subjects who volunteered to donate blood to PCBT during the study period from January 1<sup>st</sup> to December 31<sup>st</sup>, 2015.

## 2.2 Study Population

2298 VBD were counted, including 1896 males and 402 females, aged between 18 to 60 years. Data were collected anonymously from blood donor records and registers taking into account the following variables: age, sex, occupation, educational level, donor status, and residential setting.

## 2.3 Laboratory Procedures

Venous blood was collected from the donors who were present at the blood bank unit of the laboratory. The blood was screened for hepatitis b surface antigen. Alere Determine™ HBsAg test (Chiba, Japan) was used for screening donors' serum samples. The test was based on the principle of immuno-chromatography. The procedure in obtaining test results was carried out according to the standard operating procedures which were based on manufacturer's instruction in the package insert of the test strip. Other markers of viral hepatitis B have not been investigated among VBD because they are not available and are not recommended by National Blood Transfusion Program of the Democratic Republic of Congo.

## 2.4 Data Analysis

Data obtained was entered into Microsoft Excel spreadsheet for cleaning and exported to Epi Info Version 7™ statistical package for analysis.

The data collected were grouped and presented through the frequency tables. For the comparison of proportions, chi-square of Pearson was used at a significance level of 0.05.

## 2.5 Ethical Consideration

Permission was obtained from the authorities of the Public Health of the Democratic Republic of Congo before beginning the research.

## 3. RESULTS

Table 1 describes volunteer blood donors by socio-demographic characteristics, their donor status, and their residential environment.

**Table 1. Description of volunteer blood donors by socio-demographic characteristics, their donor status and their residential setting**

Characteristics	N (%)
<b>Age (years)</b>	
<20	451 (19.6)
20-29	1201 (52.2)
30-39	530 (23.0)
40-49	91 (3.9)
50-59	22 (0.9)
60-65	3 (0.1)
<b>Sex</b>	
Male	1896 (82.5)
Female	402 (17.5)
<b>Profession</b>	
Pupils	842 (36.6)
Students	315 (13.7)
Nurses	45 (1.9)
Traders	254 (11)
Teachers	88 (3.8)
Jobless	754 (32.8)
<b>Level of education</b>	
Illiterate	115 (5)
Primary	160 (6.9)
Secondary	1255 (54.6)
Superior	768 (33.4)
<b>Donor status</b>	
Former	1714 (74.6)
New	584 (25.4)
<b>Residential setting</b>	
Mangobo	734 (31.9)
Kabondo	712 (30.9)
Tshopo	489 (21.2)
Makiso	322 (14.0)
Lubunga	23 (1)
Kisangani	18 (0.7)

The majority of blood donors were 20 to 29 old years (median age 27.5 years), males, pupils from secondary education, former donors and predominantly from the Mangobo and Kabondo communes.

Table 2 presents the prevalence of the carriage of HBs antigen among volunteer blood donors.

**Table 2. Prevalence of HBs antigen carriage among volunteer blood donors**

HBs antigen	n (%)
Positive	149 (6.5)
Negative	2149 (93.5)
Total	2298 (100)

Among 2298 volunteer blood donors, 149 of them were carriers of the HBs antigen in the blood, a prevalence of 6.5%.

Table 3 illustrates the prevalence of carriage of HBs antigen among volunteer blood donors by socio-demographic characteristics, donor status, and residential setting.

The prevalence of HBs antigen carriage was higher in the 20 to 29-year-old, male, jobless, illiterate population, living predominantly in the Mangobo and Kabondo communes. This high prevalence was significantly associated with sex, profession, level education and status donor.

#### 4. DISCUSSION

In this study, the prevalence of carriage of HBsAg among VBD is 6.5%. This prevalence is

higher than that found in Kinshasa in 2005 (3.63%) and Kisangani in 2004 (3%) [12,15]. On the other hand, it is lower than that found by Mbendi et al. in Kinshasa-East in 2001 (9.2%) [13] and results reported by other authors in Cameroon (10.8%) [16], Ghana (8.2%) [17] Angola (15.1%) [18] and Ivory Coast (12.5%) [19]. This relatively low prevalence of DBS in Kisangani would be underestimated by the fact that other immunologic markers of viral hepatitis B are not being sought by the Provincial Blood Transfusion Center in Kisangani City — just like HBsAg, HBcAg, HBcAb, HBeAg, HBeAg — and excluding at-risk individuals when recruiting VBD. Mutations affecting the HBs antigen may make it undetectable by serological tests which may also justify the prevalence found in this study [20]. The most affected age group in this study is the one between 20 and 29 years old. This result is

**Table 3. Prevalence of carriage of HBs antigen among volunteer blood donors by socio-demographic characteristics, donor status, and residential setting**

Characteristics	HBs antigen positive		
	N	(%)	P-val
<b>Age (years)</b>			
<20	451	15 (3.3)	
20-29	1201	110 (9.1)	
30-39	530	21 (3.9)	
40-49	91	3 (2.9)	
50-59	22	0 (0)	
60-65	3	0 (0)	
<b>Sex</b>			<b>0.001</b>
Male	1896	137 (7.2)	
Female	402	12 (2.9)	
<b>Profession</b>			<b>0.02</b>
Pupils	842	61 (7.2)	
Students	315	9 (2.8)	
Nurses	45	2 (4.4)	
Tradespeople	254	12 (4.7)	
Teachers	88	3 (3.4)	
Jobless	754	62 (8.2)	
<b>Level of education</b>			<b>0.001</b>
Illiterates	115	14 (12.1)	
Primary	160	15 (9.3)	
Secondary	1255	89 (7.1)	
Superior	768	31 (4.0)	
<b>Donor status</b>			<b>0.001</b>
Former	1714	95 (5.5)	
New	584	54 (9.2)	
<b>Residential setting</b>			
Mangobo	734	71 (9.6)	
Kabondo	712	48 (6.7)	
Makiso	322	11 (3.4)	
Tshopo	489	17 (3.4)	
Lubunga	23	0 (0)	
Kisangani	18	0 (0)	

similar to those of Dongdem et al. in Ghana [21] and Noah et al. in Cameroon [16]. This study population consisted of a majority of young people, which is a characteristic of the population and blood donors of developing countries [14]. Obstetrical factors limiting blood donation in female VBD (pregnancy, breastfeeding for less than 6 months, menstrual period) and the role of socio-cultural characteristics only present in men such as circumcision argue in favour of a prevalence high carriage of HBs antigen in male VBD [22,23]. Students, teachers and blood donors of superior level are less infected with hepatitis B. High levels of education about infection patterns and preventative measures against viral hepatitis B seem to explain this low prevalence among these categories of VBD, which should be privileged over others (jobless and pupils). The weak carriage of HBs antigen observed in regular VBD can be justified on the other hand by strengthening their capacities by the means of prevention of transmissible diseases by blood transfusion during different blood drive campaigns across the city, and secondly by their loyalty in time with the assistance of associations of VBD through the city of Kisangani. VBD living in the communes Mangobo and Kabondo represent more than half of HBs antigen carriers. The PCBT regularly organises more blood drives in these two communes than in others. This fact may explain this finding. This deserves further exploration by analytical studies that should be conducted later.

## 5. CONCLUSION

The prevalence of HBs antigen was relatively low in VBD in Kisangani (6.5%). But this rate remains high in this group of donors yet renowned less risky. To reduce this risk of transfusion and further secure blood recipients, policymakers should strengthen the education of the population and the technical capacities of the Provincial Blood Transfusion Center for screening for hepatitis B. Immunisation against hepatitis B should be systematic across the country, targeting, in particular, the young people who constitute the majority of VBD in the Democratic Republic of Congo.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

Permission was obtained from the authorities of the Public Health of the Democratic

Republic of Congo before beginning the research.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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