Original Research Article

Hepatitis B Virus and behavioral risk among Blood donors, Gabon

Abstract

Background : HIV and hepatitis B virus (HBV) co-infection poses important public health considerations in resource-limited settings. This cross-sectional study was undertaken with the aim of to determine HBV seroprevalence patterns in urban blood bank.

Methods : A cross-sectional study was conducted at the urban blood bank setting. A total of 1610 blood donors were enrolled and 283 consecutive plasma samples with unknown HBsAg status were selected for risks factors. HBV seroprevalence was based on the Chemiluminescence technique (Cobas® e601, Roche). Logistic regression analysis was used to determine the association between demographic factors and HBV infection.

Result : Of 1610 participants, Overall HBsAg seroprevalence was 5.5% (95% CI : 4.36%–6.58%) ranging from 0.06% (95% CI : 0-0.18) (HCV) to 0.12% (95% CI : 0-0.30) (Syphilis). Seroprevalence of infection increased in older age groups (20-39 years) but was not similar for both sexes. The multivariate model showed the following to be predictors of HBV infection : male gender (aOR=2,5 (95% CI 1,14-5,58), *P= 0,02*), first-time donor status (aOR = 11.06, (95% CI 5.34-22.9), *P= 0.01*) and residence outside of Libreville (OR = 2.52, 95% CI 1.09-5.83), *P=0.03*).

Conclusion : HB and co-infection are relatively common in Gabon. Intermediate seroprevalence was associated with male gender, first-time donors status and residence outside of Libreville. HCV and HBV infection among the younger age groups are becoming an alarming issue. Prevention and control of HBV infection are needed to reduce HBV transmission.

Keywords: Blood transfusion, HBV co-infection, Transfusion-transmissible infection, Africa

التعليق [DS21]: In resource-limited settings, co-infection between HIV and hepatitis B virus (HBV) poses important public health considerations. This cross-sectional study was undertaken with the aim of determining HBV seroprevalence patterns in urban blood banks.

التعليق [DS22]: an

التعليق [DS23]: enrolled,

التعليق [DS24]: ??

التعليق [DS25]: overall

التعليق [DS26]: ??

التعليق [DS27]: ??

التعليق [DS28]: Two space

التعليق [DS29]: How was the decision made that it is common and the percentages do not exceed 0.1%

INTRODUCTION

Blood transfusion forms part of the backbone of basic medical care in sub-Saharan Africa (SSA), in particular, its use is crucial in limiting mortality associated with malaria and obstetric blood loss [1]. Hepatitis B virus (HBV) infection is a serious worldwide public health concern and is a major cause of chronic hepatitis, cirrhosis, and hepatocellular carcinoma : an estimated 2 billion people have evidence of prior infection and 350–400 millions persons are infected chronically [2].

التعليق [DS210]: million

Chronic hepatitis B prevalence, as indicated by the presence of circulating HBsAg, estimates of the prevalence of HBV co-infection among HCV-infected Africans vary from approximately 5 to 20% but the prevalence and epidemiology of HCV-HBV co-Infection is unknown in many sub-Saharan African populations [3]. The endemicity of HBV infection varies greatly over the world, from highly endemic areas (> 8% infection rate), to intermediate (2−8%) and low endemicity areas (< 2%). Africa is among the highly endemic areas [4].

In some countries, such as Cameroon, Gabon and RCA, a large part of the population will be exposed in the course of their lives to HBV and become infected [5, 6, 7]. All of Central and Southern Africa is also in the high endemicity category [8, 9]. Few studies evaluated the status of HBV co infection among blood at the urban blood bank in Gabon. In 2019, Groc *et al.* [10] reported a HBV prevalence of 7.4% among general population survey and that infection was associated with certain host factors (presence of viral co- infections), demographics and behavioural risk factors.

التعليق [DS211]: donors

التعليق [DS212]: behavioral

In Gabon, in a recent report, a prevalence of 7.28% for HBsAg was reported among first-time donors in Libreville [11]. Given that little is known on the epidemiology of transfusion transmitted infection (TTIs) in urban areas of Gabon. Data obtained from the study will permit to see the relative safety of donated bloods for transfusion there by health policy makers may consider a better diagnostic scheme. Also, evaluation of potential risk groups and the extent of factors will strengthen the decision on selection of low-risk donor, proper collection and application of better screening methods there by, safe and adequate blood donation for transfusion will be guaranteed.

We have set for this study the goal of assessing the determining the prevalence rates of HBV, HCV and Syphilis in urban blood bank, Gabon, and risk factors of HBV

التعليق [DS213]: and

التعليق [DS214]: for

MATERIALS AND METHODS

Sample size determination and sampling techniques

A total of 1610 blood donors were enrolled and 283 consecutive plasma samples were selected for risks factors. Informed consent was taken from patients and controls and ethical clearance was taken from the Gabonese National Ethical Committee for research (authorization n° 0088/2019/PR/SG/CNER). A questionnaire was filled for all cases and controls which contained the basic information about the individual like age, gender, blood donor status, residence, blood exposure, vaccination. The questionnaires were self-administered by subjects or any subjects who needed help in filling the questionnaires were assisted by trained volunteers who were medical doctors, medical laboratory scientists, medical laboratory science students, and laboratory technologists.

التعليق [DS215]: enrolled,

التعليق [DS216]: risk

التعليق [DS217]: obtained

التعليق [DS218]: filled out

التعليق [DS219]: s,

التعليق [DS220]: them

Laboratory methods

Plasma from all the samples were screened for HBV infection by the chemiluminesce using the COBAS® e601, Roche according to the manufacturer's instructions.

Statistical Analysis and definition of variables

Statiscal analyses were conducted using SPSS 22.0 statistics software. The Chi-square test was applied to assess the association between the categorical variants. A *P-value* of < 0.05 was used as the cut-off level for significance. All demographic and behavioral risk factors with *p-values* less than 0.2 in univariate logistic regression models were included in the "first" logistic regression model.

التعليق [DS221]: ?

RESULTS

Out of 1610 blood donors, the male-to-female (M:F) ratio was 2:1 (1048 males, 65%; 562 females, 35%). The ages of the participants ranged from 18 to 54 years. The plasma samples were analysed for HBsAg, Of the 1610 samples. The overall seroprevalence of HBV was 5.5% (95% CI : 4.36%–6.58%) ranging from 0.06% (95% CI : 0-0.18) (HCV) to 0.12% (95% CI : 0-0.30) (Syphilis), The prevalence of HBV was higher among males (M:F ratio 5.8 :1). The HBV-HIV co-infection was not observed (table 1). The pattern of age-specific HBsAg prevalence is shown in figure 1. HBV infections were found in all age groups (figure 1). The age group most

التعليق [DS222]: The number of males in the study is basically double the females, so it is not necessarily an indication that the percentage is higher in males, perhaps if the percentage of females was close to males, the prevalence rate would be close, please follow another statistical test to determine the prevalence difference between the sexes

infected with HBV was 20–29 years old. The prevalence of HBsAg was lowest in the youngest age group (1%).

Risk factors of HBV infection

Among 283 blood donors, a total of 71 HBsAg positive blood donors (60 new donors and 11 repeat donors) and 212 HBsAg negative blood donors were included in the study. Table 2, show the unadjusted odds ratios and adjusted odds ratios (aOR) and 95 percent confidence intervals (95% CI's). In the final multivariate model, first-time donors status were strongly association to overt HBV infection (Table 2).

التعليق [DS223]: shows

التعليق [DS224]: donor

التعليق [DS225]: was

التعليق [DS226]: ???

التعليق [DS227]: associated

DISCUSSION

Blood transfusion safety in sub-Saharan Africa (SSA) is marred by the high prevalence of infectious agents, chronic blood shortage and lack of resources. The WHO encourages blood donation from voluntary donors because this kind of donation believed to have lesser chance harboring and transmitting TTIs [1].

التعليق [DS228]: is

In ASS such as Gabon, data on co-infection of TTIs are lacking, and the influence of geographic variability, ethnicity and socioeconomic factors on these infections has not been studied in urban ureas. Studies on the sero-prevalence of HBV co-infection and the associated risk factors are needed.

التعليق [DS229]: areas

The overall seroprevalence of HBV infections in this study was 5.5%, which was similar to the study done by previous studies conducted in Gabon [14, 11]. Our findings contrasted with those reported by Groc *et al*. who showed intermediate seroprevalence of HBV in general population [10]. The situation described concerning HBsAg seropositivity among blood donors at the Gabonese NBTC would rather indicate a positive impact of measures to control this infection in the general population and not the effectiveness of the conventional blood safety strategy. This rate was also reported in other African countries [15, 16, 17, 18].

التعليق [DS230]: remove it

التعليق [DS231]: ??

We found that HBV, HCV, Syphilis and co-infection are relatively common in Gabon. HBV co-infection seroprevalence was highest among male gender. In particular, it is interesting to note that cases of HCV and Syphilis were more common among the younger and older age. HBV/HCV or HBV/Syphilis infection seroprevalence decreased with the age of the donors. In the case of syphilis, this may represent a proportion of undisclosed infections given the existing stigma associated with syphilis. While transmission of HCV through injecting drug use is an underappreciated problem [19], and since it is considered a taboo practice, it is also likely to be undisclosed. HBV exposure with HCV infection and syphilis, suggesting that the ongoing HBV transmission in adulthood could be sexual, as has been reported in some other African countries [20, 21, 22]. HBV/HCV and HBV/Syphilis profile rate were similar to the study done by previous studies conducted in Equatoriale Guinea [23].

التعليق [DS232]: age groups

التعليق [DS233]: rates

التعليق [DS234]: remove it

Although our results also showed increased HBsAg seropositivity with age, the peak prevalence was observed in the older age group. Increased overt HBV infection among the adult population has also been reported among blood donors of Gabon [14, 11]. This observation was also

التعليق [DS235]: in

التعليق [DS236]: adulthood,

reported in other African countries [23, 24] in adulthood suggesting ongoing adult transmission associated with a low prevalence of chronic HBV.

Global variation in the spectrum of HBV-related disease is substantial in part due to variation in the modes of transmission and natural history of infection. Regarding demographic and behavioral factors, several factors have been associated. Male gender (aOR= 2.5 (95% CI : 1.14-5.58), *P=0,02*), First-time donor status (aOR= 11.06 (95% CI : 5.34-22.9), *P=0.01*) and residence (outside Libreville vs Libreville) (aOR= 2.52 (95% CI : 1.09-5.83), *P= 0.03*) were associated with HBsAg seropositivity. In our study, we find that gender male more than 2.5 times the odds of being HBsAg positive than gender female while adjusting for other factors, but it was similar to finding reported among gabonese blood donor in 2018 [11]. Volunteer blood donors, in particular the young volunteers representative of the demography currently recruited to replace family replacement donors in Gabon, are a self-selected healthy group of people who were screened for the potential risk factors such as homosexuality, intravenous drug abuse, history of diabetes and presence of several sexual partners [25]. These behaviours risks were not associated with overt HBV infection in this study because the subjects were excluded from donation some donors may conceal exposure to high risk factors in the questionnaire. Male gender, first-time donors status and residence are the major transmission factors of HBV infection in our study and remains similar compared to the study done by previous studies conducted in african countries [26, 27].

التعليق [DS237]: found

التعليق [DS238]: had

التعليق [DS239]: to the finding reported among Gabonese blood donors

التعليق [DS240]: behavioral

التعليق [DS241]: donor

التعليق [DS242]: remain

التعليق [DS243]: studies

التعليق [DS244]: African

Our study had some limitations. This study was cross-sectionally designed, and detection of HBV was based on HBVsAg marker without considering IgM and IgG antibodies to the core protein ideal for a complete diagnosis of infection stages. Thus hepatitis B seroprevalence may be underestimate or overestimated in the population when using the HBsAg positive rate as the level of chronic HBV infection. Additionally, the sample sizes was limited, the study period was semingly short. A more precise classification of risk factors questionnaire could be assessed in later studies, along with more potential factors, such as urban and rural blood bank.

التعليق [DS245]: On the

التعليق [DS246]: S,

التعليق [DS247]: underestimated

التعليق [DS248]: size

التعليق [DS249]: and the

التعليق [DS250]: seemingly

التعليق [DS251]: banks

CONCLUSION

This present survey reports gives clear insights into the epidemiological status of HBV and co-infection. The important demographic and behavioural factors were male gender, first-time donor status and residence. Conventional approaches to assuring blood product safety through donor questioning and laboratory testing have been highly effective for controlling risks from

التعليق [DS252]: report

التعليق [DS253]: behavioral

التعليق [DS254]: deter

التعليق [DS255]: donors

the major blood transmissible diseases. These provide useful information in the development of individual pre-donation questionnaires to defer those at risk from donating blood. Our study highlights that the main blood transfusion centre in Gabon is firmly reliant on blood donor, which is in line with the existing blood transfusion practice in the majority of countries in SSA.

Consent to publication

Not Applicable.

Availability of data and materials

Data used for this study is available on request

Ethics declarations

Ethics approval and consent to participate

Informed consent was taken from patients and controls and ethical clearance was taken from the Gabonese National Ethical Committee for research (authorization n° 0088/2019/PR/SG/CNER). The study was explained to each participant, and a written informed consent was obtained before enrollment to the study. Participants who found to be seropositive for hepatitis B virus were channelled to the appropriate clinics for further evaluation and management.

REFERENCES

1. World Health Organization. *GLOBAL HEPATITIS REPORT*. WHO, Editor. 2017.
2. Word Health Organization. *HEPATITIS B.*WHO, Editor. 2022
3. Matthews, P.C., Geretti, A.M., Goulder, P.J., Klenerman, P. Epidemiology and impact of HIV coinfection with hepatitis B and hepatitis C viruses in Sub-Saharan Africa. Journal of clinical virology, (2014), 61(1), 20–33. https://doi.org/10.1016/j.jcv.2014.05.018
4. Béguelin, C., Fall, F., Seydi, M., Gilles Wandeler, G. The current situation and challenges of screening for and treating hepatitis B in sub-Saharan Africa, Expert Review of Gastroenterology & Hepatology (2018):, DOI: 10.1080/17474124.2018.1474097
5. Bivigou-Mboumba B., Rouet F., Mouinga-Ondeme A.1, Deleplancque L., Sica J., Ndjoyi-Mbiguino A. , Njouom R.4 , Fran9ois-Souquiere S. Hepatitis B, C, and E infection among HIV-

infected patients in Franceville, Gabon: retrospective cross-sectional study. Me´decine et Sante´ Tropicales 2017 ; 27 : 274-280

6. Nambei, W.S., Rawago-Mandjiza, D., Gbangbangai, E. Seroepidemiology of HIV, syphilis and hepatitis B and C viruses among blood donors in Bangui, Central African Republic. Medecine et sante tropicales (2016)., 26(2), 192–198. https://doi.org/10.1684/mst.2016.0553
7. Noubiap, J.J.N., Aka, P.V., Nanfack, A.J., Agyingi, L.A., Ngai, J.N., Nyambi, P.N. Hepatitis B and C co-infections in some HIV-positive populations in Cameroon, West Central Africa: Analysis of samples collected over more than a decade. PloS one, (2015). 10(9), e0137375. https://doi.org/10.1371/journal.pone.0137375
8. François-Souquière, S., Makuwa, M., Bisvigou, U., Kazanji, M. (2016). *Epidemiological and molecular features of hepatitis B and hepatitis delta virus transmission in a remote rural community in central Africa*. Infection, Genetics and Evolution, *39*, 12–21. https://doi.org/10.1016/j.meegid.2015.12.021
9. Yooda, A.P., Sawadogo, S., Soubeiga, S.T., Obiri-Yeboah, D., Nebie, K., Ouattara, A.K., Diarra, B., Simpore, A., Yonli, Y.D., Sawadogo, A.G., Drabo, B.E., Zalla, S., Siritié, A.P., Nana, R.S., Dahourou, H., Simpore, J. (2019). *Residual risk of HIV, HCV, and HBV transmission by blood transfusion between 2015 and 2017 at the Regional Blood Transfusion Center of Ouagadougou, Burkina Faso*. Journal of Blood Medicine:10 53–58. http://dx.doi.org/10.2147/JBM.S189079.
10. Groc, S., Abbate, J.L., Le Gal, F., Gerber, A., Tuaillon, E., Albert, J.L., Nkoghé, D., Leroy, E.M., Roche, B., Becquart, P. (2019). *High prevalence and diversity of hepatitis B and hepatitis delta virus in Gabon.* Journal of viral hepatitis, 26(1), 170–182. https://doi.org/10.1111/jvh.12991

11. Mba, J.M.E., Bisseye, C., Ntsame Ndong, J.M., Mombo, L.E., Bengone, C., Mouelet Migolet, G., M'batchi, B., Kosiorek, H.E., Butterfield, R.J., Roberts, L.R. (2018). *Prevalent hepatitis B surface antigen among first-time blood donors in Gabon*. PLoS One, 13(4), e0194285. https://doi.org/10.1371/journal.pone.0194285

12. Olotu, A.A., Oyelese, A.O., Salawu, L., Audu, R.A., Okwuraiwe, A.P., Aboderin, A.O. *Occult Hepatitis B virus infection in previously screened, blood donors in Ile-Ife, Nigeria : Implications for blood transfusion and stem cell transplantation*. Virology journal, (2016), 13, 76. https://doi.org/10.1186/s12985-016-0533-3

13. Seed, C.R. Screening and confirmatory testing strategies for the major transfusion-transmissible viral infections. International Society of Blood Transfusion, ISBT Science Series (2014) 9, 6–13.

14. Bisseye, C., Mombo, L.E., Bie, S.M.M., Edou, A., Eko-Mba, J.M., Etho-Mengue, J.C., Mbacky, K., Mongo-Delis, A., M'batchi, B., Nagalo, B.M. (2018). *Trends of blood-borne infectious diseases in a rural blood donation center of southeast Gabon (Koula-Moutou)*. The Pan African Medical Journal, 31(1). https://doi.org/10.11604/pamj.2018.31.81.16331

15. Fopa, D., Candotti, D., Tagny, C.T., Doux, C., Mbanya, D., Murphy, E.L., Kenawy, H.I., El Chenawi, F., Laperche, S. (2019). *Occult hepatitis B infection among blood donors from Yaoundé, Cameroon*. Blood Transfusion, 17(6), 403. **https:**//doi.org/10.2450/2019.0182-19

16. Kabamba, A.T., Kalunga, B.T., Mwamba, C.M., Nyembo, C.M., Dufrasnec, F., Dessillyc, G., Kabamba, B.M., Longanga, A.O. Epidemiological aspects and molecular characterization of the hepatitis B virus among blood donors in Lubumbashi, Democratic Republic of Congo. Société franc¸aise de transfusion sanguine (SFTS). 1246-7820. https://doi.org/10.1016/j.tracli.2020.10.012

17. Mohamed, Z., Kim, J.U., Magesa, A., Kasubi, M., Feldman, S.F., Chevaliez, S., Mwakale, P., Taylor-Robinson, S.D., Thursz, M.R., Shimakawa, Y., John Rwegasha, J., Lemoine, M. High prevalence and poor linkage to care of transfusiontransmitted infections among blood donors in Dar-es-Salaam, Tanzania. J Viral Hepat. 2019;26:750–756. DOI: 10.1111/jvh.13073

18. Twagirumugabe, T., Swaibu, G., Walker, T.D., Lindh, M., Gahutu, J.B., Bergström, T., Norder, H. (2017). *Hepatitis B virus strains from Rwandan blood donors are genetically similar and form one clade within subgenotype A1*. BMC Infectious Diseases 17(1):32. https://doi.org/10.1186/s12879-016-2149-z

19. Layden, J.E., Phillips, R.O., Owusu-Ofori, S., Sarfo, F.S., Kliethermes, S., Mora, N., Owusu, D., Nelson, K., Opare-Sem, O., Dugas, L., Luke, A., Shoham, D., Forbi, J.C., Khudyakov, Y.E., Cooper,R.S. High Frequency of Active HCV Infection Among Seropositive Cases in West Africa and Evidence for Multiple Transmission Pathways. Clinical Infectious Diseases 2015;60(7):1033–41. DOI: 10.1093/cid/ciu965

20. Awili, H.O., Gitao, G.C., Muchemi, G.M. Seroprevalence and Risk Factors for Hepatitis B Virus Infection in Adolescent Blood Donors within Selected Counties of Western Kenya. BioMed Research International Volume 2020, Article ID 8578172, 6 pages https://doi.org/10.1155/2020/8578172

21. Boushab Mohamed Boushab, Ould Cheikh Melaïnine Mohamed Limame, Fall-Malick Fatim Zahra , Savadogo Mamoudou, Belizaire Marie Roseline Darnycka, Sow Mamadou Saliou. Estimation of seroprevalence of HIV, hepatitis B and C virus and syphilis among blood donors in the hospital of Aïoun, Mauritania. Pan African Medical Journal. 2017; 28:118 doi:10.11604/pamj.2017.28.118.12465

22. Onyango, C.G., Ogonda, L., Guyah, B., Okoth, P., Shiluli, C., Humwa, F., Opollo, V. Seroprevalence and determinants of transfusion transmissible infections among voluntary blood donors in Homabay, Kisumu and Siaya counties in western Kenya. BMC Res Notes, (2018). 11:171. https://doi.org/10.1186/s13104-018-3276-y

23. Xie, D.-D., Li, J., Jiang-Tao Chen, Urbano Monsuy Eyi, Rocio Apicante Matesa, Maximo Miko Ondo Obono, Carlos Sala Ehapo, Li-Ye Yang, Hui Yang, Hui-Tian Yang, Min Lin. Seroprevalence of Human Immunodeficiency Virus, Hepatitis B Virus, Hepatitis C Virus, and Treponema pallidum Infections among Blood Donors on Bioko Island, Equatorial Guinea. PLoS ONE 10(10): e0139947. doi:10.1371/ journal.pone.0139947

24. Osei E, Lokpo SY, Agboli E. Seroprevalence of hepatitis B infection among blood donors in a secondary care hospital, Ghana (2014): A retrospective analysis. BMC Research Notes [Internet]. Springer Science and Business Media LLC. 2017;10(1). DOI: 10.1186/S13104-017-2733-3

25. World Health Organization (WHO) (2008). Universal access to safe blood transfusion. Available: http://www.who.int/bloodsafety/universalbts/en

26. Abebe, M., Alemnew, B., Biset, S. Prevalence of Hepatitis B Virus and Hepatitis C Virus among blood donors in Nekemte blood bank, western Oromia, Ethiopia: retrospective 5 years study. Journal of Blood Medicine 2020; 11, 543-550. http://doi.org/10.2147/JBM.S282099

27. Jary, A., Dienta, S., Leducq, V., Quentin Le Hingrat, Cisse, M., Diarra, A.B. , Fofana, D.B. , Ba, A., Baby, M. , Achenbach, C.J. , Murphy, R., Calvez, V., Anne-Geneviève Marcelin, A.- G., Maiga, A.I. Seroprevalence and risk factors for HIV, HCV, HBV and syphilis among blood donors in Mali. BMC Infectious Diseases (2019) 19:1064. https://doi.org/10.1186/s12879-019-4699-3

Table 1 Prevalence of HBV and co-infection among blood donors by sex

	No. Positive (%)		Ratio	Total (%)
	Male	**Female**	**M:F**	**No. Positive (%)**
Prevalence of HBV infection	75 (85.2%)	13 (14.8%)	(5.8 :1)	88 (5.5%)
Co-infection of HBV/HCV	1 (100%)	0 (0%)	(1 :0)	1 (0.06%)
Co-infection of HBV/Syphilis	2 (100%)	0 (0%)	(2 :0)	2 (0.12%)
Co-infection of HBV/HIV	0	0		

% : percentage

Table 2 Risk factors associated with HBV positivity

Variables	Univariate analysis		Multivariate analysis	
	Crude OR, CI95%	***P-value***	**aOR, CI95%**	***P-value***
Age (20-29 vs 30-49)	1 [0.97-1.04]	*0.71*		-
Male gender	1.82 [0.89-3.71]	*0.1*	2.5 [1.14-5.58]	***0.02***
First-time donor statut	10.6 [5.25-21.42]	*0.00001*	11.06 [5.34-22.9]	***0.01***
Residence*	3.89 [1.88-8.08]	*0.0003*	2.52 [1,09-5.83]	***0.03***
Less than graduate	1.69 [0.98-2.92]	*0.06*	1.6 [0.85-2.99]	*0.15*
Blood exposure	3.01[0.19-48.83]	*0.44*	-	-
Non-vaccination for HBV	0.88 [0.47-1.64]	*0.68*	-	-

*Residence (Outside Libreville vs Libreville)

OR : Odds ratio with 95% confidence Intervals.

Bold/italic was used for significant (P < .05) results.

aOR : Adjusted odds ratios

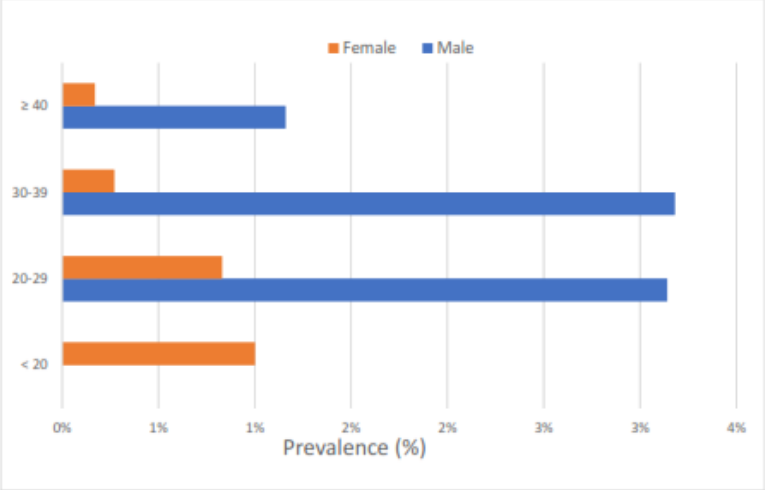

Figure 1. Seroprevalence of hepatitis B infections by sex and age group, Gabonese National Blood Transfusion Centre, 2020.