



Hepatitis B Virus Awareness and Vaccine Coverage among Voluntary Blood Donors in Jos: Implication for Eradicating the Hepatitis B Virus

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Hepatitis B virus (HBV) is one of the leading causes of chronic viral infections worldwide. The World Health Organization (WHO) aims to eliminate HBV as a global health threat by 2030. Our study, therefore, aimed to identify factors that may hinder the WHO's objective of eradicating HBV in our environment and suggests ways of addressing them.

We conducted a survey at the National Blood Transfusion Service, Jos, among voluntary non remunerated blood donors (VNRBD) aged 18-65 years from October to December 2020 using

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structured questionnaires addressing awareness of HBV, vaccine uptake, socio-demography, and other information. Of the 120 participants, 88.3% were aware of HBV. The majority (35.8%) had heard about the virus through Health talks given at schools and hospitals by health personnel, followed by Social media (25.5%), Family members (18.0%), Friends (13.2%), Taught in School (2.8%), Mass media (1.9%), Print media (1.9%) and told by a patient (0.9%). A Significant proportion of the population (63.6%) was found to be unvaccinated against HBV, citing unawareness of the vaccine (57.9%) and not knowing where to get the vaccine (21.6%) as reasons for non-uptake. The participants' sources of awareness of HBV vaccine were Health talk (40.9%), Social media (18.2%), Friends (15.2%), Family members (10.6%), taught in school (4.5%), Mass media (4.5%), Print media (4.5%), and told by a patient (1.5%). This study found that awareness of HBV among participants did not translate into increased vaccine uptake. We identified unawareness, poor accessibility and unavailability of the vaccine as obstacles for eradicating HBV in our setting. We recommend strengthening childhood immunization, teaching about vaccines at elementary schools, increasing social media utilization for vaccine information dissemination, and increased availability of the vaccine.

Keywords: *Hepatitis B virus; vaccine unawareness; voluntary non remunerated blood donors; World Health Organization.*

1. INTRODUCTION

Hepatitis B virus, a transfusion-transmissible pathogen, is a significant global health threat [1]. The virus can be transmitted vertically from mother to child and horizontally through sexual intercourse, blood transfusion, contact with saliva, and inoculations from contaminated sharps [2,3,4]. Occult HBV infection among blood donors threatens blood safety, especially in Sub-Saharan Africa, where the health system is weak and the virus is endemic [4,5,6]. The virus can withstand adverse conditions and remain viable on surfaces for several days [7,8]. The ability to establish latency, transmit through multiple means and produce drug resistance, has conferred on this virus a survival advantage and thus, has led to it establishing itself as one of the leading causes of chronic viral infections, with about 296 million people chronically infected worldwide in 2019 [9].

Several studies have reported an increased prevalence of the virus among blood donors, especially in Sub-Saharan Africa [10,11]. A significant proportion of blood discards and donor rejections were attributed to HBV [12]. Hepatitis B Virus infected Voluntary blood donors are more likely in endemic areas, increasing the chance of transfusing HBV infected blood [13].

Despite the availability of a potent vaccine, HBV still retains a global presence suggesting a gap in vaccination [9]. The World Health Organization strategized to eliminate HBV as a worldwide health threat and aimed at reducing new infections by 90% and deaths from the virus by

65% by the year 2030 [9]. As contaminated blood is an important source of HBV infection, universal access to and uptake of the HBV vaccine by blood donors is critical in preventing new HBV infection; this will ensure that blood donors are HBV-free and safe blood is availability for transfusion. This study, therefore, seeks to identify some of the factors that may hamper the process of eradication of HBV in our environment and delay the realization of the WHO's objective of eliminating HBV as a global threat.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted at the National Blood Transfusion Service (NBTS), North-Central Zone of Nigeria. The NBTS is located in Jos, the capital of Plateau State, and it serves the blood needs of Plateau State and the neighbouring states of Bauchi, Kaduna, Benue, Nasarawa Taraba.

2.2 Study Design

The work was a cross-sectional facility-based study conducted between October and December 2020. The participants were VNRBD aged 18 – 65 years who presented at the regional NBTS centre for blood donation. When the volunteers arrived for blood donation, the objective of our study was explained to them. All the participants gave informed consent and were subsequently recruited until the desired sample size of 120 was attained. Each participant was

asked to fill a structured questionnaire that collected socio-demographic information, HBV immunization history, and other details pertaining to awareness of HBV and the vaccine.

2.3 Sample Size Determination

The sample size of 120 was arrived at using the following formula:

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

n = is the desired sample size

z = is the standard error. The standard error usually set as 1.96 which corresponds to the 95% confidence level

p = is the prevalence of hepatitis B virus among voluntary blood donors in our environment which is 13.8% [14]

d = is the degree of error tolerable in this study, usually set as 0.05

$$n = \frac{1.96 \times 0.138 (1-0.138)}{0.05 \times 0.05}$$

n = 93

Considering an attrition rate of 10% and the desire to increase representation, a sample size of 120 was considered.

2.4 Data Analysis

Data obtained were cleaned, coded and entered into a predesigned excel spreadsheet and subsequently analyzed using the IBM Statistics for Windows, version 23.0 (Chicago, IL: IBM Corp). Mean, and Standard deviation was used to summarize normally distributed continuous variable. Chi-square was used to test the associations between categorical variables. A p-value <0.05 was considered significant. Results were presented using tables and charts.

3. RESULTS

The blood donors' mean age was 36.12 ± 10.22, and an age range of 18-58 years with a mean (± SD) of 36.12 ± 10.22 years, and a median age of 35 years (Table 1). The highest frequency of donors belonged to the age group of 28-37 years. There were more males (71.7%) than females (28.3%) with a Male-Female ratio of 2.5:1 (Table 1). The majority, 41 (34.2%) of blood donors were self-employed, 34 (28.3%) were civil

servants, 26 (21.7%) were students, 6 (5.0%) were businessmen and women, while others, including security personnel and clergies, accounted for 10.8% of the subjects. Ninety-six (80.0%) participants had tertiary level education, while those with secondary and primary education were 18.3% and 1.7%, respectively (Table 1). Sixty-four (53.3%) participants were married, followed by 53 (46.7%) who were unmarried (Table 1).

All the participants (100%) were voluntary non-remunerated donors. First-time and Repeat donors were 16.7% and 83.3%, respectively (Fig. 1). The number of times the repeat donors donated blood ranged from 2 to 34 times; seventy of them had donated blood ≤ ten times (Table 2).

Regarding knowledge of the HBV, 106 (88.3%) had heard about the virus, while 14 (11.7%) had not (Table 3). Of those who were aware of the virus, the majority (35.8%) had heard about it through Health talks, followed by Social media (25.5%), Family member (18.0%), and Friends (13.2%). Other sources were: Taught in school (2.8%), Mass media (1.9%), Print media (1.9%), and told by a patient (0.9%) (Table 3). Regarding the awareness of HBV vaccine, sixty six (55.5%) were aware, while fifty four (45.5%), were unaware (Table 3). The sources of awareness of the vaccine were as follows: Health talk (40.9%), Social media (18.2%), Friends (15.2%), Family members (10.6%), taught in school (4.5%), Mass media (4.5%), Print media (4.5%), and told by a patient (1.5%) (Table 3).

The majority (63.6%) of the participants were unvaccinated against the hepatitis B virus, while 36.7% had received the vaccine (Table 4). Forty-four (57.9%) unvaccinated participants were unaware that hepatitis B has a vaccine; 16 (21.1%) did not know where to get the vaccine; 6 (7.9%) had no time to get vaccinated, 3 (3.9%) felt there was no need to get vaccinated because they tested negative for the virus; while 7 (9.2%) gave no reason why they did not receive the vaccine. The majority (70.5%) of those who were vaccinated had had the recommended three doses, while the remaining 29.5% had not (Table 4). There was no statistically significant difference between educational level and compliance with the recommended three doses of the HBV vaccine (Fisher-exact p value ~ 0.570) (Table 5).

Table 1. Socio-demographic characteristics of Blood Donors in Jos between October and December 2020

Demographic characteristics	Frequency	Percentage
Age group		
18-27	25	20.8
28-37	48	40.0
38-47	26	15.8
48-57	19	21.7
58-67	2	1.7
Gender		
Male	86	71.7
Female	34	28.3
Educational level		
Tertiary	96	80.0
Secondary	22	18.3
Primary	2	1.7
Marital status		
Married	64	53.3
Single	56	46.7
Occupation		
Self-employed	41	34.2
Civil servants	34	28.3
Student	26	21.7
Business	6	5.0
Others	13	10.8

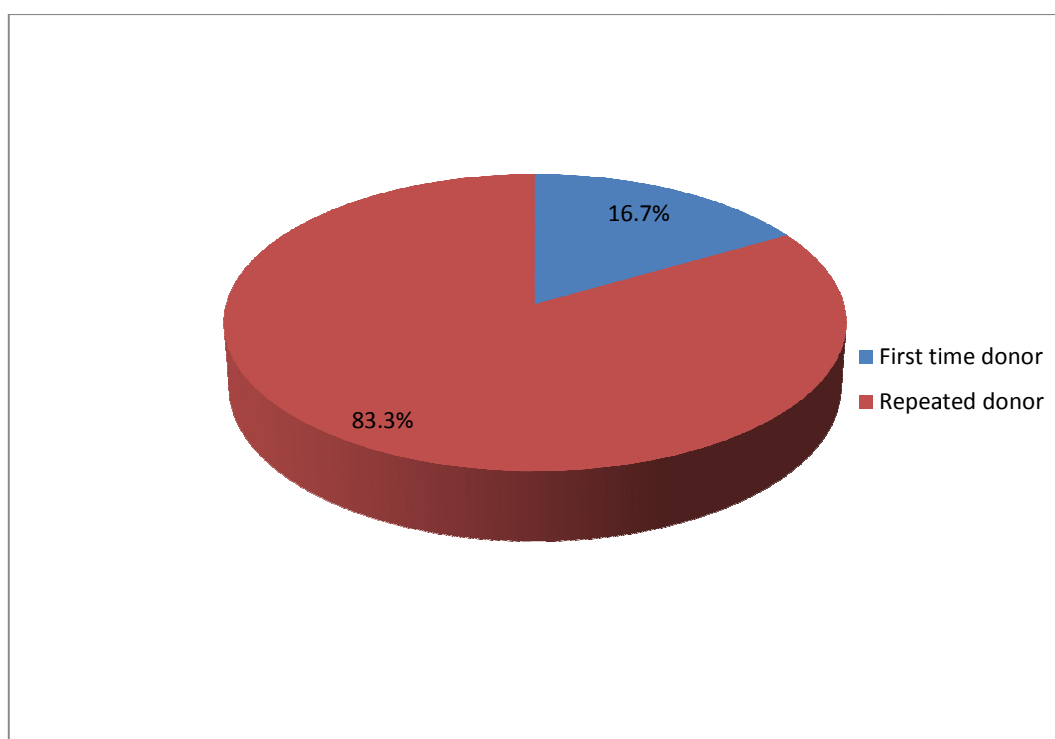


Fig. 1. Type of voluntary blood donors at the NBTS Jos, between October and December 2020

Table 2. Number of times Repeat Voluntary Blood donors donated blood at the NBTS Jos, between October and December 2020

Grouping	Frequency (n=99)	Percentage
≤10	70	70.7
11-20	19	19.2
>20	10	10.1

Table 3. Awareness of Hepatitis B Virus and Vaccine among Voluntary Blood donors in Jos, between October and December 2020

Variables	Frequency	Percentage
Aware of hepatitis B virus		
Yes	106	88.3
No	14	11.7
Source of awareness of hepatitis viruses (n=106)		
Health talk	38	35.8
Social media	27	25.5
Family member	19	18.0
Friends	14	13.2
Taught in school	3	2.8
Mass media	2	1.9
Print media	2	1.9
A patient	1	0.9
Aware of hepatitis B vaccine		
Yes	66	55.5
No	53	45.5
Source of awareness of hepatitis B vaccine (n=66)		
Health talk	27	40.9
Social media	12	18.2
Family member	10	15.2
Friends	7	10.6
Taught in school	3	4.5
Mass media	3	4.5
Print media	3	4.5
A patient	1	1.5

Table 4. Hepatitis B Vaccine uptake among Voluntary Blood donors in Jos, between October and December 2020

Variables	Frequency	Percentage
Vaccination status		
Vaccinated	44	36.7
Unvaccinated	76	63.3
Reasons for not vaccinated (n=76)		
Not aware of the vaccine	44	57.9
Don't know where to get the vaccine	16	21.1
No time to get vaccinated	6	7.9
Tested negative	3	3.9
No reason	7	9.2
Completed recommended 3 doses (among those who got vaccinated) n=44		
Completed	31	70.5
Not completed	13	29.5
Received vaccine (among those that were aware of hepatitis B vaccine) n=66		
Yes	41	62.1
No	25	37.9

Table 5. Association between Level of Education and Compliance with the recommended HBV vaccine doses among blood donors between October and December 2020

Educational level	Compliance with recommended 3 doses		X ²	p-value
	Completed	Not completed		
Primary	0(0.0)	0(0.0)	0.884	0.347(0.570*)
Secondary	2(50.0)	2(50.0)		
Tertiary	29(72.5)	11(27.5)		

*Fisher's exact p-value

4. DISCUSSION

The level of awareness of HBV was high among study subjects in this study, which was higher than the findings by Majolegbe et al. [15] and Boutayeb et al. [16]. Studies on the awareness of HBV among blood donors are few; most studies looked at non-blood donors [17,18,19]. Improved knowledge of HBV and other transfusion transmissible pathogens in the general population may translate into more blood donors knowing about pathogens, their modes of transmission, and preventive measures being taken as blood donors are derived from the population. The majority of the study subjects learnt about HBV through health talks given at hospitals, places of worship, and schools. Health talks at schools and places of worship are given by health personnel on invitation or through non-governmental initiatives outside the hospital setting. Social media was the source of information on HBV in a significant proportion of the participants, bringing to bear a role social media can play in the containment of HBV as a global threat, especially among the younger population. Only few study participants were taught about HBV in school, implying that many students pass through schools without acquiring a basic knowledge of some of these vaccine-preventable viruses and risk being infected in their ignorance. By integrating basic information on vaccine-preventable pathogens in Health education classes at grade levels and secondary schools, the population will be equipped with the basic information on the virus, mode of transmission, vaccination and other preventative measures against the pathogens.

This study found suboptimal vaccine uptake among the participants. Several studies corroborated our finding of low vaccine uptake [20,21,22]. However, the majority of the vaccinated participants in this study completed the recommended three doses of the vaccine. Though most of the study subjects who did not complete the three doses of the vaccine had tertiary level education, there was no statistically

significant association between educational level and compliance with the recommended dosage of the vaccine. The poor compliance may result from a lack of information at vaccination points on the recommended doses that clients needed to take. Some clients may have experienced adverse events, influencing them to stop further vaccination. At vaccination points, complete and accurate information about the recommended doses should be made available to clients and they should also be advised to report any side effects of the vaccine; this may improve vaccine acceptance and compliance.

Despite the impressive level of awareness of HBV, a significant proportion of the unvaccinated population is unaware that HBV has a vaccine and cited it as the main reason for non-uptake. Hepatitis B virus vaccine unawareness as a reason for non-vaccination was also reported in other studies [22,23,24]. As seen in this study and others, high-level HBV vaccine awareness did not translate into increased vaccine uptake, suggesting a role played by other factors [25,26,27]. The lack of information on where to get the vaccine, as cited by some of our subjects, may be the reason for decreased uptake in the other studies. In some studies, the unavailability of the vaccine constituted a reason for non-uptake [28,29,30,31]. Deficiency in the knowledge of the existence of the vaccine and where to access it can impede the WHO's effort at eradicating HBV. A comprehensive approach integrating information about the existence of HBV, its effect on human health, preventive measures, and the availability of an effective vaccine against it should be adopted. The vaccine should be made easily accessible to the population and at affordable cost. The various sources of awareness of the viruses enumerated in this study can be targeted for disseminating the correct information. The training and retraining of health personnel giving health talks in hospitals and worship places will ensure that clients' questions are properly addressed. This will reduce vaccine hesitancy and improve acceptability. As found in the study, Social media

can become a powerful tool for creating awareness of the HBV vaccine and its use.

The identified gaps must be bridged to ensure universal vaccine coverage among the population. As blood donors are derived from the society, enhanced vaccine coverage will positively affect blood safety as more HBV-free blood donors will be available for retention, reducing the risk of introducing contaminated units into the transfusion chain and minimizing the haematogenous spread of the virus.

5. CONCLUSION

This study identified critical gaps that can hinder the eradication of HBV as a global health threat: sub-optimal vaccination, HBV vaccine unawareness and accessibility issues. We recommend wider information dissemination on the virus, the modes of transmission, the health impact, and the effective vaccine against it. This information should be made available to the younger generation early in life, especially during their formative years in schools. Mandatory screening for HBV in schools and vaccination of students would reduce the burden of HBV in the population. A concerted effort by government and non-governmental organizations at all levels to increase vaccine availability and accessibility is required to reduce the burden of HBV globally.

6. LIMITATIONS

The study relied on self-reported HBV vaccine uptake by participants and did not assess their seroconversion status, which could have permitted us to assess vaccine efficacy.

CONSENT

Participants consent sought to enroll them as participants in the study.

ETHICAL APPROVAL

The study was conducted as a part of an extensive study titled 'Immunization Status of Voluntary Blood Donors in Jos, and its Implication on Safe Blood Transfusion Practice.' Ethical approval was obtained from the NBTS before the work was carried out.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Wong GL, Wong VW. Eliminating hepatitis B virus as a global health threat. *The Lancet Infectious Diseases*. 2016;16:1313-4.
DOI: 10.1016/S1473-3099(16)30214-6
2. Stasi C, Silvestri C, Voller F. Emerging Trends in Epidemiology of Hepatitis B Virus Infection. *J Clin Transl Hepatol*. 2017;5:272-6.
DOI: 10.14218/JCTH.2017.00010.
3. Nakano LA, Katayose JT, Abreu RM, Mendes LC, Martins MC, Pinto VB, et al. Assessment of the prevalence of vertical hepatitis B transmission in two consecutive generations. *Rev. Assoc. Med. Bras*. 2018;64:154-8.
DOI:10.1590/1806-9282.64.02.154
4. Keane E, Funk AL, Shimakawa Y. Systematic review with meta-analysis: The risk of mother-to-child transmission of hepatitis B virus infection in sub-Saharan Africa. *Alimentary pharmacology & therapeutics*. 2016;44:1005-17.
DOI:10.1111/apt.13795
5. Said ZN, Sayed MH, Salama II, Aboel-Magd EK, Mahmoud MH, Setouhy ME, et al. Occult hepatitis B virus infection among Egyptian blood donors. *World J Hepatol*. 2013;5:64-73.
DOI: 10.4254/wjh.v5.i2.64.
6. Fopa D, Candotti D, Tagny CT, Doux C, Mbanya D, Murphy EL, et al. Occult hepatitis B infection among blood donors from Yaoundé, Cameroon. *Blood Transfus*. 2019;17:403-8.
DOI: 10.2450/2019.0182-19.
7. Than TT, Jo E, Todt D, Nguyen PH, Steinmann J, Steinmann E, et al. High Environmental Stability of Hepatitis B Virus and Inactivation Requirements for Chemical Biocides. *J Infect Dis*. 2019;219:1044-8.
DOI: 10.1093/infdis/jiy620.
8. König A, Than TT, Todt D, Yoon SK, Steinmann J, Steinmann E, et al. High tolerance of hepatitis B virus to thermal disinfection. *Journal of hepatology*. 2019;71:1249-51.
DOI:10.1016/j.jhep.2019.08.022
9. World Health Organization. Hepatitis B. Available: <https://www.who.int/news-room/fact-sheets/detail/hepatitis-b> Accessed on 14th May 2021
10. Nwobegahay JM, Njukeng PA, Kengne M, Ayangma CR, Abeng E, Nkeza A, et al.

- Prevalence of Hepatitis B virus infection among blood donors at the Yaounde Military Hospital, Cameroon. *Micro Res In.* 2016;2:6-10.
11. Eko Mba JM, Bisseye C, Ntsame Ndong JM, Mombo LE, Bengone C, Moelet Migolet G, et al. Prevalent hepatitis B surface antigen among first-time blood donors in Gabon. *PLoS One.* 2018;13:e0194285.
DOI:10.1371/journal.pone.0194285
 12. Damulak OD, Bolorunduro S, Deme KS, Elisha ER, Itse A. Blood Discards in a Nigerian Transfusion Service Centre: The Implications in a Resource Poor Setting. *J Med Trop.* 2010;12.
DOI: 10.4314/jmt.v12i2.69315
 13. Seo DH, Whang DH, Song EY, Han KS. Occult hepatitis B virus infection and blood transfusion. *World J Hepatol.* 2015;7:600-6.
DOI: 10.4254/wjh.v7.i3.600.
 14. Dapus DO, Ogbenna A, Ma'an V, Rufai O, Kut SD, Bodunde T, et al. Hepatitis B virus sero-positivity among voluntary blood donors at a centralized blood service centre in Nigeria. *International Journal of Medical and Applied Sciences.* 2013;2:10-8.
 15. Majolagbe ON, Oladipo EK, Daniel LE. Prevalence and awareness of hepatitis B infection among blood donors in Abubakar Tafawa Balewa University Teaching Hospital (ATBUTH), Bauchi, Nigeria. *International Journal of Multidisciplinary and Current Research.* 2014;2:955-60.
 16. Boutayeb H, Aamoum A, Benchemi N. Knowledge about hepatitis B and C viruses and HIV among blood donors in Casablanca. *EMHJ - Eastern Mediterranean Health Journal.* 2006;12:538-547.
Available:<https://apps.who.int/iris/handle/10665/117115>
 17. Singh A, Jain S. Prevention of hepatitis B; knowledge and practices among medical students. *Healthline.* 2011;2:8-11.
 18. Abeje G, Azage M. Hepatitis B vaccine knowledge and vaccination status among health care workers of Bahir Dar City Administration, Northwest Ethiopia: A cross sectional study. *BMC infectious diseases.* 2015;15:1-6.
DOI: 10.1186/s12879-015-0756-8
 19. Tatsilong HO, Noubiap JJ, Nansseu JR, Aminde LN, Bigna JJ, Ndze VN, et al. Hepatitis B infection awareness, vaccine perceptions and uptake, and serological profile of a group of health care workers in Yaoundé, Cameroon. *BMC Public Health.* 2016;16:1-7.
DOI: 10.1186/s12889-016-3388-z
 20. El-Ghitany EM, Farghaly AG. Serological pattern of hepatitis B virus among Hbsag negative blood donors in Alexandria, Egypt. *East Mediterr Health J.* 2013;19:600-7.
PMID: 24975302.
 21. Bonsu A, Kwabena-Adu D, Obeng-Ofuri D. Utilization of Hepatitis B Vaccine among Blood Donors in the Kintampo North Municipal. *International Journal of Multidisciplinary Studies and Innovative Research.* 2021;4:37-51.
DOI:10.21681/IJMSIR-052301-16348-2021
 22. Abdo AE, Mohammed DA, Satti M. Prevalence of Hepatitis B virus among blood donors and assessment of blood donor's knowledge about HBV in Sudan. *HIV/AIDS Res Treat Open J.* 2015; 2:76-80.
DOI: 10.17140/HARTOJ-2-112
 23. Butt M, Khan IM, Ashfaq MW, Jamal M. Hepatitis B vaccination status among students of a medical college in Islamabad. *J Islam Med Dent Coll.* 2015;4:157-61.
 24. Mohanty P, Jena P, Patnaik L. Vaccination against Hepatitis B: A Scoping Review. *Asian Pac J Cancer Prev.* 2020;21:3453-3459.
DOI: 10.31557/APJCP.2020.21.12.3453.
 25. Chingle MP, Osagie IA, Adams H, Gwomson D, Emeribe N, Zoakah AI. Risk perception of hepatitis B infection and uptake of hepatitis B vaccine among students of tertiary institution in Jos. *Annals of African medicine.* 2017;16:59-64.
DOI:10.4103%2Faam.aam_49_16
 26. Kesieme EB, Uwakwe K, Irekpita E, Dongo A, Bwala KJ, Alegbeleye BJ. Knowledge of Hepatitis B Vaccine among Operating Room Personnel in Nigeria and Their Vaccination Status. *Hepat Res Treat.* 2011;2011:157089.
DOI: 10.1155/2011/157089.
 27. Sannathimmappa MB, Nambiar V, Arvindakshan R. Hepatitis B: Knowledge and awareness among preclinical year medical students. *Avicenna J Med.* 2019;9:43-7.
DOI: 10.4103/ajm.AJM_164_18
 28. Maina AN, Bii LC. Factors affecting HBV vaccination in a Medical training College in

- Kenya: A mixed methods Study. BMC Public Health. 2020;20:48.
DOI: 10.1186/s12889-020-8158-2.
29. Auta A, Adewuyi EO, Kureh GT, Onoviran N, Adeloje D. Hepatitis B vaccination coverage among health-care workers in Africa: A systematic review and meta-analysis. *Vaccine*. 2018;36:4851-60.
DOI: 10.1016/j.vaccine.2018.06.043.
30. Dayyab FM, Iliyasu G, Ahmad BG, Bako AT, Ngamariju SS, Habib AG. Hepatitis B vaccine knowledge and self-reported vaccination status among healthcare workers in a conflict region in northeastern Nigeria. *Ther Adv Vaccines Immunother*. 2020;8:2515135519900743.
DOI: 10.1177/2515135519900743.
31. Feleke BE. Low Coverage of hepatitis B vaccine and determinants among health professionals working in Amhara Regional State Hospitals, Ethiopia. *J Public Health Afr*. 2016;7:553.
DOI: 10.4081/jphia.2016.553

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