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Prevalence and Risk Factors of Hepatitis B Virus Infection among a Cohort of Primary Health Care Workers in Nigeria

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Abstract

Hepatitis B Virus (HBV) infection is one of the most infectious diseases globally. Nigeria is among the endemic countries for HBV, with a National prevalence of 11%. The Primary Healthcare Center (PHC) is critical for interrupting the transmission of HBV infection. Consequently, the baseline information concerning the prevalence, associated risk factors, and vaccination status of the health workers for HBV is required for the system strengthening, hence, the need for this study. To determine the prevalence of HBV among health workers in PHCs in AMAC, Abuja. 2. To identify the risk factors associated with HBV infection amongst this cohort. A hospital-based cross-sectional descriptive study involving 168 randomly selected PHC health workers. Data was collected with a structured questionnaire, and participants were screened for HBsAg. Data were analyzed using SPSS version 21.0 with results significant at p-value < 0.05. 168 respondents participated in the study, 65.5% were females, and the mean age was 34 +/- 9 years. The full vaccination rate was 44%, while the prevalence of HBV infection was 4.8%. The history of dental procedure was the only significant predictor of HBV infection, and those who had the dental procedure were thrice more likely to be infected with HBV than their counterparts (OR: 3.077). The prevalence of HBV in this study is low, per, National prevalence, but high for this cohort of health workers with a considerable Hepatitis B vaccination rate. There is a need to strengthen health workers' HBV screening and vaccination in addition to improving infection prevention and control in dental clinics/surgeries.

Keywords: *HBV Infection, Health-worker, Primary Healthcare Center, Prevalence, Risk Factors.*

Introduction

Hepatitis B infection is a systemic viral infection caused by the hepatitis B virus (HBV), which infects the liver, resulting in hepatocellular necrosis as well as liver cell inflammation [1]. HBV is a double-stranded DNA virus from the hepadnaviridae family, measuring about 42 nm containing a nucleocapsid core, the Hepatitis B Core Antigen (HBcAg), which measures about 27 nm. These components were surrounded by an outer envelope made of lipoprotein that hosts the Hepatitis B surface antigen [2]. The Hepatitis B virus causes an illness spectrum that ranges from asymptomatic to symptomatic, progressive, and severe disease conditions [1]. HBV (as well as hepatitis C and hepatitis D viruses) are the only viruses that can cause chronic infection among all the hepatotropic viruses known to cause liver inflammation [3]. Thus, HBV infection can be classified as either acute or chronic. The acute form is defined as the persistence of positive

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hepatitis B surface antigen (HBsAg) for less than six months, while the chronic form is defined as the persistence of HBsAg seropositivity for six months or more chronic form is classified as a major public health challenge [1]. The infection occurs in phases, starting with a simple acute infection which is self-limiting and can resolve spontaneously, to persistent chronic life-long infection, which may eventually lead to death [4].

Hepatitis B is a globally endemic disease, with about half of the World's population living in areas of high endemicity [1]. Countries can be categorized into three based on the HBsAg carrier rates, which are High endemicity (above 8% prevalence rate), intermediate endemicity (2-8% prevalence rate), and low endemicity (less than 2% prevalence rate). According to WHO estimates, 257 million people were living with chronic hepatitis B infection in 2015, and the condition resulted in an estimated 887 000 deaths, with most of the mortality coming from cirrhosis and hepatocellular carcinoma, which is primary liver cancer [5]. The 2016 global prevalence of Hepatitis B virus infection, according to Schad [6], 3.9%, with differing prevalence across the WHO regions of the World, namely: Western pacific region 6.2%, African region 6.1%, Eastern Mediterranean region 3.3%, Southeast Asia region 2.0%, and European region 1.6%, the Americas region 0.7% [5].

In Nigeria, there are about 22 million persons infected with Hepatitis B and a National prevalence of 11%, thus, positioning the Country as one of the highest endemic countries in the World.[7] However, some recent studies have reported differing prevalence rates across various subpopulations and regions in Nigeria. [3] recorded 6.7% prevalence among adult blood donors in Gombe State, while among pregnant women, [8] reported 8.5% in Abuja, [9] reported 8.3% in Ibadan, [10] reported 7.9% in Kano, while [11] recorded 6.7% prevalence in Ekiti. Elsewhere in Africa, among pregnant women, [12] found 5.4% in 2016, while [13] reported a 7.9% prevalence in 2019 both in Ethiopia (East Africa) and [14] recorded a 5.1% prevalence rate in Sudan (North Africa). However, among the general population in Senegal (West Africa), [15] reported an 11 % prevalence rate in 2019.

The transmission of HBV is mainly through percutaneous or mucosal exposure to infected blood and other body fluids. These are menstrual, vaginal, saliva, and seminal fluids [1]. However, in the areas of high endemicity, vertical transmission from a mother to child in utero/at birth and horizontal transmission via exposure to infected blood during the first five years of life from an infected child to an uninfected child becomes a very vital source of infection [5].

Sexual transmission of hepatitis B is also an important route of infection, predominantly in non-vaccinated men who have sex with men and heterosexual persons with multiple sexual partners or those patronizing commercial sex workers, in addition to those with a history of other STDs. Transmission of HBV may also occur through recycled needles and syringes either in healthcare settings or intravenous injection drug users. Besides, the infection can occur during dental, medical, and surgical procedures due to lapses in infection prevention & control measures through tattooing or using razors and similar objects contaminated with infected blood [5].

A review of some published studies in Nigeria and Sub-Saharan Africa revealed a range of risk factors associated with HBsAg seropositivity among pregnant women. For instance, Tanga et al., in Ethiopia, reported a history of abortion, unemployed status, and multiple sexual partners as significant risk factors associated with HBsAg seropositivity [13]. Other studies in Nigeria reported a history of blood transfusion, tattooing, abortion, ear piercing, and a nuclear family history of HBV infection as risk factors associated with HBV infection [10].

Furthermore, another study in Nigeria by [13] recorded multiple sexual partners and early age at sexual debut while [16] also reported the

above two factors as well as a history of sexually transmitted infection as significant risk factors for HBV infection among pregnant women in Nigeria. On the background of the above statistics, non-selective screening of all pregnant women as well as health education on lifestyle and sexual behavior modification should be important components of an effective HBV infection prevention and control program in our environment [16].

Justification

Hepatitis B viral infection, especially the chronic phase, is a major public health problem, a pandemic, affecting more of Low- and Middle-Income Countries (LMICs), including Nigeria, which are Countries with weak health systems capacity to deal with this public health challenge. Chronic hepatitis B is defined as persistent HBV infection, in other words, the presence of detectable Hepatitis B surface antigen in the blood or serum for longer than six months.

This health condition is associated with high morbidity and mortality; nevertheless, it is preventable and largely treatable. Perinatal transmission has been shown to result in a high rate of chronicity, thus, any effective intervention to interrupt this mode of transmission will be highly effective in controlling as well as eradicating HBV infection in the long term. Worldwide, about 650 000 people die each year from the complications of Chronic Hepatitis B viral infection. This mortality is mostly from cirrhosis and hepatocellular carcinoma, the complications of CHB affecting up to 30% of CHB patients [1].

It is important to note that the majority of the people presenting with these late complications of CHB are not aware of their HBV infection. Progression from acute to chronic HBV infection is common following acute infection in neonates (90% of neonates born to hepatitis B e antigen [HBeAg]-positive mothers) develop CHB and in young children under the age of 5 years (about 20–60%), but CHB rarely occurs (<5%) when the infection is acquired in adulthood. Across the globe, most people with CHB condition got infected at birth (in utero or peripartum) or in their early childhood [1].

Therefore, to tame the tide of the increasing prevalence of CHB over time and achieve the World Health Assembly 2016 Global Health Sector Strategy on Viral Hepatitis, which included specific targets to help in eliminating HBV and hepatitis C virus by 2030, [4] there is a need to employ a coordinated strategy, targeted at the routine screening of at-risk groups such as health-workers, universal screening of pregnant women for HBV, universal vaccination of all infants at birth, Vaccination of infants born to HBV seropositive mothers with HBIG, Management of labor/deliveries of all HBV seropositive women in a manner to reduce perinatal transmission as well as Management of Hepatitis B in all patients by the appropriate specialist.

The Primary Health Care system has a vital role to play in the fight to interrupt transmission of HBV infection, especially as most of our rural populace, especially women, patronize the PHCs for their ANC and other maternal and child health services. To re-position the Primary Health Care system to play this role, there is a need to know the prevalence of HBV infection among the health workers working in these PHCs, institute a universal screening mechanism for HBV in these PHCs, and increased access and uptake of Hepatitis B vaccine. These and other pertinent issues surrounding HBV infection prompted the inquiry to carry out this study.

Therefore, this study is timely which is aimed at evaluating the burden in terms of prevalence and risk factors of HBV infection among PHC health workers. The findings will inform recommendations to the appropriate authorities, and strategies that can help in reducing the burden of HBV infection in the FCT and, by extension Nigeria.

The objective of the study is to determine the prevalence of HBV among health workers

working in PHCs in AMAC, FCT, and Abuja. It is also to identify the risk factors associated with HBV infection amongst the health workers working in PHCs in AMAC, FCT, and Abuja.

Research Questions

1. What is the prevalence of HBV among health workers working in PHCs in AMAC, FCT, Abuja?
2. What are the risk factors associated with HBV infection amongst the health workers working in PHCs in AMAC, FCT, Abuja?

Materials and Methods

Study Area

The study area is Abuja Municipal Area Council (AMAC), Abuja, the Federal Capital Territory (FCT), of Nigeria. AMAC is one of the six area councils of the FCT. It has 12 political wards and hosts the metropolis of the administrative capital of Nigeria. The Nigeria Health System is designed to operate a three-tier national healthcare system, namely, the primary, secondary, and tertiary healthcare levels. Abuja, the FCT operates this health systems strategy, served by three Tertiary health institutions, 13 Secondary health facilities, and over 250 Primary health centers. The Abuja Municipal Area Council proposed for this study has 58 functional Primary Health Centers and 243 Health workers cutting across all cadres, as reported by the Management of the PHC department, AMAC. In Nigeria, the Primary health center serves as the entry point into the healthcare system and provides basic healthcare services to the populace as well as referrals to the higher level of care as the need arises.

Study Population

The study population will comprise all health workers on the employment of AMAC, working in all the 58 PHCs in Abuja Municipal Area Council of FCT, Abuja. According to the M/E, Planning, and research unit of the AMAC health department, the estimated total population is 243.

Study Design

This is a hospital-based, cross-sectional descriptive study conducted between September and November 2021.

Sample Size

The Cochran's formula was used to calculate the minimum sample size [17]. The formula is given as

$$\boldsymbol{n = Z^2 Pq / e^2}$$

Where:

n = sample size
Z = standard normal deviate at 95% confidence interval = 1.96
p = Is the (estimated) proportion of the population which has the attribute of interest = 0.11 [11% prevalence] [7]
q = 1-p
e = The margin of error set at 5%, (0.05)
n = 1.96^2 x 0.11 x (1- 0.11) / 0.05^2
n = 3.8416 x 0.11 x 0.89 / 0.05^2
n = 0.3760/0.0025 = 150

minimum sample size = 150.

To make adjustments for attrition, improperly filled questionnaires and non-responses, the sample size (N) was adjusted at the rate of 10%, giving 150 and rounded off to **165.**

Sampling Technique

A simple random sampling technique was used in selecting 176 health workers across the 58 functional PHCs in AMAC (30 PHCs x 4 participants + 28 PHCs x 2 participants = **176** participants) who consented to participate in the study. During the analysis, 8 questionnaires were excluded due to the incompleteness of the information, and 168 questionnaires were analyzed.

Data Collection Method

The data were collected using a structured self-administered questionnaire. These questionnaires were pre-tested prior to use. The HBsAg screening test was carried out using a

validated rapid test kit. Besides, three research assistants, who are two licensed Nurses/Midwives familiar with the local language, and a laboratory technician were recruited and trained to assist in data collection and screening for HBV.

Validity of Questionnaire

To ensure the validity of the questionnaire, it was pretested, critically scrutinized by peers, and validated by the research Guide/supervisor, who made necessary input to perfect the tool. Furthermore, the pre-test of the instrument was in non-project PHCs in neighboring Bwari Area Council of the FCT, with similar characteristics to the study populations, thus, helping to check the appropriateness of the variables as well as easy comprehension of the questions.

Reliability of the Instruments

The reliability coefficient of the questionnaire was determined from the pre-test using the Alpha-Cronbach test. A correlation coefficient that is greater than 0.5 was accepted and regarded as good reliability.

Data Collection Process

The validated structured questionnaires were administered with the help of the two Nurse/midwife research assistants. The laboratory technician conducted the Hepatitis B surface antigen screening test using the validated HbsAg rapid test kit.

Selection of Study Participants

The first two or four health workers depending on the PHC, who volunteered to participate were enrolled in the study. An informed consent form was signed by the participants before conducting the questionnaire interview and HbsAg screening test.

Inclusion Criteria

Health workers working in the PHCs in AMAC consented to participate in the study.

Data Analysis

Data were analyzed using SPSS version 21.0. Univariate analysis was performed to evaluate the distribution for each variable of interest. Multiple logistic regression analysis was done to identify the associated risk factors. Results was considered significant at a p-value < 0.05.

Ethical Consideration

The ethical approval was obtained from the FCT Health Research and Ethics Committee, HHSS, Federal Capital Development Authority, Nigeria. Moreover, all the participants who volunteered to participate in the study signed an informed consent form. Anonymity and confidentiality of the collected data were maintained during and after the study.

Results

Table 1. Socio-demographic Characteristics

Variable	Number of Respondents (N = 168)	Percentage (%)
Gender		
Male	58	34.5
Female	110	65.5
Age Range (Years)		
18-29	54	32.1
30-39	70	41.7
40-49	24	14.3
50-59	16	9.5
60-69	4	2.4
Marital Status		

Single	38	22.6
Married	120	71.4
Separated	2	1.2
Divorced	2	1.2
Widow/widower	6	3.6
Highest Qualification		
Secondary education	4	2.4
Tertiary education	124	73.8
Post Graduate education	40	23.8
Occupation		
Doctor	2	1.2
Nurse/Midwife	20	11.9
Community Health Extension Worker (CHEW)	78	46.4
Community Health Officer (CHO)	12	7.1
Junior Community Health Extension Worker (JCHEW)	18	10.7
Lab Scientist/Technician	24	14.3
Research Assistant	2	1.2
Environmental Health Officer (EHO)	6	3.6
Medical Record Officer (MRO)	2	1.2
Hospital attendant	2	1.2
Pharmacy Technician	2	1.2

Table 1 reported the socio-demographic characteristics of the respondents. A total of 168 respondents across all the 58 PHCs in the 12 political wards of AMAC, FCT, participated in the study, 65.5% were females, and most of the respondents were between the age range of 30-39 years (41.7%). Married respondents represented 71.4%, and most had tertiary education (73.8%); the CHEW category comprised almost half (46.4%).

Table 2. Mean Age & Years of Service

Variable	**Respondents' age (years)**	**Respondents' years of service**
Mean Age	34.11 years	8.90 years
Standard Deviation	9.41 years	8.04 years

Table 2 reported the overall mean age of the respondents to be 34.11 years, standard deviation of 9.408 years. The minimum age of the respondents was 20 years, while the maximum age was 60 years.

Table 3. Hepatitis B Vaccination Status

Fully Vaccinated	**Frequency**	**Percentage (%)**
Yes	74	44.0
No	94	56.0
Total	168	100.0

Table 3 presented the vaccination status of the respondents with respect to the Hepatitis -B vaccine. Almost half of the respondents (44%) reported having been fully vaccinated with Hepatitis B Vaccine.

Table 4. Prevalence of Hepatitis B Virus Infection

Test Result	Frequency	Percentage (%)
Positive	8	4.8
Negative	160	95.2
Total	168	100.0

The results of the analysis, as shown in Table 4, reported a prevalence of 4.8% for Hepatitis B infection among Health workers in PHCs in AMAC.

Table 5. Multivariate Risk Analysis

Variable	Wald	p-value
Ever received a blood transfusion?	0.000	0.499
Ever gone through surgery?	0.573	0.981
Ever had a miscarriage?	0.001	0.973
Ever had an evacuation after a miscarriage?	0.001	0.980
Ever shared sharp objects?	0.000	0.998
Ever had your body tattooed?	0.000	0.997
Ever visited a dentist either for tooth removal or any of the oral health services?	5.879	0.015*
Has any family member ever been HBV positive?	0.000	0.996
Ever had an intimate sexual r/ship with more than one partner in the past?	0.000	0.999
Ever performed labour/delivery activities as a health worker?	0.000	0.985
Ever performed surgical procedures as a health worker?	2.592	0.107
Ever experienced needle stick or surgical cut injuries as a health worker?	0.000	0.983

*p-value significant at < 0.05; 95% Confidence interval, reference: positive for HBsAg

Table 5 presented the multinomial logistic regression result, which revealed that among the 12 risk factors for HBV infection assessed, only a history of dental procedure was a significant predictor of HBV infection.

Table 6 presented the risk estimate analysis for the risk factors that showed a significant positive association with Hepatitis B virus infection. The result revealed that respondents who had gone through surgery and those who had performed labour and delivery activities

were one and a half times more likely to be infected with the Hepatitis B virus (OR: 1.667 & 1.481, respectively). Those who had performed surgical procedures and those who had experienced needle stick injuries were, respectively, twice more likely to be infected with the virus than their counterparts (OR: 2.400 & 2.222, respectively). Finally, those who had attended dental clinics for dental surgery/tooth removal were three times more likely to be infected with the Hepatitis B virus than those who had not (OR: 3.077).

Table 6. Univariate Analysis

Risk Estimate	Value	95% CI, Lower	95% CI, Upper
For cohort Ever gone through surgery? = Yes	1.667	.801	3.466
N of Valid Cases	168		
For cohort Ever visited dentist for dental surgery/ tooth removal? = Yes	3.077	1.415	6.693
N of Valid Cases	168		
For cohort Ever performed labour/delivery activities as a health worker? = Yes	1.481	1.330	1.650
N of Valid Cases	168		
For cohort Ever performed surgical procedures as a health worker? = Yes	2.400	1.513	3.807
N of Valid Cases	168		
For cohort Ever experienced needle stick or surgical cut injuries as a health worker? = Yes	2.222	1.872	2.637
N of Valid Cases	168		

Discussions

The prevalence of Hepatitis B infection among the health workers in the Primary Health Centers in AMAC was 4.8% (Table 5). This prevalence is below the 6.1% reported for the WHO African region [5] and far below the 11%, which is the current National prevalence for Nigeria [7], and the 13% prevalence reported by a similar study among Nigerian health workers.[18] Elsewhere in Africa and Asia, there have been reports of other studies with prevalence rates higher than the rate found in this index study, such as the 7.0% prevalence reported among health workers in Tanzania [19] and 8.7% found among health workers in Saudi Arabia [20]. This prevalence of 4.8%, which is lower than the national prevalence among the general population, maybe because of a substantial level of complete vaccination status for the Hepatitis B vaccine among the cohort of these health workers (44%) in the AMAC PHCs (Table 4). This is supported by fact that hepatitis B vaccines are effective in reducing the risk of hepatitis B infection to an almost zero rate [21]. Furthermore, this study documented a high level of HBV awareness and high HbsAg screening level among these health workers (Table 8), which could have translated into a good preventive attitude against HBV infection. Nevertheless, in comparison with our study, there are documented levels of lower Hepatitis B seroprevalence among healthcare workers. These include 2.9% prevalence found in Rwanda, Sub-Saharan Africa [22], 2.07% in

Enugu Nigeria, Sub-Saharan Africa [23], 1.8% in Libya, North Africa [24], 1.2% in Poland, Europe [25], and 0.8% in Brazil, South America [26].

Risk Factors Associated with HBV Infection amongst the Health Workers

The history of dental surgery/tooth removal was established as the only significant predictor of HBV infection among the health workers in this study, $p = 0.015$ (table 6). This is similar to findings in other studies like the study in Duhok city, Iraq, among blood donors, [27] the study among pregnant women in Northwest Ethiopia, [28] and Eastern Ethiopia, [29] and the study among the general population in Nigeria. [30] It is worth noting that the study in Duhok city, Iraq, reported dental surgery as the only predictive factor for HBV, just like in our index study, whereas the rest studies recorded other factors in addition to dental surgery as independent predictive factors for HBV infection. Nevertheless, the findings of this study is dissimilar to the study in the Eastern part of Ethiopia by [31], who reported that dental surgery was not a predictive factor for HBV infection [31]. The study also demonstrated an association between some of the risk factors and HBV infection. These factors include the history of past surgery and taking deliveries which were associated with a one and half-fold risk of contracting HBV infection. These were followed by a history of performing surgical procedures and needlestick injuries, which independently were associated with a two-fold risk, while a history of past dental surgery/tooth removal had a three-fold risk of contracting HBV infection among the PHC health workers. This may be due to the high infectivity of HBV and because these procedures are associated with significant exposure to the blood and body fluids of the patients. These findings are like the work of [32].

Conclusion

The prevalence rate of Hepatitis B virus infection found in this study is considered high, given the significant Hepatitis B vaccination rate among this cohort of PHC health workers. Furthermore, the study revealed that a history of past surgery, needlestick injuries, taking deliveries, and performing surgical procedures were associated with an increased risk of HBV infection. Notwithstanding, the history of dental surgery/tooth removal was the only significant predictor of HBV infection among these workers.

Recommendations

1. The Management of the AMAC PHC Department should institute a program to increase the uptake of the Hepatitis B vaccine among her staff and establish periodic HbsAg screening for the staff.
2. The FCT Public health department should improve infection prevention and control practices at dental clinics/surgeries and their infection prevention and control practices at dental clinics/surgeries in the FCT.

Conflict of Interest

The authors declare that they have no conflict of interest.

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References

[1] World Health Organization. Guidelines for the prevention, care, and treatment of persons with chronic hepatitis B infection [internet]. 2015 [cited Feb 2021]. Available from www.who.int/hepatitis/publications/hepatitis-b-guidelines/en/.

[2] World Health Organization. Global alert response: Hepatitis B [internet]. 2014 [cited Feb 2021]. Available from http://www.who.int/csr/disease/hepatitis/whocdscsrlyo20022/en/index2.html.

[3] Mukhtar I. G, Yakasai, B.W, Muhammad S. M, Salisu A. I. 2018. Prevalence of hepatitis b virus surface antigen and hepatitis c virus antibody among prospective blood donors at Murtala Muhammad specialist hospital, kano, Nigeria. *Journal of Pure and Applied Sciences.* 4 (1): 170-176. Available from https://www.researchgate.net/publication/329591929.

[4] World Health Organization. Global hepatitis report, 2017 [internet]. 2017 [cited Feb 2021]. Available from www.who.int/hepatitis/publications/global-hepatitis-report2017/en/.

[5] World Health Organization. Hepatitis B, Key Facts [internet]. 2019 [cited Feb 2021]. Available from www.who.int/news-room/fact-sheets/detail/hepatitis-b.

[6] Schad V.A. Global prevalence of hepatitis B virus (HBV) infection in 2016 estimated [internet]. 2018 [cited Feb 2021]. Available from https://www.infectiousdiseaseadvisor.com/home/advisor-channels/hepatitis-advisor/global-prevalence-of-hepatitis-b-virus-infection-in-2016-estimated/.

[7] Abutu A. Nigeria's complicated hepatitis burden. The lancet. Gastroenterology & hepatology. 2018; 3 (10): 669. Available from DOI: doi.org/10.1016/S2468-1253 (18)30279-.

[8] Orji I. A, & Okoli U. T. Prevalence of Hepatitis-B infection among Pregnant Women in a Primary Healthcare Centre in Abuja, Nigeria. *Texila International Journal of Public Health.* 2016; 4 (4): Art. 57. Available from DOI: 10.21522/TIJPH.2013.04.04.

[9] Anaedobe CG, Fowotade A, Omoruyi CE, Bakare RA. 2015. Prevalence, socio-demographic features, and risk factors of Hepatitis B virus infection among pregnant women in Southwestern Nigeria. Pan African Medical Journal. 20: 406. Available from www.panafrican-med-journal.com/content/article/20/406/full/ doi:10.11604/pamj.2015.20.406.6206.

[10] Yakasai IB, Ayuba R, Abubakar IS, Ibrahim SA. 2012 Jan-Dec; Sero-prevalence of Hepatitis B Virus Infection and its Risk factors among Pregnant Women Attending Antenatal Clinic at Aminu Kano Teaching Hospital, Kano, Nigeria. *Journal of Basic and Clinical Reproductive Sciences.* 1 (1 & 2). Available from www.jbcrs.org DOI: 10.4103/2278-960X.104297.

[11] Esan A.J, Omisakin C.T, Ojo-Bola T, Wooden M.F, Fasakin K.A, Ogunleye A. A. 2014; Sero-Prevalence of Hepatitis B and Hepatitis C Virus Co-Infection among Pregnant Women in Nigeria. *American Journal of Biomedical Research.* 2 (1): 11-15. Available from http://pubs.sciepub.com/ajbr/2/1/3.

[12] Desalegn Z, Mihret A, Beyene H.B, Yilma M, Seid Y, Tamiru W, et al. 2016; Survey of Hepatitis B virus infection and risk factors among pregnant women at public hospital in Ethiopia. *International Journal of Biomedical Research.* 7(7): 450-456. Available from DOI: 10.7439/ijbr.

[13] Tanga AT, Teshome MA, Hiko D, Fikru C, Jilo GK. 2019; Sero-prevalence of hepatitis B virus and associated factors among pregnant women in Gambella hospital, South-western Ethiopia: facility based cross-sectional study. *BMC Infectious Diseases*. 19: 602 Available from https://doi.org/10.1186/s12879-019-4220-z.

[14] Osman A.M.M, Mirghani O.A, Gasim G.I, Adam I. 2014; Hepatitis B Virus, Hepatitis C Virus, and Human Immunodeficiency Virus Infections among Pregnant Women in Central Sudan. *Sudan Journal of Medical Sciences*. 9 (2): 91-96.

[15] Coste M., De Sèze M., Diallo A., et al. 2019; Burden and impacts of chronic hepatitis B infection in rural Senegal: study protocol of a cross-sectional survey in the area of Niakhar (AmBASS ANRS 12356). BMJ Open. 9: e030211. Available from doi:10.1136/ bmjopen-2019-030211.

[16] Rabiu KA, Akinola OI, Adewunmi AA, Omololu OM, Ojo TO. 2010 Aug; Risk factors for hepatitis B virus infection among pregnant women in Lagos, Nigeria. Acta Obstetrician Et Gynecologica Scandinavica. 89: 1024–1028. Available from https://www.researchgate.net/publication/45268763. DOI: 10.3109/00016349.2010.482580.

[17] Glen S. Sample size in statistics (How to find it): Excel, Cochran's formula, general tips. From Statistics HowTo.com: Elementary statistics for the rest of us [internet]. 2020 [cited March 2021]. Available from https://www.statisticshowto.com/probability-and-statistics/find-sample-size/.

[18] Ola SO, Odaibo GN, Olaleye OD, et al. 2012; Hepatitis B and E viral infections among Nigerian healthcare workers. *Afr J Med Sci*. 41: 387–391.

[19] Mueller A, Stoetter L, Kalluvya S, Stich A, Majinge C, Weissbrich B, Kasang C. 2015 Sep 23; Prevalence of hepatitis B virus infection among health care workers in a tertiary hospital in Tanzania. *BMC Infect Dis.* 15:386. doi: 10.1186/s12879-015-1129-z. PMID: 26399765; PMCID: PMC4581415.

[20] Alqahtani JM, Abu-Eshy SA, Mahfouz AA, et al. Sero-prevalence of hepatitis B and C virus infections among health students and health care workers in the Najran region, southwestern Saudi Arabia: the need for national guidelines for health students. *BMC Pub Health* 2014; 14: 577.

[21] Bonani P and Bonnacorssi G. Vaccination against hepatitis B in health care workers. Vaccine 2001; 19: 2389–2394.

[22] Kateera F, Walker TD, Mutesa L, et al. 2015; Hepatitis B and C seroprevalence among health care workers in a tertiary hospital in Rwanda. *Trans R Soc Trop Med Hyg*. 109: 203–208.

[23] Orji CJ, Chime OH, Ndibuagu EO. 2020; Vaccination status and prevalence of hepatitis B virus infection among health-care workers in a tertiary health institution, Enugu State, Nigeria. Proceedings of Singapore Healthcare. 29(2): 119-125. doi:10.1177/2010105820923681.

[24] Elzouki AN, Elgamay SM, Zorgani A, et al. *2014*; Hepatitis B and C status among health care workers in the five main hospitals in eastern Libya. *Infect Pub Health* 7: 534–541.

[25] Rybacki M, Piekarska A, Wiszniewska M, et al. 2013; Hepatitis B and C infection: is it a problem in Polish healthcare workers? *Int J Occup Med Environ Health* 26: 430–439.

[26] Ciorlia LA, Zanetta DM. 2005 Oct; Hepatitis B in healthcare workers: prevalence, vaccination, and relation to occupational factors. *Braz J Infect Dis.* 9(5):384-9. doi: 10.1590/s1413-86702005000500005. Epub 2006 Jan 6. PMID: 16410889.

[27] Hussein N.R. 2018; Risk factors of hepatitis B virus infection among blood donors in Duhok city, Kurdistan Region, Iraq. *Caspian J Intern Med.* 9(1):22-26. doi:10.22088/cjim.9.1.22.

[28] Molla S, Munshea A & Nibret E. 2015; Seroprevalence of hepatitis B surface antigen and anti HCV antibody and its associated risk factors among pregnant women attending maternity ward of Felege Hiwot Referral Hospital, northwest Ethiopia: a cross-sectional study. *Virol J.* 12: 204. https://doi.org/10.1186/s12985-015-0437-7.

[29] Tiruye G, Shiferaw K, Tadesse F. 2018; Seroprevalence of Hepatitis B Virus Infection and Associated Factors among Pregnant Women Attended Antenatal Care Services in Harar City, Eastern Ethiopia. *J Women's Health Care*, 7: 436. doi:10.4172/2167-0420.1000436 P.

[30] Olayinka AT, Oyemakinde A, Balogun MS, Ajudua A, Nguku P, Aderinola M, Egwuenu-Oladejo A, Ajisegiri SW, Sha'aibu S, Musa BO, Gidado S, Nasidi A. 2016 Oct 5; Seroprevalence of Hepatitis B Infection in Nigeria: A National Survey. *Am J Trop Med Hyg*. 95(4):902-907. doi: 10.4269/ajtmh.15-0874. Epub 2016 Aug 15. PMID: 27527630; PMCID: PMC5062798.

[31] Umare A, Seyoum B, Gobena T, Haile Mariyam T. 2016; Hepatitis B Virus Infections and Associated Factors among Pregnant Women Attending Antenatal Care Clinic at Deder Hospital, Eastern Ethiopia. *PLoS One*. 11(11): e0166936. https://doi.org/10.1371/journal.pone.0166936.

[32] Mahboobi N, Porter SR, Karayiannis P, Alavian SM. 2013 Mar; Dental treatment as a risk factor for hepatitis B and C viral infection. A review of *recent literature. J Gastrointestin Liver Dis.* 22(1):79-86. PMID: 23539395.