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RESEARCH

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Carriage of Hepatitis B Virus and Risk Factors among Health Care Workers in Ogun State, Nigeria.

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ABSTRACT

Background: Health-care workers (HCWs) are often exposed to potentially infectious body fluids-carrying Hepatitis B virus (HBV) from their workplaces. Typically, most asymptomatic HBV carriers-status may remain unnoticed for decades, despite a few percentages of them with vaccination history. In this study, we aimed at investigating asymptomatic carriage of HBV and its associated risk factors among co-health workers ultimately impacting on patients.

Methods: Venous blood samples and demographic data were obtained from a cross sectional survey of HCWs categories working in OOUTH, a referral teaching hospital and other selected health facilities in Ogun state. Immuno-chromatographic discs and Enzyme Linked Immuno-Sorbent assay (ELISA) techniques were adopted for the determination and confirmation of the presence of HBsAg, anti-HBs and total anti-HBc in sera. A structured questionnaire was used for obtaining demographic data which were analyzed by regression analytical technique.

Results: About 11.44% (43) of the 376 healthcare workers (HCWs), were infected with HBV. The serological marker of viral particles identified in this positive study population included Hepatitis B envelope antigen (53.49%), Hepatitis Core antigen (13.15%), Hepatitis B surface antibodies (3.99%); and Hepatitis B core antibodies (0.80%). A significant association existed between risk factors such as recapping of used needles and carriage of HBV among the HCWs (p-value =0.017).

Conclusion: The carriage rate (11.44%) of HBV among HCWs in Ogun state referral health facilities as against the 8% set standard by W.H.O. in 2009, depict the associated risk factors of asymptomatic carriage, pathogenesis and dissemination in and outside of the health facilities.

Keywords: Hepatitis B, Health-care workers, ELISA, immuno-chromatographic, antigen, serological markers.

1.0 INTRODUCTION

Hepatitis B virus (HBV) is a predominant hepato-trophic viral infection, characterized by parenchymal cell necrosis and histolytic periportal inflammation of the liver. Globally, there is varying endemicity of HBsAg infection ranging from ≤ 2% prevalence (low endemicity) in Western and Northern Europe, Northern America and Australian; 2-7% (moderate endemicity) in Eastern Europe, Mediterranean, Asia; and ≥ 8% (high endemicity) in sub-Saharan Africa, South East Asia and China [1].

Most cases of HBV are spread by a mix of either vertical transmission from infected mothers to child, horizontal perinatal transmission in early childhood, or exposure to infected blood products via cultural practices [2, 3, 4, 5]. Also, there exists a risk of HBV transmission between family members in a household possibly via contact of non-intact skin and/or mucous membrane with secretion laden with the virus [6]. Further still, existing risk factors of HBV spread include possible sexual transmissions, promiscuity, healthcare-related (blood transfusion and/or occupational risk/accidental needle prick exposure particularly among the health care workers particularly in sub -Saharan Africa [7] and blood exposure due to cultural practices.

HBsAg has been found in seminal fluid. This HBV is commonly found in almost all body secretions (such as vaginal secretions) and excretions; although concentrations in these fluids are lower than in the blood. Apart from percutaneous injuries with blood exposure, HBV are detected in other body fluids including saliva, urine, nasopharyngeal fluid, semen, cervico-vaginal fluids, tears, human bites and transfusion [8, 9, 10, 11, 12]. Nonetheless, there was possibility of HBV transmission post -exposure to non-intact skin and mucous membranes; as a case report described the transmission of HBV via broken skin, following contact with saliva and nasopharyngeal fluids from the source. Though, this viral infection has a varying incubation period of 45-180 days, it could be effectively prevented by immunization. Often, the clinical importance of HBV is associated with both serious acute infection and chronic illnesses [13, 14].

Subtle occurrence of acute fatal hepatitis used to be very common in health care facilities following exposure to various hazardous occupational risk factors. In Nigeria, the prevalence of Hepatitis B surface antigen (HBsAg) has been described as 9.76% [15].

There was affirmation that HBV infection has a universal public health impact affecting over 300 million chronic carriers presenting varying clinical outcomes such as fatal acute infection and/or chronic hepatitis, liver cirrhosis, and liver cancer. Moreover, HBV infections with or without its satellite, Hepatitis D virus (HDV, or the delta agent) may be associated with either an asymptomatic or mild anicteric illness or an acute disease with jaundice progressing to severe prolonged jaundice or fulminant hepatitis (acute liver failure). A persistent infection (a prolonged carrier state) may advance to a more severe chronic liver disease. In addition, there is substantial evidence of an etiological association between infection with chronic hepatitis B and C and hepato-cellular carcinoma (HCC) [16, 17]. It has been noted that a relative decrease in the prevalence of HBsAg infection and carriage, possibly due to reducing cases of liver cancer patterns of liver dysfunctions; these may be linked to the successful implementation of hepatitis B vaccination programs in highly endemic countries [18, 19].

However, healthcare workers are often at great risk of occupational exposure to blood-borne pathogens such as Hepatitis B virus (HBV) without their awareness of being carrier. The presence of Hepatitis B surface antigen (HBsAg) as a marker of infectivity indicates either acute or chronic infection. While HBV virus can survive outside the body for at least a week, several factors such as viral load of the 'source'; and hazard from needle stick injuries may influence its risk of transmission, though transmission rate remains unknown.

HBV being a potentially life-threatening liver infection, the low awareness of its asymptomatic carrier and the ensuing casualties most commonly among HCWs may further threaten the depletion in the existing shortage of medical practitioners particularly in sub-Saharan Africa. Many individuals infected with hepatitis B virus rarely display any symptom, although they may still transmit the virus to others [20].

Hence, we aimed at studying carriage of HBV by estimating the HBV serological marker prevalence and the associated occupational risk factors of HBV infection among asymptomatic HCWs in referrals health facilities despite the antibodies to HBV produced by already immunized HCWs in the state.

2 METHODOLOGY

The study was conducted among healthcare workers (HCWs) including Doctors, Staff nurses, Laboratory Scientists and Laboratory technicians across referral health

care institutions in Ogun State. The selected hospitals were Olabisi Onabanjo University teaching hospital, Sagamu (OOUTH); General hospital, Ijaye (GHI-1); Abeokuta general Hospital, Idi-Aba (AGH); General hospital, Ijebu-Ode (GHI-2); General hospital, Itori (GHI-3); General Hospital, Sango Ota (GHS) and General Hospital, Ilaro (GHI-4).

Ethical approval was obtained from the Olabisi Onabanjo University Teaching Hospital Ethical review committee. Demographic data and blood samples were collected from all consenting individuals. Data were analyzed to determine the pattern of risk factors implicated in HBV carriage among the HCWs.

Five milliliters of venous blood were obtained from 376 HCWs by venipuncture. These blood samples were centrifuged at 2000 revolution per minutes using Spectrafuge 24D centrifuge, (Jencons, UK) to remove the serum kept at -20 °C until ready for use.

All sera were analyzed using Sandwich and indirect ELISA techniques. The Sandwich ELISA technique was used to confirm the presence of the HBsAg that were either tested positive or negative from immune-chromatographic discs while the Indirect ELISA technique was used to ascertain the presence of the antibodies. To investigate the occurrence of HBV in the blood samples obtained, we screened all the sera for quantitative anti -HBs and total anti-HBc. Those reactive to total anti-HBc and negative for anti-HBs were tested for HBsAg. The reactive samples were tested for HBeAg and anti-HBe with a commercially available immune-chromatographic strips/kits.

The test procedures (Immunochromatographic assay) also known as the lateral flow was conducted according to the manufacturer's recommendations. It simply detects either the presence or absence of target analytes in the sample without the need for specialized and costly tools. The HBcAg and HBeAg were determined using a five-panel test strip (Lumiquick diagnostics Inc., Santa Clara, USA). The same procedure was repeated for the detection of other HBV serological markers such as Hepatitis B core antibody (HBcAg), Hepatitis B envelope antigen (HBeAg), Hepatitis B core antibody (HBcAb) and Hepatitis B surface antigen (HBsAg).

Bio-data were obtained using a structured questionnaire to establish the presence of possible risk factors. Graph pad prism version 8 was used for data handling and graphical analysis. All results were read, recorded, and interpreted where applicable.

The prevalence rates and corresponding 95% confidence intervals (95% CI) of HBV infection and carriage were estimated. Logistic regression was used to calculate the crude ORs and 95% CIs, and where confounding data was suspected, multiple logistic regression models on variables were adopted using Statistical Package for Social Sciences (SPSS) version 20. This investigation was limited to the asymptomatic HCWs working and based in Ogun state.

3 RESULTS

A total of 376 individual HCWs at the various referral health facilities in three different senatorial districts of Ogun state were recruited for this study. Our findings revealed age groups between ≥ 20 and ≤ 50 years were predisposed to Hepatitis B virus infection (figure 1). The HBV carriage was highest among age groups 31 – 35 years but least in age groups 26-30 and ≥ 50 years. Though more females than males were enrolled for this study, the prevalence and carriage of HBV were higher in the females than their male counterparts (figure 2).

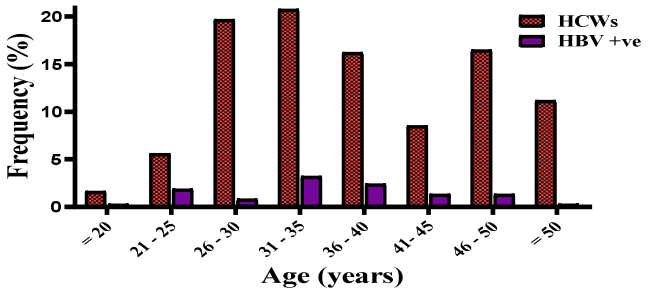

Figure 1. Age Distributions and HBsAg Status of Healthcare Workers

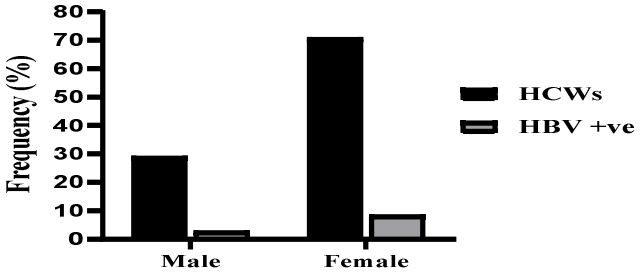

Figure 2. Gender and HBsAg Status of Healthcare Workers

Based on the educational backgrounds of the study population, HCWs with the Bachelors (HND/BSc) degree qualifications had a relatively higher HBV carriage in compared with either the MSc or the ND holders hence reflecting their predisposition to HBV infection (figure 3).

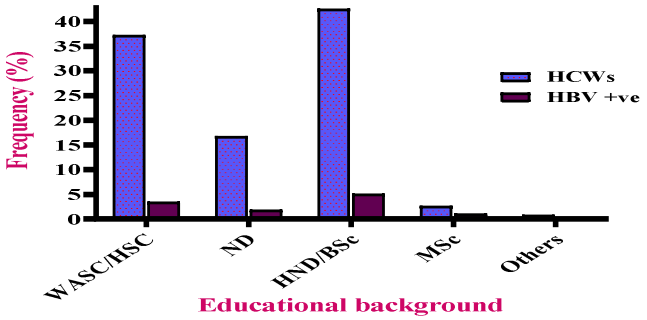

Figure 3. Educational Background and HBsAg Status of Healthcare Workers

The following were some of the evident risk factors among HCWs that were significantly associated with the carriage of HBV based on regression analysis: recapping of used needles after drawing blood samples from patients; bending of used needles after usage and their discard into a puncture-proof container; use of protective equipment such as goggle, masks during surgical procedures; disinfection of surgical tables and work bench immediately after use; usage of hand gloves when discarding used equipment.

The HBV infection and carriage rates varied significantly between the health facilities, from as low as 2.33% (General Hospital, Itori) in mostly Ogun East senatorial district to as high as 37.21% (General Hospital, Ijaye) in Ogun Central senatorial district in Ogun state.

Nevertheless, with regards to HBsAg prevalence, the great majority of the health facilities with positive subjects (Nurses, Doctors and Medical Laboratory Scientists) showed rates varying from high to moderate endemic patterns, as shown by the prevalence rate of 6.91%, 2.66% and 1.33% respectively (figure 4). Likewise, HBV carriage was highest among the Doctors (18.52%), moderate among the nurses (13.83%) but lower among the Medical Laboratory Scientists (6.67%). Likewise, carriage of HBV serological markers including HBsAg, HBeAg and HBcAg was more pronounced among singles and married health care workers (figure 5).

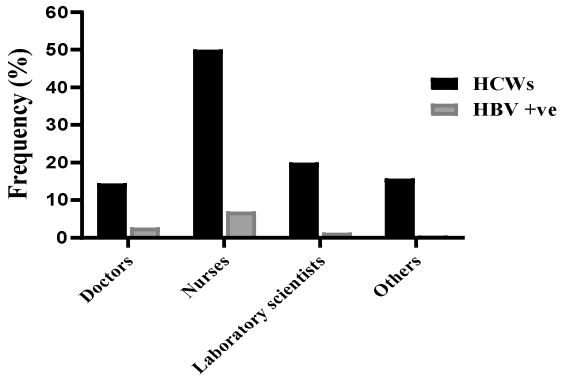

Figure 4. Designation and HBsAg Status of Healthcare Workers

Nurses showed the highest prevalence of HBsAg followed by Doctors and Laboratory scientists. Current infection ($HBsAg^{+}$) prevalence was (11.44%) and also increased significantly with 3.04%.

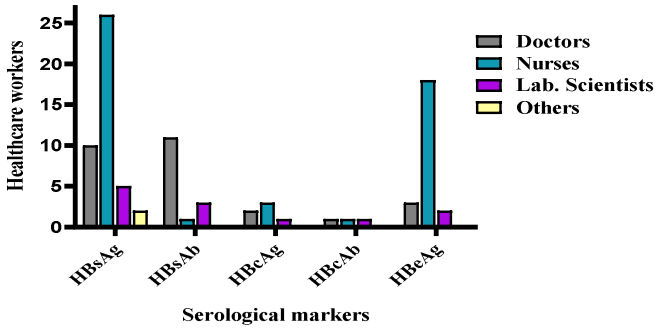

Figure 5. HBV Serological Markers of the Healthcare Worker

Table 1 showed the duration of service of the screened HCWs and their HBV status. It was observed that HCWs that have spent between 6-10 (30.23%) years in service have the highest prevalence of HBV while HCWs with 26-30 (2.33%) years in service have the lowest prevalence. Table 2 showed the distribution of the predisposing factors of HBV among the responded HCWs. The table showed that recapping of used needles, with the P-value

Table 1. Duration of Service and HBV Status of Healthcare Workers

Duration (Yrs)	N (%)	HBV (%)
0 -5	80 (21.28)	7 (16.28)
6 – 10	118 (31.38)	13 (30.23)
11 – 15	107 (28.46)	11 (25.58)
16 – 20	31 (8.25)	2 (4.65)
21 – 25	27 (7.18)	7 (16.28)
26 – 30	5 (1.33)	1 (2.33)
31 – 35	8 (2.13)	2 (4.65)
TOTAL	376 (100)	43 (100)

Table 2. Predisposing Factors of Carriage of Hbv among the Healthcare Workers That Responded

Variables	Number	HBs Ag (+ve)	Statistics R^2	P-Value
Do you recap needles after being used?				
Yes	210(56.0%)	43	0.375	0.017
No	165(44.0%)	0		
Do you bend used needles by hand after drawing blood from patients?				
Yes	38(10.1%)	18	0.087	0.042
No	336(89.6%)	25		
Do you sterilize used medical equipment immediately after being used?				
Yes	297(79.2%)	19	0.225	0.019
No	78(20.8%)	24		
Do you disinfection Injection table, examination table, and workbench immediately after use?				
Yes	291(77.6%)	5	0.090	0.030
No	84(22.4%)	38		
Do you use condoms during sexual intercourse?				
Yes	127(33.9%)	6	0.046	0.022
No	248(66.1%)	37		
Do you have more than one sexual partner?				
Yes	33(8.8%)	14	0.044	0.045
No	342(91.2%)	27		
Do you believe that you at risk of HBV?				
Yes	293(78.1%)	14	0.365	0.059
No	82(21.9%)	29		
Do you use of protective equipment like gloves when drawing blood from patients?	314(83.7%)	8	0.209	0.028
Yes	61 (16.3%)	35		
No				
Have you been immunized against Hepatitis B virus?				
Yes	107(28.5%)	0	0.099	0.082
No	268(71.2%)	43		

0.017, by the HCWs was the main predisposing factor of HBV infection among the HCWs. A close predisposing factor to recapping of used needles is sterilization of medical equipment. This report showed that some of those medical equipment are not properly sterilized.

4 DISCUSSION

Hepatitis B Virus is an important occupational hazard for healthcare providers. It is highly preventable with a safe and effective vaccine [21]. It is very easy to generally presume that healthcare workers, as a result of their nearness to the health facility, should have adequate knowledge about diseases generally and other health conditions. This study still gave a high prevalence of 11.44% showing that the majority of the infected healthcare providers were nurses. The total infected healthcare providers were 43 of which 26 were nurses and 10 Medical Doctors. There were 6 Laboratory Scientists, 1 Dental physician and 1 Physiotherapist even though, a little over 79% of the respondents were aware of their risk to the Hepatitis B virus. This is very high when compared to the world health organization standard of 8% peak for high prevalence in 2009. This report agrees with the work done by Yu-Ling Qin *et al.,*[22] in 2019 on healthcare workers in Freetown, Sierra Leone. Their work reported a 10% prevalence out of 211 respondents which is close to 11.44 reported in this work among 376 respondents.

The Enzyme Linked Immunosorbent Assay was used to confirm the Hepatitis B surface antigen (HBsAg). There were seven samples detected by ELISA technique which an immunochromatographic test proved to be negative. This is in concordance with Babalola *et al.,* [23]. This work also showed that ELISA is more sensitive than any immunochromatographic strips.

In 2018, Elichilia *et al.,* [24] conducted a study on the sero-prevalence of Hepatitis B virus among Healthcare workers in Tanzania. The result observed in this work is in corroboration with their obtained report. They recorded a high prevalence of the virus among the recruited participants. They also reported that history of blood transfusion increased risks while vaccine uptake decreased the risk of HBV infection. Moreover, in 2019, Thi *et al.,* [25] carried out a cross-sectional survey on 314 healthcare workers working at Vietnam's primary and Tertiary health facilities. They discovered that 75.5% of the healthcare workers did not know HBV infection car-

ries the highest risk of developing chronic infection at birth. Also, about one-third (30.2%) of their respondents wrongly believed that HBV could be transmitted through eating or sharing food with chronic hepatitis B patients. About 38.8% did not feel confident that the hepatitis B vaccine was safe. Up to 48.2% reported they consistently recap needles with two hands after injection, a practice that would put them at greater risk of needle stick injury which was also reported in this study. This study showed that hand washing, recapping of used needles, and not sterilizing workbench, injection tables and examination tables were significantly associated with Hepatitis virus infection. They are highly significant. This is in corroboration with the work done by Amha *et al.,* [26] in Oromnia, Ethiopia. This result also corroborates with the report of Abdallah *et al.,* [27] and Nwokediuko [28] in Uganda.

In 2013, Amha [26] and his colleagues also discovered that needle stick injuries caused many infection with Hepatitis B virus among the healthcare workers that responded in Ethiopia. In this work, it was also observed that needle stick injuries caused most of the infections. From the regression analysis, the needle stick injuries were highly significant. It was also shown on the P-value which showed 0.017 as against 0.05 standards.

In addition to this, Kisangau *et al.,* [29] in 2019 surveyed the prevalence of hepatitis B virus infection and uptake of hepatitis B vaccine among 312 healthcare workers at Makueni County in Kenya. Their work discovered that 249 (80%) HCWs received ≥1 HBV vaccine dose, only 119 (48%) received all three recommended doses. This work showed a very low immunized population. Adekanle *et al .,* [30] also observed that 33% of the healthcare workers were aware of the Hepatitis B virus while in this work, 78.1% were very much aware that they were at risk of the virus. The lower percentage of the active immunity against the virus can be attributed to the lackadaisical attitude of the healthcare workers to the vaccine in Ogun state, Nigeria.

In 2018, Habtemu *et al.,* [31] stated the positivity of HBsAg was 2.5% in their work as against 11.44% reported in this work. This was discovered from their work done in South-West Ethiopia. Our work showed a higher prevalence as against the work done by Habtemu et al even though their respondents were 340, which is slightly lower than the respondents in this work. They mentioned that most participants had good knowledge of HBV (73.9%) which was also discovered among the respondents in this work. They reported that Females were at a lower risk of HBsAg compared to males. This is in contrast to this work as we reported a higher prevalence in females than the males.

According to another work done in Northern Ethiopia by Endalew *et al.,* [32] in 2018, it was discovered that Males accounted for 54.9% and the mean age for all studied participants was 28.3. The HBsAg was detected in 2.6% of health care workers. A high rate of hepatitis B virus infection was detected among those aged 30–40 years who were more infected (6.6%). Thus, it is in corroboration with the data presented in this study that showed the highest prevalence among ages 31–35 years of age. The prevalence of HBeAg among HBsAg-positive individuals was also with the positive subjects having 31 - 35 years of age.

In 2017, Abebayo *et al.,* [33] carried out a survey on the Hepatitis B virus vaccination status and associated factors among health care workers in Shashemene Zonal Town, Shashemene, Ethiopia, they discovered that 53 (12.9%) respondents were fully vaccinated. In 2013, Amha *et al.,* [26] carried out a prevalence study among healthcare workers in Oromia, Ethiopia. They discovered that only a very small percentage of the healthcare workers were vaccinated. This study showed a high prevalence agreeing with Amha *et al.,* [26] . This agrees with this work which shows that many of the workers were not vaccinated. Ogoina *et al.,* [34] reported that 36.2% of the healthcare workers had collected the total dose of the vaccine in their work place which is higher than the report discovered and it is in contrast with the report analyzed in this work.

Overall, our study demonstrates that HBV continues to be an important public health issue. Sequel to the above epidemiological survey, HBV is very high among healthcare workers in Ogun state while the majority of the HCWs were not vaccinated against the virus. HBV can be effectively prevented by vaccination; since a safe and effective vaccine has been available since the 1980s. It is therefore recommended that healthcare workers be vaccinated.

Conflicts of Interest

The authors declare no competing interests.

Authors' Contributions

OAO collected blood samples and performed sample analysis. **MOB** conceived and designed the study, con-

tributed to sample analysis and manuscript writing. **TAB** contributed to manuscript. **CSO** contributed to collection of blood samples. **CON** performed data analysis. All authors approved the final copy of the manuscript.

References

1. Shepard CW, Simard EP, Finelli L, Fiore AE, Bell BP. Hepatitis B virus infection: epidemiology and vaccination. Epidermol Rev. 2006; 28: 112-125
2. Chang MH. Natural history of hepatitis B virus infection in children. J. Gastroenterol Hepatol. 2000; 15: 16-19
3. Brasil LM, Fonseca JC, Souza, RB, Braga WS, Toledo LM. Prevalência de marcadores para o vírus da hepatite B em contatos domiciliares no Estado do Amazonas. Rev Soc Bras Med Trop. 2003; 36: 565-570
4. Candotti D, Allain JP. Transfusion-transmitted hepatitis B virus infection. Journal of Hepatology. 2009; 51: 798-809.
5. Brabin L, Brabin BJ. Cultural factors and transmission of hepatitis B virus. Am J Epidemiol. 1985; 122:725-730.
6. Shi Z, Yang Y, Wang H, Ma L, Schreiber A, Li X, et al., Breastfeeding of Newborns by Mothers Carrying Hepatitis B Virus: A Meta-analysis and Systematic Review. Archives of Pediatrics and Adolescent Medicine. 2011; 165 (9): 837–846.
7. Barker LF, Shulman NR, Murray R, Hirschman RJ, Ratner F, Diefenbach WC, Geller HM. Transmission of serum hepatitis. Journal of the American Medical Association. 2013; 276 (10): 841–844.
8. Catterall RD. Some observations on the epidemiology and transmission of hepatitis B virus. British Journal of Venereal Diseases. 1978; 54(5):335-340.
9. Alter MJ, Ahtone J, Weisfuse I, Starko K, Vacalis TD, Maynard JE. Hepatitis B virus transmission between heterosexuals. JAMA. 1986; 256(10):1307-1310
10. Kidd-Ljunggren K, Holmberg A, Blackberg J, Lindqvist B. High levels of hepatitis B virus DNA in body fluids from chronic carriers. J Hosp Infect. 2006; 64(4):352-357.
11. Van der Eijk AA, Niesters HG, Hansen BE, Pas SD, Richardus JH, Mostert M. Paired, quantitative measurements of hepatitis B virus DNA in saliva, urine and serum of chronic hepatitis B patients. Eur J Gastroenterol Hepatol. 2005; 17(11):1173-1179.
12. Heiberg IL, Hoegh M, Ladelund S, Niesters HG, Hogh B. Hepatitis B virus DNA in saliva from children with chronic hepatitis B infection: implications for saliva as a potential mode of horizontal transmission. Pediatr Infect Dis J. 2010; 29(5):465-7.
13. Ayoola EA, Ladipo OA, Odelola HA. Antibody to hepatitis B core antigen, e-antigen and its antibody in menstrual blood and semen. International Journal of Gynaecology and Obstetrics. 1981; 19(3):221-223.
14. Braga WS, Castilho MC, Borges FG, Martinho AC, Rodrigues IS, Azevedo EP, Scazufca M, Menezes, PR. Prevalence of hepatitis B virus infection and carriage after nineteen years of vaccination program in the Western Brazilian Amazon Revista da Sociedade Brasileira de Medicina Tropical. 2012; 45(1):13-17.
15. Aparna S, Johannes H, Rafael T, Mikolajczyk G, Krause J, Jördis J. Estimations of worldwide prevalence of chronic hepatitis B virus infection: a systematic review of data published between 1965 and 2013. German Journal of Virology. 2015; 82: 654 – 662.
16. Vardas E, Mathai M, Blaau D, McAnerney J, Coppin A, Sim J. Pre-immunisation epidemiology of hepatitis B virus infection in South African children. J Med Virol. 1999; 58: 111-115.
17. World Health Organization. Hepatitis B. Fact sheet no. 204. Geneva, Switzerland: www.who.int/mediacentre/factsheets/fs204/en/index.html.World Health Organization. 2000.
18. Ni YH, Chang MH, Huang LM, Chen HL, Hsu HY, Chiu TY, et al.. Hepatitis B virus infection in children and adolescents in a hyperendemic area: 15 years after mass hepatitis B vaccination. Ann Intern Med. 2001; 135:796-800.
19. Zanetti AR, Van Damme P, Shouval D. The global impact of vaccination against hepatitis B: A historical overview. Vaccine. 2008; 26:6266-6273.
20. Ugbebor O, Aigbirior M, Osazuwa F, Enabudoso E, Zabayo O. The prevalence of hepatitis B and C viral infections among pregnant women. Journal of Medical Science. 2011; 3(5): 238–241.
21. Mueller A, Stoetter L, Kalluvya S, Stich A, Majinge C, Weissbrich B, Kasang C. Prevalence of hepatitis B virus infection among health care workers in a tertiary hospital in Tanzania. Biomedcentral Infectious Diseases. 2015; 15:386.
22. Yu-Ling Q, Bo L, Yue-su Z. Prevalence and associated knowledge of Hepatitis B infection among Healthcare workers in Freetown, Sirra Leone. BMC infectious disease. 2019; 18(1): 315-321
23. Babalola, OA, Fasola, FA, Odaibo, GN, Odetunde, A, Alamukii, NA, Ajayi, D, Akpe, O, Brown, BJ, Brown, BJ, Babalola, CP, Falusi, AG. Haematological changes associated with Hepatitis B virus infection in individuals with or without sickle cell disease. W.Afr.J of Med. 2017 30:38 (12):1167-11
24. Elichilia RS, Innocent BM, Daniel WG, Flora GR, Eliza-

beth MT, Nkwama ML, Pyuzza JJ, Kilonzo KG, Lyamuya FS, Paro VP. Seroprevalence of Hepatitis B Virus infection and associated risk factors among Healthcare workers in Northern Tanzania. BMC infectious disease. 2018; 18 (1):474-483

25. Thi, TH, Thuy, XL, Dong,TN, Chow, ML, Troung, BD, Tran, PD, Toy. Knowledge, attitude and Practices of Hepatitis B prevention and immunization of pregnant women and mothers in Northern Vietnam. J. of Pone. 2016; 14(4): 1-5
26. Amha G, Aschalew G, Feleke M, Mulat D. Seroprevalence of hepatitis B virus infections among health care workers at the Bulle HoraWoreda Governmental Health Institutions, Southern Oromia. Ethiopia Journal of Environmental Science. 2013; 2(1): 9-14.
27. Abdhalah K, Bwogi J, Namale A, Wainaina C, Mayanja-Kizza, H. Sero-prevalence and risk factors for hepatitis B virus infection among health care workers in a tertiary hospital in Uganda. BMC Infectious Diseases. 2010; 10:191.
28. Nwokediuko S. Risk Factors For Hepatitis B Virus Transmission In Nigerians: A Case-Control Study. International Journal of Gastroenterology. 2009; (10): 31-35
29. Kisangau NE, Awour A, Juma B, Odhiambo D, Muasya T, Too R, Lowther SA. Prevalence of Hepatitis B Virus vaccine among healthcare workers, Makueni County, Kenya. J. Public health. 2019; 41(4): 765-771
30. Adekanle O, Ndubaba DA, Olowookere SA, Ijarotimi O, Ijadunola KT. Knowledge of Hepatitis B Virus infection, Immunization with Hepatitis B Vaccine, Risk, Perception and challenges to control Hepatitis among Healthcare workers in a Nigerian Tertiary Hospital. Epub. 2015; 31 (1): 1-6
31. Habtemu JK, Gemeda DH, Abdusemed. Hepatitis B and C Viral Infection. Prevalence, Knowledge, attitude, practice and occupational exposure among Healthcare workers of Jimma University Medical centre, Ethiopia. The scientific World Journal. 2018; 2: 1-11
32. Endalew Y, Tangalew G, Gela M, Mulu G, Mulat A, Heilu D, Tedila S. Sero-prevalence of Hepatitis B virus infection and associated factors among Healthcare workers and Medical waste Handlers in primary hospitals of North-West Ethiopia. 2018; 11(1): 437-441
33. Adebayo A, Olabowale O. Prevalence of Hepatitis C Virus antibody among University students in Nigeria. J. Virus erad. 2018; 4(4);228-229
34. Ogoina D, Pondei K, Adetunji B, Chima G, Isichei C, Gidado S. Prevalence of Hepatitis B Vaccination among healthcare workers in Nigeria. J occup Environ Med. 2014; 5(1): 51-56