

# Immunodiagnosis of Hepatitis B Virus among Healthcare Givers in Resource-Limited Setting.

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## ABSTRACT

**Background:** Hepatitis B virus (HBV) is a highly infectious blood-borne virus (BBV) responsible for acute and chronic hepatitis B (HB) infections of the liver resulting in considerable morbidity and mortality in Sub-Saharan Africa. In a hospital setting transmission of HBV can be from patient to patient, which presents the greatest risk, followed by patient to HCW and lastly HCW to patient infections. This study determines Hepatitis B virus among Healthcare givers in Gwagwalada, Nigeria. **Methods:** This is a prospective cross sectional study which spanned two months (March-May 2016). The study population comprises of staffs of University of Abuja Teaching Hospital and hospital identification card was used to screen the staff. A total of Two hundred (200) healthcare providers randomly selected. **Results:** There were 70 males (35.0%) and 130 females (65.0%) and the male to female ratio (M: F) was 1:2. Among the healthcare givers 16 (22.8%) males were HBV positives to the virus while 37 (28.5%) females were surface antigen HBV positive. The mean age of healthcare givers was 44 years. The overall seropositive to hepatitis B virus among healthcare workers in Abuja was 26.5%. **Conclusion:** Prevalence of Hepatitis B virus is high among health care workers. Healthcare givers should know their status in order to avoid transmission to their patients and families alike.

**Keywords:** Immunology, Hepatitis B virus, Healthcare givers, Nigeria.

## INTRODUCTION

Hepatitis B virus (HBV) is a highly infectious blood-borne virus (BBV) responsible for acute and chronic hepatitis B (HB) infections of the liver resulting in considerable morbidity and mortality in Sub-Saharan Africa. Chronic carriage of HBV in sub-Saharan countries ranges from 9-20%, and in the whole of Africa about 50 million are estimated to be lifetime carriers with an estimated 12.5 million expected to die from HBV related liver diseases.<sup>[1]</sup> The main route of transmission of HBV in this region is unexplained horizontal transmission in childhood, with sexual transmission in adolescents and adults being the next most important route of transmission.<sup>[1]</sup> However, because HBV is blood borne and healthcare workers (HCWs) handle blood and other body fluids; this puts them at considerable risk of acquiring HBV infection if prevention and

control measures are not adequate in hospitals.<sup>[1,2]</sup>

In a hospital setting transmission of HBV can be from patient to patient, which presents the greatest risk, followed by patient to HCW and lastly HCW to patient infections.<sup>[2]</sup> It is reported that around 80% of chronic HBV infections are undiagnosed and this means that infected HCWs and patients can unwittingly act as carriers putting others at risk of infection.<sup>[3]</sup>

Human immunodeficiency virus (HIV) and HBV share common transmission routes and co infection in countries highly endemic with both viruses is to be expected.<sup>[4]</sup> In South Africa, HIV/HBV co-infection ranges from 4.8% to 17%.<sup>[4]</sup> In low prevalence areas such as the continental United States and Western Europe, injection drug abuse and unprotected sex are the primary methods, although other factors may also be important. In moderate prevalence areas, which include Eastern Europe, Russia, and Japan, where 2-7% of the population is chronically infected, the disease is predominantly spread among children. In high-prevalence areas such as Southeast Asia transmission during childbirth is most common.<sup>[4,5]</sup> HIV related immunosuppression increases the viral replication of

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HBV and is thought to increase efficiency of transmission of HBV, increase the risk of acute HBV infection progressing to the chronic state, and increase the risk of reactivating latent HBV infections.<sup>[4]</sup>

There is evidence that HBV is highly endemic in some parts of Nigeria. A mean prevalence of 9.4 % of Hepatitis-B surface antigen (HBsAg) was found in patients attending dental centre of a tertiary hospital at university of Lagos more so a study among donors at Benue State,<sup>[5]</sup> Nigeria found the seropositivity rate of HBsAg to be 20%.<sup>[5]</sup>

In another separate study, the prevalence of HBsAg positivity in Nnewi was 5.9% and found the prevalence of 6.3% and 5.6% in the HIV-infected and un-infected population, respectively.<sup>[6-8]</sup> This could however be the tip of the iceberg, since HIV positivity in hospitalised patients is associated with occult (hidden) HBV infection. The high rate of HIV positive patients treated at the hospital is likely to result in higher than expected HBV carriers who are given care at Gwagwalada, resulting in higher risk of exposure to HBV for HCWs.

Variations exist between area, countries and continents as to the age at which the highest transmission takes place. In hyperendemic areas prenatal transmission is common especially when HbcAg is positive. Infection may also be transmitted between household contacts.<sup>[7]</sup> Estimates of infectivity range from 2% (HBeAg absent) to 40% (HBeAg present). The source of infection cannot be identified in about 35% of cases.<sup>[7]</sup>

HBV presents an occupational risk of infection for all HCWs the world over. HBV vaccine and safe working practices present an opportunity to prevent infection of HCWs at risk; however infections are still occurring in healthcare settings all around the world.<sup>[7-9]</sup>

A Nigerian study at university of Lagos found that the majority of HCWs were not immune to HBV, and had not received any vaccination to prevent HBV infection.<sup>[7]</sup> In Nigeria there is no legislation to enforce provision of free vaccination by employers against HBV, so it is up to the individual or the employer to get vaccinated. There is thus a possibility that the majority of HCWs in Nigeria are not immune to HBV. The absence of data calls for urgent assessment of the preparedness for prevention and control of HBV among HCWs.<sup>[7,8]</sup>

In Africa 65 million people are chronically infected with HBV of the approximately 360 million infected globally.<sup>[9]</sup> Nigeria is highly endemic for HBV infection. A study in Jos (Nigeria) reported that about 75% of the population were likely to have been exposed to HBV at one time or another in their life, with a nationwide prevalence of between 7.4-26%.<sup>[10,11]</sup> The prevalence was reported to be 14.3% and 10.4% among healthy blood donors in Jos and Gombe states respectively. The prevalence of HBV was found to be as high as 28%

among hospital patients; this poses a peculiar problem to health care workers.<sup>[11-13]</sup> Thus HCWs in Nigeria are exposed to a large pool of potential carriers of HBV.

Hepatitis caused by hepatitis B virus is a highly enigmatic disease. The virus is not cytopathogenic; the greatest damage to the host is self-inflicted. Hepatocellular injuries caused HBV infection are predominantly immune-mediated, immune attacks by the host against HBV and are mainly mediated by a cellular response to small epitopes of HBV proteins, especially HBcAg, presented on the surface of liver cells. HLA class I restricted CD+ cells recognize HBV peptide fragments derived from intracellular processing and presentation on the liver surface of by class I molecules. This process leads to direct cell killing by the CD8+ cytotoxic T-lymphocytes.<sup>[12-15]</sup>

## MATERIALS AND METHODS

### Study Design

This is a prospective cross sectional study which spanned two months (March-May 2016) with staffs of University of Abuja Teaching Hospital.

### Study Area

This study was carried out at the Microbiology research laboratory unit, Microbiology and Parasitology department, University of Abuja Teaching Hospital (UATH) Gwagwalada, Federal Capital Territory (F.C.T). The Hospital is located in Gwagwalada whose geographical coordinates are 8° 56' 29" North and 7° 5' 31" East. It has an area of 1,043 km<sup>2</sup>. The Federal Capital Territory had a projected population of 1,406,239 inhabitants in the year 2006, of which 157770 (11.22% approximately) inhabitants reside in Gwagwalada.16 Projected population of Gwagwalada city in 2012 was over 1 million people. The hospital provides health care services to the inhabitants of Abuja and neighbouring states including Niger, Kaduna, Kogi and Nassarawa states.

### Study Population

The study population comprises of staffs of University of Abuja Teaching Hospital and hospital identification card was used to screen the staff.

### Inclusion Criteria

University of Abuja Teaching Hospital staffs.

### Exclusion Criteria

Spouses of staffs

Children of staffs

Those on probation (yet to be confirmed)

Staffs that are sick hospitalized or on sick leave at the time of this study.

### **Study Sample Size**

The sample size was determined using the following equation as described [17] below

$$n = \frac{Z^2 P (1-P)}{d^2}$$

Where n = sample size for sera.

z = statistics for a level of 95% confidence interval = 1.96

P = Prevalence rate = 0.043%

d = precision (allowable error) = 5%=0.05

Thus  $n = \frac{(1.96)^2 \times 0.043 \times (0.957)}{(0.05)^2} = 63$

A total of Two hundred (200) healthcare providers randomly selected at University of Abuja Teaching Hospital participated.

### **Sampling Method And Research Instrument**

This study did focus on three health groups namely Doctors, Nurses and Laboratorians. These groups of healthcare givers are vital in the daily usage of sharps objects. Using a structured questionnaire with closed ended questions to collect data from HCWs will be used for this study and about Three milliliter of blood will be collected from the staffs.

### **Procedure**

All materials and specimen were brought to room temperature and the test device was removed from the sealed foil pouch. The test device was placed on a flat horizontal surface and labeled the test device with specimen identity. Transfer pipette was used to draw up the sample and dispensed 2-3 drops (80-100µl) of sample in a vertical position into the each sample well individually. The result was read at 20 minutes after adding the sample. When coloured bands appeared within 20 minutes. When coloured band appears in the control zone (C) and another coloured band appeared in the test zone (T) this was considered POSITIVE. When coloured band appeared in the control zone (C) and no colour band in the test zone (T) this was considered NEGATIVE. When no coloured band appeared in the control zone (C) within 20 minutes this was considered INVALID.<sup>[18]</sup> The HBV panel test would be interpreted according to the manufacturer instructions. The panel test includes HBsAg, HBsAb, HBeAb, HBeAg, AntiHBc IgM, AntiHBcIgG.

### **Principle**

HBsAg test is a double antibody sandwich immunoassay. Colloidal gold conjugated anti-HBsAg antibody complexes are dry-immobilized in the test device. When the sample was added, it migrated by capillary diffusion through the strip rehydrating the gold conjugate complexes. Presence of HBsAg reacted with the gold conjugate complexes forming particles. These particles continued to migrate along the strip until the test zone (T) where they are captured by anti-HBsAg antibody immobilized there and a visible red line

appeared in the test zone (T). The gold conjugate complexes continued to migrate along until they are captured in the control zone by immobilized goat anti-mouse IgG antibody aggregating a red line, which indicated the validity of the test.<sup>[18]</sup>

### **Limitation**

This work serves as serological screening test and as such will only be restricted to lateral flow immunochromatographic assay. Others such as ELISA and RT-PCR was not done.

### **Statistical Analysis**

All generated data will be analyzed using SPSS version 16.0, using chi-square contingency table and a degree of freedom of 95%, p-value of <0.05 was reported as statistically significant.

### **Ethical approval**

The ethical clearance for this study will be sought and obtained from the Research Ethics Committee of the University of Abuja Teaching Hospital.

## **RESULTS**

This study was carried out among 200 healthcare givers between the ages of twenty-two years and sixty-five years. Samples were collected from these healthcare givers and none withdrew after consenting to the study. There were 70 males (35.0%) and 130 females (65.0%) and the male to female ratio (M: F) was 1:2. Among the healthcare givers 16 (22.8%) males were HBV positives to the virus while 37 (28.5%) females were surface antigen HBV positive. The mean age of healthcare givers was 44 years, with the highest proportion within the age range of 41-50 years accounting for 36.5% of the healthcare givers and the lowest proportion being 21-30 years accounting for (3) 1.5%. 21 HBV positive healthcare givers were within the 41-50 years age group, 18 HBV positive were within the 51-60 years age group while none were HBV positive in the 21-30 years age group. However, this distribution was not statistically significant (P =0.09, Table1). Doctors were mostly investigated with frequency of 83 representing 41.5% while the laboratorian which was made up of the core laboratorian and phlebotomist were 56 representing 28.0% of those investigated. Waste managers investigated were 10 and represented 5.0% while Nurses were 47 representing 23.5%. 20 Doctors were HBV positive while 14 and 17 were HBV positive among Nurses and laboratorian respectively. This distribution was statistically significant (p=0.001, Table 3). The overall seropositive to hepatitis B virus among healthcare workers in Abuja was 26.5%.

In terms of marital status, 54 (27.0%) of the 200 healthcare workers were married while 71 (35.5%) of the healthcare worker were single. 40 (19.5%) were single parents and the divorced group were 35

(17.5%). Those healthcare givers with time of practice of 5-10 years were predominantly investigated and were 74 subjects accounting for 36.1%, this group was closely followed by those that had worked as healthcare giver for 1-5 years representing 29.8% of those investigated. Ten (7.3%) Of the healthcare givers practice bisexual relationship while 103 (50.2%) had multiple partner relationship and 33 (16.1%) were never expose to sexual intercourse. This relationship was statistically significant (p= 0.001, Table 5). 166 (83.0%) never had blood transfusion while 34 (17.0%) of healthcare givers had previous blood transfusion. In terms of knowledge of the virus among caregivers, 53% of the respondent agreed that health workers can get infected like any other patients. In terms of transmission, 29.5% of the caregivers investigated did not know the mode of transmission of Hepatitis B virus, 26.5% agreed that transmission can be by sharps while only 17% choose sexual means as the commonest mode of transmission of Hepatitis B virus. Majority of respondents were aware that Hepatitis B virus is a DNA virus, While 15% were certain the causative agent was a bacteria.

**Table 1: Age and distribution of HBV among healthcare workers in Abuja, Nigeria.**

Age group (years)	Total	Percent (%)	HBV positive	Percent (%)
21-30	3	1.5	0	0.0
31-40	43	21.5	10	18.9
41-50	73	36.5	21	39.6
51-60	58	29.0	18	34.0
61-70	22	11.5	4	7.5
Total	200	100.0	53	100.0

P=0.09 df=4

**Table 2: Gender and distribution of HBV among healthcare workers in Abuja, Nigeria.**

Gender	Total	Percent (%)	HBV positive	Percent (%)
Male	70	35.0	16	30.2
Female	130	65.0	37	69.8
Total	200	100.0	53	100.0

**Table 3: Bio-dermographic and distribution of HBV among healthcare workers in Abuja, Nigeria.**

Healthcare workers	Total	Percent (%)	HBV positive	Percent (%)
Nurses	47	23.5	14	26.4
Doctors	83	41.5	20	37.7
Phlebotomist	38	19.0	11	20.8
Laboratarians	18	9.0	6	11.3
Waste Managers	10	5.0	1	1.9
Others	4	2.0	1	1.9
Total	200	100.0	53	100.0

**Table 4: Knowledge of Respondent of HBV Among Healthcare Givers in Abuja**

Factors	Frequency	Percent (%)
<b>Infect. Of caregivers</b>		
Y	106	53.0
N	94	47.0
Total	200	100.0

<b>Transmission</b>		
Sexual	34	17.0
Injection	54	27.0
Sharps	53	26.5
IDK	59	29.5
Total	200	100.0
<b>Knowledge Of Organism</b>		
DNA	91	45.5
RNA	79	39.5
Bacteria	30	15.0
Total	200	100.0
<b>Alanine Transaminases</b>		
Norm	26	13.0
Elevated	19	9.5
Napplicable	155	77.5
Total	200	100.0
<b>Alkaline Transaminases</b>		
Norm	26	13.0
Elevated	19	9.5
Napplicable	155	77.5
Total	200	100.0
<b>Immunodiagnosis Of Hepatitis B Virus (Serology)</b>		
Positive	53	26.9
Negative	147	73.5
Total	200	100.0
<b>Blood Transfusion</b>		
Yes	34	17.0
No	166	83.0
Total	200	100.0
<b>Sexual Behaviour</b>		
Single partner	54	27.0
Multiple partner	103	51.5
Never exposed	33	16.5
Bisexual	10	5.0
Total	200	100.0
<b>Marital Status</b>		
Married	54	27.0
Single	71	35.5
Single (M or F)	40	20.0
Divorced	35	17.5
Total	200	100.0

NB: NORM= Normal NAPPLICABLE= Not applicable

## DISCUSSION

The prevalence of Hepatitis B virus among healthcare givers in Abuja was 26.5%. This figure varies with findings in Nigeria and other parts of the world.

The finding of 25.6% prevalence in this study is higher than studies in Lagos (Adewale et al., 2013) and Nnewi.<sup>[6]</sup> In the Lagos study, the wide scale use of HBV vaccine might have contributed to a reduction in incidence of HBV. Immunization of health workers at point of entry into service when newly employed had helped the workers; couple with the efficient and effective administration of the vaccine had led to reduction in prevalence among health workers. Hence, the relationship between the use of vaccines and subsequent reduction of HBV infections is well established. The prevalence in Abuja was lower than seropositive in North-central Nigeria in Benue state University.<sup>[4]</sup> These differences observed may be due to differences in methodology and sampling methods. Also, in this study the categories of caregivers were limited to



Doctors, laboratory technicians and nurses. This finding was lower than studies from Gombe where 28.0% was reported. This difference may be explained by the fact vaccination against HBV for healthcare givers had not commenced in Gombe.

In this study, the older age groups were mostly affected by the virus, there were 39 healthcare givers that tested positive and were between the age group 41 and 60 years. This was contrary to findings in Lagos where younger and middle age healthcare workers were affected. Although the younger age healthcare givers were less affected and tested negative to the virus, they should be educated and equipped with the knowledge of transmission of the virus so as to observe universal precaution in performing procedures and remain negative at older age. This provides an ample opportunity to mentor younger healthcare givers about accessing HBV vaccine. There were healthcare givers with acute and chronic liver changes in this study, 19 (9.3%) with chronic HBV and elevated alanine transferases. This could affect the productivity of the healthcare workers, increase man-hour loss and might shorten their life expectancy, nevertheless the long years of knowledge and experience acquired.

Higher proportion of the female care givers were serologically positive to HBV test 37(28.5%) compared to the males, this was similar to findings in Lagos and Benue. The reason for this high female HBV seropositive may probably due to the higher preponderance of females recruited and investigated been ratio 2:1 female to male ratio. This can also be due to the fact that there is more female work force in the hospital care giving setting. This findings is particularly worrisome because female healthcare givers may be in a single or polygamous family setting, as such transmission of the virus to her household may be rapid and it had been seen in this findings that 103 of the healthcare giver responded to multiple sexual practice and 71 (35.5%) were single. There were no MSMs (Men having sex with Men) among the caregivers.

From the study the pattern of perception and knowledge about HBV among healthcare workers was low, 29.5% did not know the mode of transmission and 15% thinks HBV was a bacteria. The low perceptions was worrisome because in resource limited health system, the community do depend heavily on health information from healthcare workers. These healthcare givers were not only enlightened about the virus but were also taught the preventive measures considering the fact that the respondents are important man-power when delivery of health education and that they constitute the most informed group in the hospital.

## CONCLUSION

Hepatitis B viruses does not only infect the common man in the street, it also infects the health workers or

caregivers who takes care of people that are sick. Healthcare givers should know their status in order to avoid transmission to their patients and families alike. This work has showed that HBV is prevalent among caregivers and an important viral agent that can be seradicated if careful advocacy is undertaken among caregivers in the hospital. Therefore, a national policy veered toward community and hospital awareness, cost effective testing, affordable treatment and prevention is needed urgently.

## Recommendations

1. Regular education and periodic information dissemination on hepatitis B infection, its vaccine and points of accessing it should be made available to health staff by the hospital authority.
2. The Hospital should ensure the teaching and observation of universal basic precaution to health care workers through sensitization workshops.
3. Hospital should have a free, structured hepatitis B vaccination programme for its staff.
4. Nigerian Government should toe the line of other countries that have legislations mandating hospitals to ensure hepatitis B vaccination for health care workers.
5. Nigerian Government should make hepatitis B vaccines available and accessible at all points of health care delivery to facilitate uptake. Although this may be capital intensive, international bodies and collaboration can aid in making it a reality.

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