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Hepatitis B Virus and Human Immunodeficiency Virus Infections among Health Care Workers in Some Health Care Centers in Benue State, Nigeria

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Abstract

Introduction: Benue State of Nigeria has a high morbidity and mortality among individuals from HIV/AIDS. HBV is common among people who are at risk of/or living with HIV since both are transmitted in the same ways and in the presence of co-infection, there is increased risk for serious life threatening liver and other health complications. This study was carried out to assess the prevalence of HBV and HIV infections among Health Care Workers (HCWs) in some health care centers in the state. **Materials and Methods:** A total of 255 randomly collected blood specimen of consenting HCWs from some health care centers located in Benue State were screened by ELISA for Hepatitis B virus markers. Antibodies to HIV 1and 2 were detected in sera using Determine (Alero, Japan) and Stat Pak (USA) test strips. Other information was obtained through administration of structured questionnaire and data generated were analyzed using Chi square (χ^2) test. **Results:** Of the 255 sampled individuals, 221 (86.7%) showed serological evidence of exposure to HBV markers, some through natural infection (21.6%) and others (23.9%) through vaccination; 10.6% of the exposed were currently infected, while 30.6% were indeterminate. HIV antibodies were in 43 (16.9%) while 6 (2.4%) had both HBV and HIV infections. HIV significantly (P = 0.027) increased with increasing years of professional service in the health sector, similar to needle stick injury (P = 0.000) in this study. Both HBV and HIV were significantly higher (P = 0.025, P = 0.000 respectively) in individuals with history of

previous surgery. **Conclusion:** Therefore, HBV and HIV infections are common among HCWs in Benue State. Hence, there is need to scale up vaccination coverage for HBV and upgrade the medical facilities especially in rural health care centers as well as intensification of programmes targeting safety and prevention for precautions.

Keywords

HBV, HIV, Health Care Workers, Benue State, Nigeria

1. Introduction

About 33.3 million people are currently living with HIV/AIDS with 68% residing in Sub-Saharan Africa [1]. HIV attacks $CD4^{+}T$ cells as critical cells in cellular and humoral immunity, leading to defective cell-mediated and humoral immune responses [2]. This put potential and infected HIV patients at increased risk of both viral and microbial infections. It has been documented that one of the frequent complications of HIV infections is hepatitis B co-infection and due to the common methods of transmission of these two viruses, the incidence rate of co-infection is increasing [2] especially among health care workers. HIV/HBV co-infected patients are at an increased risk of developing cirrhosis, having higher levels of HBV replication, having lower rates of spontaneous resolution of the HBV infection, and having a higher risk of reactivation of previous infections [3] [4]. HBV infection also increases the toxicity to antiretroviral medications, and may lead to rapid progression of HIV disease [5]. Patient to a health provider transmission was reportedly common before widespread hepatitis B vaccination of health care workers. A health care worker's risk of infection has been reported to correlate with his/her level of blood and needle exposure [6]. Their increased risk at the workplace may also be due to their potential contact with infected bodily fluids such as saliva or vaginal fluids [7] including urine and faeces. The Sub-Saharan region has the highest HBV rates, ranging from 5% to 8% [8], making it an endemic region. For intermediate and high HBV endemic countries, HIV and HBV co-infection rates of 10% - 20% rates have been found [9]. Despite high level of exposure of HCWs to body fluids and blood borne pathogens, significant numbers of HCWs are reportedly not vaccinated against HBV that is preventable. For example, in a study carried out in an apex health care centre in India, 41.7% of the HCWs were not vaccinated [10]. This situation could be worst in Sub-Saharan Africa where even the basic of medical care is difficult to provide and where the protection of health care workers is reportedly neglected [11]. Documentations of HIV prevalence among different segments of health work force are rear, especially in Nigeria. Studies on HIV among HCWs are usually questionnaire based and focus on occupational exposure to HIV [12] [13] [14] [15] and stigmatization [16]. In Cameroon, a study on the prevalence of HBV/HIV co-infection indicated that 21% of HIV positive patients were in-

fected with HBV [3] [17]; high levels of co-infection were also reported in South Africa in one study where 20% of 537 HIV infected individuals were HBsAg positive [3] [18]. From Nigeria, one report showed high levels of HBV/HIV co-infection with HBsAg detectable in 28.4% of 102 HIV infected patients [3] [19]. It is from the foregoing that we establish the need to determine the prevalence of HBV and HIV infection/co-infection and the associated risk factors among Health Care Workers (HCWs) in Benue State.

2. Materials and Methods

2.1. Study Area

Benue State (Nigeria) has a land mass of 31,400 KM^2. According to the last 2006 Nigerian National Population Census, its population is 4,253,641 [20]. There are three major ethnic nationalities that make up Benue State-the Tiv with a population of 2,945,994, the Idoma (1,040,449) and the Igede (267,198) [20].

2.2. Study Design and Sampling

A cross sectional study design was adopted for the study. Six Local Government Areas (LGAs) were randomly selected out of 23 LGAs comprising the state. These LGAs represent the three geopolitical regions of the state: Benue North East (Katsina-Ala and Vandekkya LGAs), Benue North West (Makurdi and Gwer West LGAs) and Benue South south (Otukpo and Oju LGAs). Samples were collected from health centers within each of the sampled LGAs.

2.3. Determination of Sample Size

In order to allow for valid analyses and to provide the desired level of accuracy in estimates of proportions, the sample size was determined using the formula;

$$n = \frac{z^2 pq}{d^2},$$

where; n = the desired sample size, z = the standard normal deviate = 1.96 (95% confidence level), p = proportion in the target population estimated to have a particular characteristic = 20% (0.20), q = 1.0 − p, d = degree of accuracy desired, set at 0.05, n = 245.

In all, samples distribution was: Katsina-Ala 41, Vandekya 42, Makurdi 43, Gwer West 41, Oju 42 and Otukpo 46. The distribution was according to the population of the LGAs, while the sample size was based on an average co-infection prevalence rate of 20% found in countries with similar settings as Nigeria such as South Africa and Cameroon. The determined sample size was 255, with a 95% confidence interval, adjusted for 15% non-response rate, a possibility of 5% drop out rate and 10% inadequate quantity and/or contamination of the sample.

2.4. Inclusion and Exclusion Criteria for Recruiting HCW

All the identified HCWs reporting to any of the chosen clinic sites were eligible

to participate irrespective of their previous HIV and HBV testing status. Those who were unwilling to participate, failure of informed consent and those who were too ill were excluded from the study.

2.5. Sample Collection

After counseling of the HCW by professional medical health practitioners at each of the selected study sites, 4 - 5 ml of venous blood was aseptically collected from each of the 255 (all HCW who met the criteria and accepted to participate after counseling were recruited into the study) participants who were available and eligible in the Health care centers by venepuncture into a vacutainer using a standard procedure. The blood was allowed to clot and centrifuged at 1000 g for 10 min under ambient temperature to separate the cells from serum. Serum was extracted using Pasteur pipettes and was stored in cryogenic vials at −17˚C if serum was not to be used immediately. Other information was obtained from the participants through administration of questionnaire in English for the educated or local dialect for the illiterate ones using trained interpreters.

2.6. Diagnosis of Hepatitis B Virus Infection by Assay of Blood Samples for Hepatitis B Virus Antigens and Antibodies

All blood serum samples collected were serologically evaluated for three Hepatitis B virus markers (designated as prime markers), namely, Hepatitis B surface antigen (HBsAg), Hepatitis B surface antibody (HBsAb) and Hepatitis core antibody (HBcAb). Sera that tested positive for HBsAg were further tested for Hepatitis B early antigen (HBeAg) and IgM antibodies to Hepatitis B virus core antigen (HBcIgM). Enzyme-linked Immunosorbent Assay (ELISA) kits specific for detection of each marker in sera were used (Diagnostic Automation/Cortez Diagnostic, Incorporated, California, USA).

Diagnosis of the different phases of HBV infection included, whether a patient had acute or chronic infection, was susceptible to infection with the virus, was immune due to past infection or vaccination through the use of the various markers or a combination of markers based on standard protocols [21].

2.7. Assays for HIV

About 50 µl of serum samples was added to selenium colloid-antigen conjugate contained in the sample pad provided by the HIV1/2 kit (Determine—Alero, Japan and Stat pak—USA); and allowed to stand for 15 minutes before reading the result. Appearance of a red line (coloration) in the sample window or compartment similar to the red line in the control window was interpreted to mean that there are HIV 1 and/or HIV 2 antibodies in the serum sample; otherwise the test was negative.

Information on risk factors such as history of needle stick injury, surgery, blood transfusion, HBV vaccination and years of professional service was obtained through administration of structured questionnaire.

2.8. Data Analysis

Data generated through laboratory analysis and questionnaire responses were entered in a statistical soft ware (Statistical Package for Social Sciences, SPSS version 20.0). Comparison of categorical variables was made in cross tabulations and differences in proportions were determined using Chi square (χ^2) test. Significant association was set at 95% level of probability.

3. Results

A total of 255 Health Care Workers (HCW) participated in the study with a mean age of 34.05 (range 18 - 70 years) and a mean period of professional practice of 8.25 years (range 4 months to 42 years). Among these were; 3 (1.2%) Medical doctors, 43 (16.9%) Nurses, 34 (13.3%) Medical laboratory Scientist/Technicians, 25 (9.8%) Assistants and 57 (21.6%) Cleaners/Ward Attendants. Community Health Extension Workers (CHEW) were 30 (11.8%) while 65 (25.5%) make up other category of workers such as pharmacists, medical records personnel and administrative staff. There was a total of 139 (54.5%) females and 116 (45.5) males.

On the whole, 27 (10.6%) were infected with HBV and 43 (16.9%) tested positive for HIV antibodies, while 6 (2.4%) tested positive to both HBV and HIV. HBV infection was higher in males (11.2%) than females (10.1%) while HIV infection was higher in females (17.9%) than their male counterpart (16.4%). However, the differences between the male and female infection for both HBV and HIV were not statistically significant (HBV: $\chi^2 = 0.086$, df = 1, P = 0.769; HIV: $\chi^2 = 0.035$, df = 1, P = 0.851). Of all the professional groups, Community health extension workers had the highest (20.0%) HBV infection rate, followed by Laboratory scientist/Technician (17.6%) but none of the doctors and Assistants tested positive for HBV. On the other hand, HIV was higher in Nurses (20.9%), followed by CHEW (20.0%) and least in Scientist/Technician (14.7%). The differences in infection rate between these professional groups were not significant for HBV ($\chi^2 = 9.317$, df = 6, P = 0.156) and HIV ($\chi^2 = 1.564$, df = 6, P = 0.955) infections, respectively (Table 1).

Considering years of professional service (Table 2), HBV infection was highest among individuals that had worked for ≤1 year (20.8%) and decreased progressively to 6.8% in those who served between 6 and10 years (P = 0.082). Conversely, HIV infection distribution differed significantly with the years in professional service ($\chi^2 = 9.186$, df = 3, P = 0.027) with higher rate in individuals that served for 6 - 10 years (29.5%) and 2 - 5 years (18.8%) but was lowest in individuals that worked for ≤1 year (8.3%).

When the questionnaire responses of HCWs on issues of vaccination and needle stick injury were compared with years of professional service (Table 3), more HCWs (45.5%) within the service years of 6 and 10 years affirmed the receipt of at least one dose of HBV vaccine while 20.8% of those that worked for a year or less accepted been vaccinated. Similarly, more HCWs (6 - 10 years in

Table 1. Prevalence of HBV and HIV infections according to Specialty of HCW in Benue State, Nigeria.

Specialty	Number Tested	HBV+ (%)	HIV+ (%)
Doctor	3	0 (0.0)	0 (0.0)
Nurse	43	5 (11.6)	9 (20.9)
Scientist/Technician	34	6 (17.6)	5 (14.7)
Assistant	25	0 (0.0)	4 (16.0)
Sweeper/Attendant	55	6 (10.9)	9 (16.4)
CHEW	30	6 (20.0)	6 (20.0)
Others	65	4 (6.2)	10 (15.4)
Total	255	27 (10.6)	43 (16.9)
χ^2		9.317	1.564
Df		6	6
P value		0.156	0.955

Table 2. Prevalence of HBV and HIV infections among HCW according to years of Professional service in Benue State, Nigeria.

Years of Service	Tested	HBV+ (%)	HIV+ (%)
≤1	48	10 (20.8)	4 (8.3)
2 - 5	101	9 (8.9)	19 (18.8)
6 - 10	44	3 (6.8)	13 (29.5)
≥11	62	5 (8.1)	7 (11.3)
Total	255	27 (10.6)	43 (16.9)
χ^2		6.700	9.186
df		3	3
P value		0.082	0.027

Table 3. Relationship between Vaccination, Needle stick injury and Years of Professional Service of health care workers.

Years of Service	Number of Responders	Affirmed Vaccinated (%)	Affirmed Needle Injury (%)
≤1	48	10 (20.8)	13 (27.1)
2 - 5	101	42 (41.6)	29 (28.7)
6 - 10	44	20 (45.5)	24 (54.5)
≥11	62	23 (37.1)	32 (51.6)
Total	255	95 (37.1)	98 (38.4)
χ^2		7.613	16.025
df		3	3
P value		0.055	0.001**

service), (51.6%) accepted having needle stick injury during work but fewer number of people (27.1%) within one year of their professional service accepted having needle stick injury (χ^2 = 16.025, df = 3, P = 0.001)

Evaluation of questionnaire responses to history of risk factors and HBV/HIV status for each response group is presented in Table 4. HBV was slightly higher in those that had a history of transfusion (12.5%) and those that accepted awareness to HBV infection (10.8%). HBV infection rate was slightly lower in HCWs that had previous needle stick injury (10.2%) than in those that had not (10.8%); HBV was also significantly lower (χ^2 = 5.027, df = 1, P = 0.025) in HCWs that had previous surgery (3.1%) than in those without previous surgery (13.1%). On the other hand, HIV was significantly higher (χ^2 = 6.605, df = 1, P = 0.010) in HCWs with history of needle stick injury (24.5%) than those who did not (12.1%). Similarly, HIV rate was significantly higher: in those with previous surgery (31.2%) than those with no history of surgery (12.0%), (χ^2 = 12.616, df = 1, P = 0.000); those who previously had awareness of HIV (19.2%) than those who did not (7.7%), (χ^2 = 3.918, df = 1, P = 048) and HCWs who accepted being vaccinated for HBV also had HIV rate of (25.3%) compared to their counterparts who were not vaccinated (11.9%), (χ^2 = 7.621, df = 1, P = 006). HIV was also higher (χ^2 = 3.311, df = 1, P = 069) in transfused individuals (28.1%) than those with no history of previous transfusion (15.2%).

HBV infection was higher (14.8%), but not significantly, in the 25 - 34 years age bracket but decreased progressively to no infection in the age ≥55 years. But HIV differed significantly with highest rate in 25 - 34 (28.4%) age category followed by 35 - 44 (26.2%) years age group (χ^2 = 22.363, df = 4, P = 0.000) (Table 5).

Evaluation of the immune status of HCWs against HBV was carried out using a guide for combination and interpretation of HBV markers [19] and questionnaire

Table 4. Questionnaire Responses to History of Risk Factor and HBV/HIV Status for each Response group.

Risk Factor History	Responses Sought	No. of Responders (%)	No. Positive for HBV (%)	P value	No. Positive for HIV (%)	P Value
Needle injury	Yes	98 (38.4)	10 (10.2)	**0.875**	24 (24.5)	**0.010***
	No	157 (61.6)	17 (10.8)		19 (12.1)	
Transfusion	Yes	32 (12.5)	4 (12.5)	**0.707**	9 (28.1)	**0.069**
	No	223 (87.5)	23 (10.3)		34 (15.2)	
Surgery	Yes	64 (25.1)	2 (3.1)	**0.025***	20 (31.2)	**0.000****
	No	191 (74.9)	25 (13.1)		23 (12.0)	
Awareness	Yes	203 (79.6)	22 (10.8)	**0.798**	39 (19.2)	**0.048***
	No	52 (20.4)	5 (9.6)		4 (7.7)	
HBV vaccination	Yes	95 (37.3)	7 (7.4)	**0.198**	24 (25.3)	**0.006***
	No	160 (62.7)	20 (12.5)		19 (11.9)	

*Significant, **Highly significant.

Table 5. Age prevalence of HBV and HIV among HCWs in Benue State, Nigeria.

Age Group	Number Tested	HBV^+ (%)	HIV^+ (%)
15 - 24	64	8 (12.5)	3 (4.7)
25 - 34	88	13 (14.8)	25 (28.4)
35 - 44	42	3 (7.3)	11 (26.2)
45 - 54	46	3 (6.5)	3 (6.5)
≥55	15	0 (0.0)	1 (6.7)
Total	255	27 (10.6)	43 (16.9)
χ^2		4.981	22.363
df		4	4
P value		0.289	0.000**

**Highly significant.

Table 6. Status of HBV infection among HCW according to Response to Question of HBV Vaccination.

Infection Status	HBV Vaccination Status		Total
	Yes (%)	No (%)	
Current Infection	7 (2.7)	20 (7.8)	27 (10.6)
Natural Antibodies	0 (0.0)	55 (21.6)	55 (21.6)
Vaccinated	61 (23.9)	0 (0.0)	61 (23.9)
Indeterminate	17 (6.7)	61 (23.9)	78 (30.6)
Negative	10 (3.9)	24 (9.4)	34 (13.3)
Total	95 (37.3)	160 (62.7)	255 (100)

response to the question of HBV vaccination. Out of 95 (37.3%) that indicated having been vaccinated against HBV, 61 (23.9%) actually tested positive to HBV exposure; 7 (2.7%) had current infection, while 17 (6.7%) were indeterminate. In all, 78 (30.6%) of the samples had indeterminate result and 34 (13.3%) were negative for all the three major markers analyzed (Table 6).

None of the doctors was vaccinated against HBV but 2 of the 3 (66.7%) had natural HBV antibodies due to previous exposure. Medical laboratory scientists/technicians had the highest number of individuals that showed evidence of HBV vaccination (38.3%), followed by CHEW (36.7%). Cleaners/Attendants had the highest number of persons with indeterminate cases (38.2%) while Assistants were recorded with the highest number of individuals negative for all the markers (36.0%) and considered vulnerable.

4. Discussion

The prevalence rate of HBV (10.6%) and HIV (16.9%) among healthcare workers reported in this work is considered high; but there are no reasons to associate it with their occupation alone since this is not higher than the population mean

(HBV,12.0%; HIV,15.9%) earlier reported [21]. Besides, the HCWs live in the same communities and are culturally part of the society under study. Indeed, the 10.6% HBV prevalence rate among HCWs in this study is notably lower than the population average and the 38.7% [22] reported among doctors and dentists in University Teaching Hospital Ibadan; and slightly lower than the 15.5% [23] observed among medical students of Usman Danfodiyo University, Sokoto and the 13.0% prevalence reported in another study among HCWs in Ibadan, Nigeria [24]. The very high rate (38.7%) reported by Olubuyide [22] among surgeons and dentists may reflect their constant contact with patients' blood, blood products and or saliva including other body fluids in the course of their work.

It is uncertain whether the higher prevalence among medical students in the study in Sokoto [23] compared to the findings in this work could be explained by the high incidence of needle stick injury reported to be prevalent among medical students in Nigeria [25]. It may be noted also that Olubuyide *et al.* [22], sixteen years ago, reported a lower vaccination rate among their studied subjects (20%) compared with 37.3% recorded in this study which could have accounted for the high prevalence observed in their study. Furthermore, the 21.1% HBeAg-positive rate among Olubuyide's sample population, in contrast to the 3.7% rate in this study, may mean a higher potential for transmission of HBV in that population, given that HBeAg is associated with infectivity [26]. Hence, the doctors and dentists' contacts with the patients in that population put them at a greater risk of HBV infection than those in this study.

However, HBV prevalence of 10.6% in this work is higher than 4.3% reported among HCWs in Federal Medical Centre Ido-Ekiti [27] and 3.2% among HCWs of Lagos State University Teaching Hospital [28]. This could be attributed to low exposure rate of the subjects (17.9%) [28], compared with 84.7% in this report. This interpretation is corroborated by Shrestha and Bhattarai [29] who reported a low HBV exposure of 14.5% in Nepal with an equivalent low (1.4%) detection of HBsAg positive cases.

On the other hand, 16.9% of HIV antibody prevalence among HCWs in this study is higher than 12.7% and 4.1% of 2010 National HIV sentinel survey among pregnant women for Benue State and Nigeria, respectively [30]. This high rate may not necessarily be acquired in the hospital given that only about 2.5% of HIV infections among HCWs have been reportedly attributed to occupational injuries [15] [31]; therefore, the relatively higher rates among HCWs in this study could be due to other confounding factors such as low sample size and also a reflection of the infection rates in the general population as indicated above. Inability to properly separate those who were already known to have been infected with HBV and HIV during this study may also mean sampling more infected people who came to check their co-infection status.

Documentations on distribution of HIV prevalence among different segments of health work force are rear especially in Nigeria. Studies on HIV among HCWs are usually questionnaire based and are focused on occupational exposure to

HIV [12] [13] [14] [15] and stigmatization [16] [31]. Stigma and fear of disclosure have been reported to be a major obstacle to HCWs accessing HIV testing and counseling [31]. Being infected with HIV appears to be a source of personal and professional shame for a health care worker and may also invoke fear of losing one's job and damaging future career prospects [31]. However, HIV prevalence reported among the different segments of health work force in this work emphasize the need to document HIV prevalence among HCWs in Nigeria; this could be of immense contribution in planning and monitoring of HCWs. For example, high prevalence of 20.9%, 20%, 16.4% and 16.0% observed among nurses, community health extension workers, sweepers/Attendance and Assistants, respectively, in this study could have serious implications for the health-care system for care giver to patient transmission of infections and vice versa. First, sick HCW may not be able to carry out their responsibilities effectively because of frequent absenteeism. Second, non-infected workers could be over loaded since they will be expected to fill in the gap left by their sick colleagues. Third, infected workers are likely to be doubly infected because of such exposure and there could be risk of exposure to nosocomial tuberculosis and drug resistant tuberculosis [32], and other hospital acquired infections. High rate of HIV antibodies observed in this work is comparable to 15.7% reported by Shisana *et al.* [32] but higher than 11.5% by Connelly *et al.* [33] among HCWs in South Africa, and 4.6% [34] among health care workers in Cameroon. HIV prevalence of 16.9% reported here far exceeds both the national (Nigeria) (4.1%) and Benue state (12.7%) prevalence for 2010 national sentinel survey [30]. But the HIV rates of 15.7% and 11.5% reported in the South African studies were lower than their national South African prevalence of 29.4% for 2007 and 29.5% for 2011 respectively. Similarly, 4.6% reported in Cameroon [34] was also slightly below the national average of 5.3%.

The decreasing prevalence of HBV infection with increasing years of professional service of HCWs in the study is consistent with the findings among HCWs in Uganda [35]. This finding is, however, at variance with what has been reported by a study in Ibadan [22] in which no infection pattern was observed with respect to years of service.

Though the exposure rate of the studied subjects increased with years of professional service, HBV current infections decreased with years of service. This is because the number of individuals vaccinated against HBV increased with years in service (**Table 3**). In addition, HBV infection is usually self limiting especially when exposure occurs during adolescence or young adulthood [36] while some may have died. Whereas, for HIV infection, once infected the individual remains infected till death. Hence, the higher the exposure to HIV, the higher is the prevalence as seen in this work. This argument tends to influence most of the results in this study though both infections are reported to have same mode of transmission and associated risk factors. Thus, there was no statistically significant relationship between HBV infection and age, but highest HBV infection

was observed among the most sexually active age group. This was more clearly observed with HIV infection where HIV infection was highly associated (P = 0.000) with 25 - 34 and 35 - 44 years age categories. This finding is consistent with the report of Connelly *et al.* [33] among HCWs in South African republic and 2010 national sentinel report that recorded the age of 30 - 34 in North Central Nigeria with the highest prevalence of 8.6%. Modes of transmission usually depend on the geographical region of the patient. For instance, in low (<2%) prevalence regions, such as Europe and America unprotected intercourse and injected drug use are the main modes of transmission affecting the adult population [37]. Alternatively, the high endemic areas (>8%) of Asia and Africa main form of transmission are cultural practices such as tattoos and scarification, perinatal, close contact in the house hold including sex and other medical procedures [9].

Lastly, the HBV/HIV co-infected prevalence seen in this study 6 (2.4%) is higher than the report from Mali of 1.13% in a large sample of 11,592 blood donors [38] but is far below the estimated range of 5% to 21% as highlighted in various studies [3] [17] [19] [39]. It has been observed and documented that HBV infection is one of the frequent complications of HIV, and as a result of similar modes of transmission, the incidence is rising [1] [2]. Co-infection with HBV among people living with HIV could lead to challenging liver complications including cirrhosis and liver cancer. Other problems are those of increased toxicity of antiretroviral drugs, higher HBV replication and reduced cellular and humoral immune responses (especially when the CD4 count is below 200 cells/ml), the reactivation of quiescent HBV infection, tuberculosis and other infections.

Therefore, the general belief that HCW is aware of the risk factors for infection for HIV/HBV and could be more protected may not always be the case. Hence, program towards the protection of all HCWs such as adequate vaccination against HBV, improvement in medical facilities and awareness creation on safety and prevention strategies should be intensified.

Study Limitations

This study had some limitations, some of which include limited sample size and many other confounding factors such as the use of convenience sampling, inability to properly separate those who were already known to have been infected with HBV and HIV. The study also failed to give representative sample size of the various professional groups including the known degree of exposure, while the risk factors highlighted were self-reported and could be subjective due to recall bias to draw valid conclusions.

5. Ethical Approval

Ethical clearance was sought and obtained from Benue State Ministry of Health and Human services, Makurdi. For reasons of privacy, all data were kept confi-

dential in accordance with World Medical Association (WMA) declaration of Helsinki [10]. All participants voluntarily signed consent forms either in own handwriting or with thumb prints as proof of willingness to provide samples for the tests.

Contributors

All authors made substantial contributions to this article: EM Mbaawuaga, CU Iroegbu and AC Ike conceived and design the study, interpreted the analysed data and drafted article. EM Mbaawuaga was also involved in acquisition of data and analysis together with SK Hembah-Hilekaan. All authors revised the article for intellectual content and approved it for submission.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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