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Seroprevalence and Knowledge of Hepatitis B and C Among Health Care Workers in a Specialist Hospital in Nigeria

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Abstract: Hepatitis B (HBV) and hepatitis C (HCV) remain a global health challenge. Health care workers (HCWs) are at high risk of contracting HBV and HCV through their occupation. The study aimed to determine the prevalence and assess knowledge of HBV and HCV infection among HCWs in a specialist hospital, Southwest, Nigeria. A hospital based, descriptive cross-sectional study conducted among 209 HCWs at a specialist hospital in Ondo State, Nigeria. Data on knowledge of HBV and HCV was collected using a structured, self-administered pretested questionnaire. Blood samples were screened for Hepatitis B surface antigen (HBsAg) and anti-HCV antibodies**.** Data was analysed using SPSS version 20.0. The prevalence of HBsAg was 6.7%, anti-HCV positivity was 8.1% and co-infection of both HBV and HCV was 1.0%. No statistically significant difference exist in the prevalence of HBV (χ^2= 2.07, p=0.155) and HCV (χ^2= 2.26, p=0.132) between at risk HCW and not at risk HCW. Work duration was the only factor associated with HBV (χ^2= 10.24, p=0.006) and HCV (χ^2= 13.61, p=0.001) positivity and knowledge score (χ^2= 8.06, p= 0.018). Knowledge about HBV and HCV was relatively high. Eighty-nine percent ever heard of HBV and 75.6% ever heard of HCV. This study found a high prevalence of HBV and HCV among this group of HCWs and a higher burden of HCV than was commonly reported. Knowledge of HBV and HCV was also high. There is a need for infection control programme and sustained health education among HCWs.

Keywords: Hepatitis B, Hepatitis C, Health Care Workers, Nigeria

1. Introduction

Hepatitis B and C can cause potentially life-threatening liver infection leading to cirrhosis and hepatocellular cancer. [1] An estimated 240 million people are chronically infected with hepatitis B (defined as being hepatitis B surface antigen positive for at least 6 months). [1] More than 780 000 people die every year due to complications from hepatitis B, including cirrhosis and liver cancer [1] and more than 350,000 people die from hepatitis C-related liver diseases worldwide. [2] The lifetime risk of complications such as

chronic hepatitis, cirrhosis and hepatocellular carcinoma in subjects with chronic hepatitis B virus infection is a major concern for health care personnel. [3] The healthcare profession at various times involves the use of small, sharp instruments which can be contaminated with blood or other fluids, with ample opportunity for accidental skin abrasion and injury. Such accidents heighten the risk of transmission of hepatitis B and C. [4] Needle sticks injuries remain a hazard to health care workers (HCWs) and their patients. [5] Health care-associated infections (HAIs) are a serious problem in the hospital setting as they are common causes of illness and mortality among HCWs and patients. It has been recommended that HCWs whose activities frequently expose them to blood be vaccinated against Hepatitis B.[6] HCWs are also to use individual protective equipment, such as gloves, protective spectacles and aprons to prevent blood-borne infection during work. Hepatitis B virus (HBV) is one of the most important occupational diseases for health workers. [7] Co-infection with hepatitis C virus (HCV) is also common. The risk of being infected is dependent on the prevalence of virus carrier in the environment, the frequency of exposure of the health worker to blood and body fluid and the infectivity of the HBV. [8] HCWs in Nigeria are at increased risk of HBV and HCV because HBV, for instance, is hyperendemic in Nigeria. [9] Prevention of any disease is proportional to knowledge. Knowing facts and having proper attitudes and behaviours are critical to prevent the spread of infections. Various studies done in the past in the country assessed knowledge of hepatitis B at different levels and among the various groups, but few determined prevalence of HBV and HCV among HCWs and those that did were limited majorly to doctors, and none was found that assessed co-infection of HBV and HCV among all groups of HCWs. The purpose of this study was to determine the prevalence and assess knowledge of HBV and HCV infection among HCWs in a specialist hospital, Southwest, Nigeria.

2. Methods

2.1. Study Area and Design

The study was a hospital based, descriptive cross-sectional study conducted in July 2015 among HCWs at the State specialist hospital (SSH), Ondo State, Southwest Nigeria. The hospital is a referral centre with 300-bed capacity and serving a large population in the central senatorial district of the state. SSH has about 420 employees in the different profession and cadre as at the time of the study and offers a wide range of preventive and curative services.

2.2. Participants and Samples

The study enrolled 209 HCWs aged 18 years and above. The study was announced in the hospital as part of the activities for the 2015 world hepatitis day using posters, flexible banners, circulars and verbal communications. Participation in the study was voluntary with consecutive recruitment of participants until the calculated sample size was obtained. About 50% of the employees was eventually sampled.

The Sample size was determined using the Kish Leslie sample size formula for a cross-sectional study. [10] Based on an HBV seroprevalence of 7.9% from a previous study in Nigeria [11] a sample size of 103 was calculated to achieve a 5% margin of error in estimating the HBV prevalence at a 95% confidence level in the study population. Using a design effect of 2 the estimated total sample size became 206 to ensure adequacy of the sample size to screen for both HBV and HCV infections, supposing HBV is more prevalent and that a minimal level of co-infection exists among the study population. However, 209 HCWs eventually participated in the study.

A structured self-administered questionnaire designed to meet the objective of the study was used to collect information about the socio-demographic characteristics of participants, and their knowledge regarding HBV and HCV infections. The questionnaire was pretested on 20 HCWs in another health facility with the necessary modification made afterwards. Non-employees and trainees on attachment in the hospital were excluded from the study. Each participant underwent a venepuncture using a vacutainer device, 5mls of venous blood was collected into sample bottles for serological analysis. All blood samples were taken by trained phlebotomists and processed by trained and experienced laboratory scientists.

Serological diagnosis was done using Rapid diagnostic test (RDTs), for HBV infection the SD BIOLINE (Standard Diagnostic (SD) Inc., Korea) one step HBV test kit was used in the diagnosis of HBV infection.[12] SD BIOLINE HBsAg can identify HBsAg in plasma, serum, or whole blood specimens with a high degree of sensitivity. The 2003 World Health Organization (WHO) evaluation of the kit reported a sensitivity of 100% and specificity of 98%. [12] For HCV the SD BIOLINE HCV test kit was used. It is an immunochromatographic rapid test for the qualitative detection of antibodies specific to HCV in human serum, plasma or whole blood with a sensitivity of 100% and specificity of 99.4%.[13] Standard techniques were applied according to manufacturer's guideline in sample analysis. All HBsAg and anti-HCV seropositive samples detected by RDT screening were confirmed by electro-chemiluminescence immunoassay with an immunoassay analyser.

2.3. Statistical Analysis

The IBM statistical Package for Social Science (SPSS Inc., Chicago, IL, USA) version 20.0 was used for data entry and analysis. Descriptive analysis such as mean and standard deviation was used for quantitative variables. Frequency and percentage distribution were used for categorised variables. The chi-squared test was used to assess the association between categorical variables. When the chi-squared test was not appropriate, likelihood chi-square test was used. A p-value <0.05 was used as the cut-off level for statistical significance. Knowledge was assessed by assigning scores to each response 'yes' or 'no'. A correct response was scored as

one point while a wrong answer was scored as zero. The scoring range of the questionnaire was 20 (highest) to 0 (lowest). The mean score was determined and used as cut off. A score below the mean was considered as poor whereas a score above the mean was considered as adequate knowledge about hepatitis. Knowledge scores for individuals were calculated and summed up to give the total knowledge score.

For analysis purpose, the occupation was classified into two subgroups: at risk health care workers (arHCW); those who have direct contact with patients and are frequently exposed to infectious materials such as used sharps and or body fluids comprising medical doctors, nurses, laboratory personnel, physiotherapy, radiographers and ward attendants. A second group not-at- risk health care workers (nrHCW) comprising administration staff, technical service staff and others that are not likely to be exposed to patients or their fluids.

2.4. Benefits for Participants

Participant's knowledge of his HBV and HCV status is of benefit, as he is able to undergo a further evaluation if he tests positive. Those who were positive in this study were appropriately referred for further evaluation and management. Those without previous infection were advised to be vaccinated against hepatitis.

2.5. Ethical Consideration

The research protocol was approved by the research ethics review committee of the hospital. Written informed consent was obtained from study participants. The confidentiality of the information was maintained by assigning identification numbers to each questionnaire and entered data was secured with a password. Only the principal investigator held the results of blood samples tested. The participants were informed of their HBV/HCV test results as desired and the test results were delivered to individuals in a sealed form.

3. Results

In all, 209 HCWs participated in the study and fully filled the study questionnaire, 155(74.2%) were females, 179(85.6%) were married. The mean age of study participants was 41.9(SD±10) and by sex was 42.5(SD±11.0) for males and 41.6(SD±10) for females. The age range was 23-64years. Other baseline characteristics are as in table 1.

Table 1. *Sociodemographic characteristics of study participants at the state specialist hospital Ondo, Nigeria and association with knowledge score. n=209.*

Variable	n (%)	With Knowledge score (χ^2, p value)
Sex		
Male	54(25.8)	χ^2=0.047 p=0.828
Female	155(74.2)	
Age group		
<29	28(13.4)	
30-39	56(26.8)	χ^2=7.63 p=0.055
40-49	61(29.2)	
50+	64(30.6)	
Marital Status		
Married	30(14.4)	χ^2=1.02 p=0.314
Unmarried	179(85.6)	
Education		
Below secondary	26(12.4)	χ^2=2.02 p=0.651
Secondary and above	183(87.6)	
Occupational Group		
arHCW	111(53.1)	χ^2=0.078 p=0.781
nrHCW	98(46.9)	
Work duration(years)		
<5	60(28.7)	χ^2=8.06 p=0.018*
6-9	42(20.1)	
>10	107(51.2)	

arHCW=at risk health care workers, nrHCW= not at risk health care workers
*Likelihood chi square

3.1. HBV and HCV Prevalence

The seropositivity of HBsAg and anti-HCV among the study participants was 14(6.7%) and 17(8.1%) respectively. Two were positive for both HBsAg and anti-HCV co-infection (1.0%). All samples that were HBsAg and anti-HCV positive at screening level remained positive on confirmatory ELISA. HBsAg positivity was higher in arHCWs 10(9.0%) than in nrHCWs 4(4.0%) although the difference was not statistically significant (p=0.155). HBV positivity was statistically associated with work duration (p=0.006) [table 2].

Similarly, anti-HCV positivity was greater among the arHCWs 12(10.8%) compared with nrHCWs 5(5.1%), however, no statistical difference was found (p=0.133). HCV positivity was equally associated with work duration (p=0.001). Co-infection of HBV and HCV was very low hence no further statistical test was done [table 2].

The seroprevalence of HBV and HCV was higher among females HCWs than males HCWs. This difference was not statistically significant.

Table 2. *Seroprevalence of HBV and HCV among healthcare workers at state specialist hospital, Ondo Nigeria n=209.*

Variable	Prevalence of HBV and HCV		
No of ,patients	HBsAg	Anti-HCV	HBsAg+ Anti-HCV
209	14(6.7%)	17(8.1%)	2(1.0%)
	HBV		χ^2 p value
	Yes n (%)	No n (%)	
Sex			
Male	3(5.6)	51(94.4)	χ^2=0.152 p=0.696
Female	11(7.1)	144(92.9)	
Occupational group			
arHCW	10(9.0)	101(91.0)	χ^2=2.07 p=0.155
nrHCW	4(4.0)	94(96.0)	
Work duration (years)			
<5	0(0.0)	60(100.0)	χ^2=10.24 p=0.006*
6-9	3(7.1)	39(92.9)	
>10	11(10.3)	96(89.7)	
	HCV		
Sex			
Male	4(7.4)	50(92.3)	χ^2=0.05 p=0.821

Variable	Prevalence of HBV and HCV		
Female	13(8.4)	142(91.6)	
Occupational group			
arHCW	12(10.8)	99(89.2)	χ^2=2.26 p=0.132
nrHCW	5(5.1)	93(94.9)	
Work duration (years)			
<5	2(3.3)	58(96.7)	χ^2=13.61p=0.001*
6-9	0(0.0)	42(100.0)	
>10	15	92	

arHCWs = at risk health care workers, nrHCWs =not at risk health care workers.
*Likelihood chi square

3.2. Knowledge Concerning HBV and HCV

The mean knowledge score for participants was 12.3(SD±3.4). Based on the mean knowledge score, 129 (61.7%) had adequate knowledge about HBV while 80 (38.3%) were within the poor knowledge range. The knowledge score was only significantly associated with work duration (p=0.018) [table 1]. Eighty-nine percent of the participants ever heard of HBV prior to the study and 158 (75.6%) ever heard about HCV. Although 175(83.7%) were aware that HBV is contagious, only 125(59.8%) described it as a lethal disease. A higher proportion of participants 183 (87.6%) correctly identified that vaccination can prevent HBV infection [table3]. Knowledge about HCV transmission was similar to that of HBV however, awareness on non-availability of vaccine for HCV was low as only 67(32.1%) noted correctly that there is no vaccine for HCV.

Table 3. *Correct answers as regards knowledge on Hepatitis B transmission and vaccination.*

Variable	Frequency	%
Ever heard of hepatitis B Infection	186	88.9
Hepatitis B is contagious	175	83.7
HBV may look without showing any symptoms of the disease	162	77.5
HBV can be lethal	125	59.8
Patient can transfer hepatitis to health personnel	185	88.5
Broken skin in contact with blood of HBV positive patient	163	78.0
Potential routes of HBV include Needle stick injury	183	87.6
Potential routes of HBV include blood and blood products	167	79.9
Potential routes of HBV include casual sexual intercourse	163	78.0
HBV vaccination can prevent hepatitis	183	87.6
HBV vaccination is not for all people	134	64.1
HBV vaccination does not increase the risk for Complication	137	65.6
HBV vaccination is contraindicated in pregnancy	126	60.3
The antibodies for HBV need to be checked after three titres	129	61.7

4. Discussion

The prevalence and knowledge of hepatitis infection among HCWs has been well researched. To the best of our knowledge, most of the studies from Nigeria majorly assessed the prevalence and knowledge of HBV among HCWs. Few if any assessed the prevalence of HCV and co-infection of HBV/HCV among HCWs in our environment. This study may, therefore, fill this gap.

The seroprevalence rate for HBV among HCWs in this study was 6.7%. This is similar to that in the general population as reported by WHO [14] and other previous studies in the country. [11, 15] The rate also compares to findings among HCWs in studies in from Tanzania [16], Uganda [17] and other parts of Sub-Sahara Africa. It is interesting to find that the prevalence of HBV among HCWs in this study was not higher than in the general populace. We propose that this may be related to factors such as high knowledge about transmission and prevention of HBV among this group of HCWs, access to preventive measures and series of training on infection control they had received as reported by the study participants. Prevention of any disease is proportional to knowledge, attitude and practice and hence negligence during the handling of infected sharps, blood and body fluid is reduced with good knowledge as may be the case in this study. It is, however, plausible that prevalence rates of HBV may differ across communities in Nigeria due to differences in exposure risks.

This study surprisingly revealed a high burden of HCV infection which was not previously reported among HCWs in the country. The prevalence of HCV in this study was 8.1%, in contrast to findings from previous reports. [11, 14-15] The seropositivity of HCV among this group of HCWs was higher than that of HBV, thence HCV might be more common than imagined but for the sparse data on HCV in Nigeria and sub–Sahara Africa. This result compares with studies from some part of the country[18] and the African continent.[19,20] This difference may be as a result of the type of population studied, geographic location, socio-economic status, regional difference in risk factors and cultural practices which predate employment as a healthcare worker and are independent of occupational status. It is documented that sero-epidemiological studies of different populations do show marked variations and differences. [15]

In this study no statistically significant difference exit in the prevalence of HBV and HCV among arHCW and nrHCW despite the higher prevalence among arHCW than nrHCW. This finding seems to suggest that risk factors for contracting HBV and HCV infection might not be very different between the two groups although there is an added risk among arHCW due to frequent exposure to possibly infected blood and body fluids. This also implies that several factors contribute to the opportunity of acquiring HBV and HCV that are beyond occupational risk. The finding does not in any way demean the risk of occupational exposure but rather justified that the health care worker is at higher risk of contracting HBV and HCV from both socio-cultural and occupational risk factors. At risk health care workers are trained to employ personal protective equipment to minimise their added risk for hospital-acquired infections. The only factor significantly associated with the prevalence of HBV and HCV in this study was work duration. The prevalence of

HBV and HCV appears to increase with long occupational exposure and thus the risk of acquiring the infection, consistent with findings from other studies. [21, 22] This, therefore, warrants that measures are put in place to protect HCWs who are repeatedly at the risk of contracting HBV or HCV as a result of long occupational exposure. In resource-limited settings like ours where cost effectiveness is always a question, the use of screening methods such as the type used in this study for a preventive programme targeted at HCWs could reduce the costs of vaccination programme because only non-immune HCWs requiring vaccination will eventually be vaccinated. [19, 23].

In our study knowledge of HBV and HCV was relatively high. Approximately 62% of the HCWs had adequate knowledge about hepatitis B and C. It is generally assumed that HCWs by virtue of their working in health facilities should have adequate knowledge about diseases and other health conditions. This study appears to strengthen this thinking as a majority of the participant demonstrated a relatively high level of knowledge of hepatitis B and C infection. This finding is encouraging because knowledge is usually the first step in behaviours' modification. Knowledge about HBV and HCV is essential to enable HCWs take proper steps in protecting themselves during work. In this present study. statistically significant association exists between work duration as an HCW and knowledge score on hepatitis (p=0.018). Older career staffs had higher knowledge score than early career staffs. It is not unlikely that the longer an individual practice as an HCW the more the knowledge he acquires either formally or informally. There is, therefore, a need for continuous health education campaigns so that newly employed HCWs and early career staffs can acquire necessary knowledge on the risks to which they are exposed and the available preventive practices and measures.

5. Study limitations

A limitation of this study was that study participants were drawn from a single health facility, hence, study findings may not be generalizable especially if prevalence varies across the community and country. Voluntary participation in any study most times has limitations resulting from recruitment bias.

6. Conclusion

This study found that the prevalence of HBV and HCV was high among this group of HCWs. It also revealed a greater burden of HCV than are commonly reported. Knowledge of HBV and HCV was also high. There is a need for infection control programmes to protect the HCWs and also a sustained health education in order to reduce the prevalence of HBV and HCV.

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References

[1] World Health Organization. Hepatitis B www.who.int/topics/hepatitis/en accessed 14/03/16

[2] World Health Organization Hepatitis C www.who.int/mediacentre/fs164/en accessed 14/03/16

[3] Ozaras R and Tahan V Acute hepatitis C: prevention and treatment. Expert. Rev. Anti. Infect.Ther. 2009; 7(3): 351-61.

[4] Moghimi M, Marashi SA, Kabir A, Taghipour HR, Faghihi-Kashani AH, *et a*l. Knowledge, attitude, and practice of Iranian surgeons about blood-borne diseases. J. Surg. Res. 2009; 151(1): 804.

[5] Charles PG, Angus PW, Sasadeusz JJ Grayson ML Management of healthcare workers after occupational exposure to hepatitis C virus. Med. J.Aust. 2003; 179(3):153-7.

[6] Knowledge, Attitude, and Practice of HBV vaccination among dentists in primary health care, dental centers and Kuwait university dental clinics. www.hsc.edu.kw/fod/research/pdf_files/MA accessed 02/02/2016.

[7] World Health Organization. Hepatitis B www.who.int/mediacentre/factsheets/fs204/en accessed 12/02/16

[8] Bonani P, Bonnaccorsi G Vaccination against Hepatitis B in health care workers. Vaccine 2001; 19:2389-2394.

[9] Musa BM, Bussell S, Borodo MM, Samaila AA, Femi OL Prevalence of hepatitis B virus infection in Nigeria, 2000-2013: A systematic review and meta-analysis. Niger J clinic P 2015: 18(2).

[10] Kish L. Survey sampling. New York: John Wiley & Sons; 1965.

[11] Ibrahim I.A, Pondei K. Hepatitis B and C Infection: should gynaecological patients be routinely screened? Int J Med Biomed Res 2014; 3(1):45-51.

[12] One step Hepatitis B virus test http://www.standardia.com/en/home/product/Rapid_Diagnostic_Test/HBsAg.html

[13] One step Hepatitis C virus test http://www.standardia.com/en/home/product/Rapid_Diagnostic_Test/Anti-HCV.html

[14] World Health Organization. Global surveillance and control of hepatitis C. Report of a WHO Consultation organized in collaboration with the Viral Hepatitis Prevention Board. *JVH* 1999; 6: 35-47.

[15] Esan AJ, .Omisakin CT, Ojo-Bola T, Owoseni MF Fasakin KA Ogunleye AA Sero-Prevalence of Hepatitis B and Hepatitis C Virus Co-Infection among Pregnant Women in Nigeria. *American Journal of Biomedical Research*, vol. 2, no. 1 (2014): 11-15.

[16] Mueller A, Stoetter L, Kalluvya S .Stich A Majinge C Weissbrich B *et al* Prevalence of hepatitis B virus infection among health care workers in a tertiary hospital in Tanzania. BMC Infectious Diseases 2015; 15: 386.

[17] Ziraba AK, Bwogi J, Namale A, Waiaina CW, Mayanja-Kizza H. Seroprevalence and risk factors for hepatitis B virus infection among health care workers in a tertiary hospital in Uganda. BMC Infect Dis. 2010; 10:191.

[18] Oje OJ, Sule WF, Famurewa D. Dual positivity of hepatitis B surface antigen and anti-hepatitis C virus antibody and associated factors among apparently healthy patients of Ekiti State, Nigeria. Viral Immunol. 2012; 25:448–55.

[19] Iles JC, Abby Harrison GL, Lyons S, Djoko CF, Tamoufe U, Lebreton M, *et al*. Hepatitis C virus infections in the Democratic Republic of Congo exhibit a cohort effect. Infect Genet Evol. 2013; 19:386–94.

[20] Guimarães-Nebenzahl H, Lopes A, Castro R Pereira F Prevalence of human immunodeficiency virus, hepatitis C virus, hepatitis B virus and syphilis among individuals attending anonymous testing for HIV in Luanda, Angola. South Afr Med J 2013; 103:186–8.

[21] Braka F, Nanyunja M, Makumbi I Mbabazi W Kasasa S, Lewis R*l*. Hepatitis B infection among health workers in Uganda: evidence of the need for health worker protection. Vaccine. 2006; 24:6930–7.

[22] Ziraba AK, Bwogi J, Namale A, Wainaina CW, Mayanja-Kizza H. Seroprevalence and risk factors for hepatitis B virus infection among health care workers in a tertiary hospital in Uganda. BMC Infect Dis. 2010; 10:191.

[23] Pellissier G, Yazdanpanah Y, Adehossi E, William T Boubacar M, Kaza I et al. Is universal HBV vaccination of healthcare workers a relevant strategy in developing endemic countries? The case of a university hospital in Niger. PloS One. 2012; 7:e44442.