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ABSTRACT

Introduction: HBV is a blood borne virus which can be transmitted via percutaneous and mucocutaneous exposure to infected body fluid. HCWs who continuously are exposed to different body fluids are at an increased risk of contracting and transmitting this virus. It is thus important to evaluate the knowledge and attitude of HCWs towards HBV, and the prevalence of HBV infection among them.

Method: This cross-sectional study was carried out between April and September, 2017. Overall, 398 HCWs were recruited for this study. Knowledge on the route of HBV transmission and attitude towards HBV was evaluated using a well-structured questionnaire. HBsAg positivity was obtained using the Monolisa HBsAg ULTRA kit (Bio-Rad). Data was analyzed using SPSS v. 20.

Results: Three hundred and thirty-eight (84.9%) HCWs had heard of HBV, 249 (62.6%) of them had adequate knowledge on the route of HBV transmission. Laboratory staffs and medical doctors were the most knowledgeable among biomedical workers and students (82.8% and 80%) respectively. Stigma rate was highest among nurses 87 (38.8%). Prevalence of HBsAg positivity was high 42 (10.6%) given that there is an efficient and available vaccine.

Conclusion: Knowledge on route of HBV transmission was fair, the level of stigmatization of HBV infected patients and the prevalence of HBV infection was high in this study. A sensitization campaign should be carried out to educate HCWs on HBV, thus reducing the level of stigma associated with HBV as well and the probability of contacting HBV as a nosocomial infection.

Key words: Health care workers, HBV, HBsAg, Attitude, Knowledge, Vaccination, Cameroon.

Abbreviations: HBV: Hepatitis B virus, MD: Medical doctor, Lab tech: Laboratory technician, HCWs: Health care workers

Strength: Monalisa™ HBsAg ULTRA ELISA kit with 100% sensitivity and specificity of 99.28% was used to determine current HBV infection. Thus the prevalence of those currently infected (HBsAg positive) reported in this can be considered to be almost exact.

Limitation: Information about vaccination status was self-reported and number of doses were not taken into consideration. Consequently, the number of HCWs with a protective level of HBV is actually lower than what is reported in this study.

INTRODUCTION

The hepatitis B virus (HBV) is an enveloped virus of the hepadnavirus family that infects the liver, causing hepatocellular necrosis and inflammation. HBV, spread by percutaneous or mucosal exposure to infected blood and various body fluids can either cause an acute or chronic disease (1). An estimated 257 million people are living with HBV (2), and about 20% to 30% of those who become chronically infected will develop complications. Currently available treatments fail to eradicate the virus in most of those treated, necessitating potentially lifelong treatment (3) and approximately 650,000 people die annually due to CHB (3). Cameroon, a sub-Saharan African country, is considered hyper-endemic with a prevalence rate of HBV infection estimated at 11.5% (4).

Health care workers (HCW) who are frequently in contact with blood and other body fluids in the course of their work are at higher risk of exposure to blood borne viral diseases such as HBV, HCV and HIV (5–7). Among the HCWs worldwide, about 2 million HCWs are exposed and about 70,000 are infected with HBV annually (7). The WHO global burden of the disease showed that 37% of HBV among HCWs was the result of occupational exposure resulting from sharps injuries to HCWs (2). More than 90% of these infections occur in developing countries (7). The risk of occupational infections in developing countries is intensified by a variety of factors, comprising but not restricted to, overcrowding in hospitals, lower HCWs:patient ratio, insufficient or absence of basic safety and protection equipment, reutilizing/reprocessing contaminated needles and sharp instruments and partial awareness of exposure-risk to blood and body fluid (5).

Although needle stick injury hepatitis sero-conversion is somewhat rare, the costs of treatment and anxiety about the possible consequences of an exposure are serious. This might be why some HCWs refuse to service patients with blood borne viral diseases such as HBV. Prevention through immunization and increasing knowledge thus stand out as the safest strategy against the high prevalence of viral hepatitis among HCWs. Knowing facts and having proper awareness, can influence the attitudes of HCWs and control the menace of the disease (8). A number of studies in Africa have evaluated the level of the knowledge, attitude, and practice of HCWs toward HBV and the vaccination status of HCWs (9–12). The low level of vaccination and the high prevalence of HBsAg

recorded in different studies might be related to the low level of knowledge on the route of transmission among HWCs (13–16).

Prevention is still a recommended safeguard against epidemic of viral hepatitis. Knowledge and attitudes of the clinician play a key role in prevention and spread of infection. By knowing facts, having proper awareness, and attitudes the menace of this disease can be prevented to a great extent. Therefore, the objectives of the present study are to assess the knowledge and attitudes of HCWs regarding HBV, and to compare their knowledge and attitude score to the prevalence of HBV infection.

MATERIALS AND METHODS

Study design and setting

This cross-sectional hospital-based study was conducted among HCWs in the Bamenda health district, NWR of Cameroon. Samples were collected between April and September 2017, and included 22 health facilities in this health district (among which were 1 regional hospital, 3 CMAs, 6 mission hospitals, 5 government health centers and 7 private hospitals). Testing stations were set up in the various wards in the health facilities.

Ethical consideration

Ethical clearance for the study was obtained from the National Ethics Committee of Cameroon (N°2017/02/871/CE/CNERSH/SP). Authorization to carry out research in the NWR was obtained from the regional delegation. Authorizations to access different hospitals were obtained from the directors or the in-charge of the hospitals. Authorization to access health centers was obtained from the District medical officer and the chief of centers of the health facilities. Written informed consent was obtained from each participant.

Study participants

All HCWs in the selected hospitals were informed and invited to participate in the study. HCWs in the study comprised of medical doctors, nurses, midwives, dentists, pharmacists, laboratory technicians, sanitary workers and biomedical students working in the Bamenda health district during the study period.

Sample Size and Justification

Sample size was determined using the Population Proportion Sample Size formula proposed by Scott Smith (13), X = Z-score * SD * (1 - SD) / MOE. The proportion of HCWs in the North-West Region was obtained from a registry published in 2015 (14) which published the national proportions of HCWs per region. The confidence level was 95% giving a Z-Score of 1.96, a margin of error (MOE) of +/- 5 and a standard deviation (SD) of 0.5. Using this formula, the calculated sample size was 385 persons.

Sample collection

Participants who consented to the study completed a structured questionnaire which was used to collect data on sociodemographic characteristics, HBV exposure risks, HBV vaccination and attitude towards HBV. The questionnaire was self-administered and contained both closed and open-ended questions to assess the perspectives of the respondents towards HBV. Participants who could read and write completed the form by themselves while those who could neither read nor write were assisted. Pre-designed and pre-tested, semi-structured questionnaire items with response options was developed based on KAP surveys with similar objectives (15–17). Serum was obtained from 4ml of blood collected from study participants into a red cap dry tube. Identification number was used to link participant's laboratory results and the questionnaire.

Definition for scoring knowledge

Knowledge was assessed using 4 questions directly linked with the route of HBV infection. Adequate knowledge was when a correct answer was given to all four questions. This minimum of 4/4 defining a good level of knowledge may seem rigorous. However, this minimum level justified the affordable difficulty of the questions.

Definition for scoring attitude

Attitude was assessed using 7 criteria: attitude towards HBV infected persons, quality of hygiene, frequency of glove use, frequency of needle stick injury, sexuality, vaccination status of the HCW and knowledge of HBV status. Attitude was considered positive when a participant was able to correctly give at least 6 of the 7 expected answers.

HBV serology

HBsAg was tested using the MONOLISA HBsAg ULTRA ELISA kit from Bio-Rad (Marnes-La-Coquette-France), a fully multivalent assay showing high sensitivity in the detection of HBV mutants to determine those who were positive for HBsAg (6). ELISA assay was performed following the manufacturer's instructions.

Statistical analysis

Data was analyzed using SPSS version 20.0 for Windows (SPSS, Chicago, Illinois, USA). Descriptive statistics for demographic characteristics, percentages for categorical variables, median and IQR for continuous variables were used to analyse the findings of the study. Pearson's Khi square ($p < 0.05$) was used to assess the significance among study variables.

RESULTS

Socio-demographic characteristics of study participants

A total of 398 HCWs across the Bamenda Health District participated in this study. Among these, 272 (68.3%) were women; the (16-25) year old age group was the most represented 167 (42.0%), and median age was 27.0 years (IQR, 23 - 32 years) at 95%CI (Table I). Most participants were nurses (56.6% of workers and 55.7%% of students), had worked for 2-4 years and lived in an urban setting (84.2%).

Assessment of Knowledge

A total of 4 questions were used to access knowledge of HCWs from different hospitals in this region on the route of HBV transmission (Table II). Three hundred and thirty-eight (84.9%) participants had heard of HBV. Most participants correctly identified sexual intercourse 313 (78.6%), kissing 299 (75.1%), mother-to-child transmission 298 (73.4 %) and contact with body fluid 324 (81.4 %) as routes of contamination with HBV. Among these, laboratory staffs were the most knowledgeable regarding HBV 63 (70.0%) while not up to 50% of cleaners had heard of HBV before this study (Table IV). Knowledge was significantly correlated to the level of education and HCWs category (p-value<0.001). Overall, these HCWs had an unsatisfactory level of knowledge on the route of HBV transmission 248 (62.3%). Knowledge on the route of HBV transmission

was higher among biomedical students 97 (65.1%) compared to the workers 151 (60.6%). Prevalence of HBsAg positivity was higher among those with adequate knowledge on the route of HBV transmission 25 (59.5%) (Table V).

Attitude of HCWS TO HBV

Among the 398 HCWs, 270 (67.8%) HCWs had a positive attitude towards HBV infected persons (Table III). Majority of HCWs practiced safe hygiene 317 (79.6%) and wore gloves often 310 (77.9%) while administering treatment. Needle stick injury and promiscuity (defined as having more than 10 sex partners in your life time, having sex with prostitude(s), and/or one night stands) was highest among sanitary workers (3 (6.8%) and 16 (36.4%) respectively). Only 175 (44.0) HCWs showed an overall positive attitude towards HBV (Table III). There was a significant correlation between HCWs category and attitude towards HBV (p-value=0.04) (Table IV). Prevalence of current HBV infection was lower among those with a positive attitude towards HBV 19 (45.2) (Table V).

Prevalence of HBsAg among HCWs

The prevalence of HBsAg positivity was 10.6% (Table IV). No statistically significant association was observed between HBsAg positivity and the different classes involved in this study. Females were 1.7 times more infected than males. Majority of those infected belonged to the (46-65) year age group 4 (16.7%), had worked for (5-9) years 7 (12.7%), had an SRN/SRM certificate 9 (16.4), were nurses 28 (12.5) and lived in an urban setting 38 (11.3). No significant correlation was observed between knowledge on the route of HBV infection, attitude towards HBV and being positive for HBsAg (Table V).

DISCUSSSION

Exposure to blood-borne pathogens such as HBV infection remains a significant occupational hazard to HCWs, especially in countries where the prevalence of this infection is high. KAP studies among HCWs are necessary to evaluate and improve the awareness on the route of transmission, prevention and management of infectious diseases. This study was carried out to assess the knowledge, attitude and prevalence of HBV among HCWs in the Bamenda Health District, NWR, Cameroon.

❖ **Assessment of Knowledge**

HCWs are at the fore front of health care provision and it is expected that they should know the routes of transmission of different infectious agents in order to protect their patients and themselves from nosocomial infections. Results of the current study revealed a significant correlation between HCWs category, level of education and knowledge on the route of HBV transmission. This may be because education trains individuals to acquire, evaluate and use information (18). This may justify the unequal access to and exploitation of educational resources which increases with level of education (19) as well as role in the health setting.

Even though majority of HCWs in this setting had heard of HBV infection prior to this study 338 (84.9%), only 248 (62.6%) of them had good knowledge on the route of HBV transmission. This is similar to the 62.5% obtained in Northern Tanzania (9) and the 58.7% obtained in the South West Region of Cameroon (20). However, this is higher than the 47.0% obtained in Yaoundé among HCWs (21), 52% obtained in North West, Ethiopia (10), the 29.9% obtained in Sierra Leone (11) and the 42.1% obtained in a rural population in the North West Region of Cameroon (22). According to Abongwa *et al*. (2016), the most probable reason for this low level of good knowledge could be inadequate health educative programs forcing the population to get information on HBV from friends and/or relatives (22). Getting information from friend, relatives and/or colleagues increases the probability of getting inappropriate information.

The level of current HBV infection was higher among those who had an adequate knowledge on the route of HBV transmission 25 (59.5%). This is contrary to what is anticipated (15) given that better knowledge on the route of disease transmission should help the individual take precautions against getting the infection in question. The disparity observed in this study can be justify by the fact that most of the infected HCWs were chronic carriers who after their first diagnosis or exposure to HBV were directed to gastroenterologist for follow-up.

❖ **Assessment of Attitude of HCWs to HBV**

There was a significant association between HCWs category and attitude towards HBV (p-value=0.04) and even though 270 (67.8%) HCWs had a positive attitude towards

HBV infected persons, only 175 (44.0%) HCWs showed an overall positive attitude towards HBV. The poor attitude of the majority of HCWs towards HBV in this study may be because of the level of inadequate knowledge on the route of HBV transmission in this population (8,15).

Prevalence of current HBV infection was lower among those with a positive attitude towards HBV 19 (45.2). Developing a positive attitude towards a disease is generally associated with acquiring adequate knowledge on that disease as discussed above (8,15). This might justify the lower prevalence of current HBV infection among those with the positive attitude towards HBV.

- **Prevalence of HBV among HCWs**

Various epidemiological and cross-sectional studies have reported marked variation in the prevalence of HBsAg among HCWs. Studies carried out among HCWs in Africa gave 1.8 % in Libya (23), 2.9 % in Rwanda (24), 7.0 % in Tanzania (25) and 8.1 % in Uganda (26). This study revealed a relatively high burden of current HBV infection (10.6%) among HCWs in Cameroon. The high prevalence of HBV in this study population is similar to the HBV prevalence obtained in a similar study carried out in Yaoundé (21) but higher than the 8.7% obtained in the national survey among HCWs (16). The difference in prevalence of HBV could be because of the different diagnostic techniques used. The high prevalence of HBV infection obtained among HCWs in Cameroon may be a reflection of the prevalence of HBV infection in the general Cameroonian population which is estimated at 11.5% (4) or the lack of adequate knowledge on the route of HBV transmission among these HCWs (15).

CONCLUSION

The level of knowledge on the route of HBV transmission observed in this study is fair. This lack of adequate knowledge might justify the relatively high prevalence of HBsAg positivity, the overall negative attitude towards HBV and the low vaccination rate among HCWs in this area. Given that knowledge is usually the first step towards modification of a desirable behaviour, HBV campaigns should be organised to sensitize HCWs on this disease. This campaign can include improved mass media program such as broadcasting health talk intermittently online and/or within other television

programs. Adequate sensitization will reduce the rate of stigma associated to the disease and probably the rate of new infections among HCWs.

APPENDIX

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Statement of Ethics: Ethical clearance for the study was obtained from the National Ethics Committee of Cameroon (N°2017/02/871/CE/CNERSH/SP). Authorization to carry out research in the NWR was obtained from the regional delegation. Authorizations to access different hospitals were obtained from the directors or the in-charge of the hospitals. Authorization to access health centers was obtained from the District medical officer (DMO) and the chief of centers of the health facilities in this region. Written informed consent was obtained from each participant.

Patient and Public Involvement: Patients and the public were not involved in designing the questionnaire, collecting and analysing data for this study.

Authors' contribution: AE and TC designed the study; AE and FV performed the experiments; AE drafted the manuscript; TC, NR, AL and KJR were involved in editing the manuscript; AE performed the statistical analysis. All authors read and approved the final manuscript.

Conflict of Interest: The authors declare no conflict of interest.

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Table I. Baseline characteristics in the studied population

Variables		Frequency (398)	Percentage
Sex	Male	126	31.7
	Female	272	68.3
Age Intervals	16-25	167	42.0
	26-35	157	39.4
	36-45	50	12.6
	46-65	24	6.0
Level of Education	Secondary and below	39	8.8
	Diploma	59	14.8
	SRN/SRM	55	13.8
	HND	103	25.9
	BSc	118	29.6
	Post Graduate	24	6.0
Duration In the Occupation	≤ 1 year	72	18.1
	2 – 4 years	218	54.8
	5 – 9 years	55	13.8
	≥ 10 year	53	13.3
HCWs category	Nurses	224	56.6
	Lab Technicians	90	11.6
	Medical Doctors	17	4.8
	Dentist/Pharmacist	23	9.2
	Sanitary Workers	44	17.6
Role In the Hospital	Biomedical Student	149	37.4
	Biomedical Personnel	249	62.6
Residence	Urban	335	84.2
	Semi-Urban	18	4.5
	Rural	45	11.3

Data are n and %.

Table II. Knowledge on route of HBV transmission

Questions		Correct Response n (%)					
		Nurses (n-224)	Medical Doctors (n=17)	Lab Technicians (n=90)	Dentist/ Pharmacist (n=23)	Sanitary Workers (n= 44)	Total (n=398)
Heard of HBV	Yes	199 (88.8)	16 (94.1)	86 (95.6)	17 (73.9)	20 (45.5)	338 (84.9)
	No	25 (11.2)	1 (5.9)	4 (4.4)	6 (26.1)	24 (54.5)	60 (15.1)
Sexually transmitted	Yes	183 (81.7)	16 (94.1)	82 (91.1)	14 (60.9)	18 (40.9)	313 (78.6)
	No	41 (18.3)	1 (5.9)	8 (8.9)	9 (39.1)	26 (59.1)	85 (21.4)

Transmitted through kissing	Yes	176 (78.6)	12 (70.6)	78 (86.7)	14 (60.9)	19 (43.2)	299 (75.1)
	No	48 (21.4)	5 (29.4)	12 (13.3)	9 (39.1)	25 (56.8)	99 (24.9)
Vertical transmission	Yes	179 (79.9)	14 (82.4)	69 (76.7)	14 (60.9)	16 (36.4)	292 (73.4)
	No	45 (20.0)	3 (17.6)	21 (23.3)	9 (39.1)	28 (63.6)	106 (26.6)
Contact with body fluids	Yes	191 (85.3)	15 (88.2)	84 (93.3)	16 (69.6)	18 (40.9)	324 (81.4)
	No	33 (14.7)	2 (11.8)	6 (6.7)	7 (30.4)	26 (59.1)	74 (18.6)
Knowledge on HBV	Yes	149 (66.5)	11 (64.7)	63 (70.0)	12 (52.2)	13 (29.6)	248 (62.3)
	No	75 (33.5)	6 (35.3)	27 (30.0)	11 (47.8)	31 (70.5)	150 (37.7)

Data are n(%).

Table III. Attitude of HCWs towards HBV

Attitudes		Health Care Worker n (%)					
		Nurses (n=224)	MDs (n=17)	Lab Techs (n=90)	Dentist/ Pharmacist (n=23)	Auxillary workers (n=44)	Total (n=398)
Attitude towards infected persons	Good	137 (61.2)	13 (76.5)	70 (77.8)	18 (78.3)	32 (72.7)	270 (67.8)
	Bad	87 (38.8)	4 (23.5)	20 (22.2)	5 (21.7)	12 (27.3)	128 (32.2)
Practice safe hygiene	Yes	193 (86.2)	14 (82.4)	63 (70.0)	20 (87.0)	27 (61.4)	317 (79.6)
	No	31 (13.8)	3 (17.6)	27 (30.0)	3 (13.0)	17 (38.6)	81 (20.4)
Wears gloves often	Yes	177 (79.0)	15 (88.2)	82 (91.1)	14 (60.9)	22 (50.0)	310 (77.9)
	No	47 (21.0)	2 (11.8)	8 (8.9)	9 (39.1)	22 (50.0)	88 (22.1)
Frequency of needle stick injury	Often	10 (4.5)	0 (0.0)	1 (1.1)	0 (0.0)	3 (6.8)	14 (3.5)
	Rarely	214 (95.5)	17 (100.0)	89 (98.9)	23 (100.0)	41 (93.2)	384 (94.5)
Received 1 dose of vaccine	Yes	43 (19.2)	4 (23.5)	28 (31.1)	13 (56.5)	5 (11.4)	93 (23.4)
	No	181 (80.8)	13 (76.50	62 (68.9)	10 (43.5)	39 (88.6)	305 (76.6)
Sexually promiscuous	Yes	46 (20.5)	4 (23.5)	10 (11.1)	8 (34.8)	16 (36.4)	84 (21.1)
	No	178 (79.5)	13 (76.5)	80 (88.9)	15 (65.2)	28 (63.6)	314 (78.9)
General Attitude	Positive	87 (38.8)	9 (52.9)	54 (60.0)	11 (47.8)	13 (31.8)	175 (44.0)
	Negative	137 (61.2)	8 (47.1)	36 (40.0)	12 (52.2)	30 (68.2)	223 (56.0)

Data are n(%).

Table IV. Prevalence of HBV infection among HCWs

Characteristic		Knowledge on route of transmission		Positive attitude		HBsAg Positivity	
		n(%)	p-value	n(%)	p-value	n(%)	p-value
Sex	Male	84 (66.7)	0.222	61 (48.4)	0.224	9 (7.1)	0.132
	Female	164 (60.3)		114 (41.9)		33 (12.1)	
Age Group	16-25	111 (66.5)	**0.043**	74 (44.3)	0.333	14 (8.4)	0.522
	26-35	101 (64.7)		72 (49.9)		19 (12.2)	
	36-45	25 (49.0)		17 (34.0)		5 (9.8)	
	46-65	11 (45.8)		12 (50.0)		4 (16.7)	
Level of education	≤ Secondary	10 (25.6)	**< 0.001**	14 (35.9)	0.186	3 (7.7)	0.819
	Diploma	32 (54.2)		23 (39.0)		6 (10.2)	
	SRN/SRM	32 (58.2)		22 (30.0)		9 (16.4)	
	HND	76 (73.8)		42 (40.8)		10 (9.7)	
	BSc	81 (68.6)		64 (54.2)		12 (10.2)	
	Post Graduate	17 (70.8)		10 (41.2)		2 (8.3)	
Duration in the occupation	≤ 1 year	44 (61.1)	0.209	30 (41.7)	0.705	7 (9.7)	0.941
	2-4 years	145 (66.5)		101 (46.3)		23 (10.6)	
	5-9 years	31 (56.4)		21 (38.2)		7 (12.7)	
	≥ 10 year	28 (52.8)		23 (43.4)		5 (9.4)	
HCWs category	Nurses	149 (66.5)	**<0.001**	87 (38.8)	**0.004**	28 (12.5)	0.495
	Lab Tech	63 (70)		54 (60.0)		8 (8.9)	
	Medical doctors	11 (64.7)		9 (52.9)		1 (5.9)	
	Dentist/Pharmacist	12 (52.2)		11 (47.8)		3 (13.0)	
	Sanitary workers	13 (29.5)		13 (31.8)		2 (4.5)	
	Biomedical students	97 (65.1)	0.374	65 (43.6)	0.914	13 (8.7)	0.359
	Biomedical personnel	151 (60.6)		110 (44.2)		29 (11.6)	
Residence	Urban	212 (63.3)	0.275	152 (45.4)	0.408	38 (11.3)	0.492
	Semi-urban	8 (44.4)		6 (33.3)		1 (5.5)	
	Rural	28 (62.2)		17 (37.8)		3 (6.7)	

Data are n(%); p-value<0.05 is considered significant.

Table V: Association between knowledge, attitude and prevalence of HBsAg

Characteristics		Reactivity to HBsAg			Unadjusted Risk of HBsAg	
		No	%	p-value	OR	95% CI
Knowledge (n=42)	Adequate	25	59.5	0.694	1.140	0.594 - 2.189
	Poor	17	40.5			
Attitude (n=270	Positive	19	45.2	0.861	0.994	0.497 - 1.795
	Negative	23	54.8			

p-value<0.05 is considered to be significant.

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KNOWLEDGE, ATTITUDE AND PREVALENCE OF HEPATITIS B VIRUS AMONG HEALTH CARE WORKERS: A CROSS-SECTIONAL HOSPITAL-BASED STUDY, BAMENDA HEALTH DISTRICT, NWR, CAMEROON.

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ABSTRACT

Introduction: The Hepatitis B Virus (HBV) is a blood borne virus which can be transmitted via percutaneous and mucocutaneous exposure to infected body fluid. Health care workers (HCWs) who continuously are exposed to different body fluids are at an increased risk of contracting and transmitting this virus. It is thus important to evaluate the knowledge and attitude of HCWs towards HBV, and the prevalence of HBV infection among them.

Method: This cross-sectional study was carried out between April and September, 2017. Overall, 398 HCWs were recruited for this study. Knowledge on the route of HBV transmission and attitude towards HBV was evaluated using a well-structured questionnaire. Hepatitis B surface antigen (HBsAg) positivity was obtained using the Monolisa HBsAg ULTRA kit (Bio-Rad). Data was analyzed using the Statistical Package for the Social Sciences version 20 (SPSS v. 20).

Results: Among the HCWs who participated in this study, 338 (84.9%) HCWs had heard of HBV, 269 (67.6%) of them had adequate knowledge on the route of HBV transmission. Medical doctors were the most knowledgeable among biomedical workers and students (76.5%). Stigma rate was highest among nurses 87 (38.8%). Prevalence of HBsAg positivity was high 42 (10.6%) given that there is an efficient and available vaccine.

Conclusion: Knowledge on the route of HBV transmission was fair, the level of stigmatization of HBV infected patients and the prevalence of HBV infection was high in this study. A sensitization campaign should be carried out to educate HCWs on HBV, thus reducing the level of stigma associated with HBV as well as the probability of contacting HBV as a nosocomial infection.

Key words: Health care workers, HBV, HBsAg, Attitude, Knowledge, Vaccination, Cameroon.

Abbreviations: HBV: Hepatitis B virus, MD: Medical doctor, Lab tech: Laboratory technician, HCWs: Health care workers, SRN/SRM: State Registered Nurse/Midwife, NWR: North West Region, KAP: Knowledge, attitude and practice/prevalence, HND: Higher National Diploma, BSc: Bachelor of Science, HBsAg: Hepatitis B surface antigen, ELISA: Enzyme-linked immunosorbent assay, CMA: Centre medical d'arrondisement (district medical centers), MOE: Margin of error.

Strength:

- Monalisa™ HBsAg ULTRA ELISA kit with 100% sensitivity and specificity of 99.28% was used to determine current HBV infection (HBsAg positivity).
- Questionnaires were answered in the presence of the researcher to prevent participants from discussing answers or getting answers online.
- Stratified sampling technique, which permits estimation of population parameters for groups within population was used for sampling.

Limitation:

- Information on knowledge and attitude were self-reported, and chances of individual bias cannot be completely overruled.
- The present study covers a cross-section of health professionals, so caution should be taken while generalizing the results.

INTRODUCTION

The hepatitis B virus (HBV) is an enveloped virus of the hepadnavirus family that infects the liver, causing hepatocellular necrosis and inflammation. HBV, spread by percutaneous or mucosal exposure to infected blood and various body fluids can either cause an acute or chronic disease (1). An estimated 257 million people are living with HBV (2), and about 20% to 30% of those who become chronically infected will develop complications. Currently available treatments fail to eradicate the virus in most of those treated, necessitating potentially lifelong treatment (3) and approximately 650,000 people die annually due to chronic hepatitis B (CHB) (3). Cameroon, a sub-Saharan African country, is considered hyper-endemic with a prevalence rate of HBV infection estimated at 11.5% (4).

Health care workers (HCW) who are frequently in contact with blood and other body fluids in the course of their work are at higher risk of exposure to blood borne viral diseases such as HBV, Hepatitis C Virus (HCV) and Human immunodeficiency virus (HIV) (5–7). Among the HCWs worldwide, about 2 million HCWs are exposed and about 70,000 are infected with HBV annually (7). The World Health Organization (WHO) global burden of the disease showed that 37% of HBV among HCWs was the result of occupational exposure resulting from sharps injuries to HCWs (2). More than 90% of these infections occur in developing countries (7). The risk of occupational infections in developing countries is intensified by a variety of factors, comprising but not restricted to, overcrowding in hospitals, lower HCWs:patient ratio, insufficient or absence of basic safety and protection equipment, reutilizing/reprocessing contaminated needles and sharp instruments and partial awareness of exposure-risk to blood and body fluid (5).

Although needle stick injury hepatitis sero-conversion is somewhat rare, the costs of treatment and anxiety about the possible consequences of an exposure are serious. This might be why some HCWs refuse to service patients with blood borne viral diseases such as HBV. Prevention through immunization and increasing knowledge thus stand out as the safest strategy against the high prevalence of viral hepatitis among HCWs. Knowing facts and having proper awareness, can influence the attitudes of HCWs and control the menace of the disease (8). A number of studies in Africa have evaluated the level of the knowledge, attitude, and practice of HCWs toward HBV and the vaccination

status of HCWs (9–12). The low level of vaccination and the high prevalence of HBsAg recorded in different studies might be justified by the low level of knowledge on the route of transmission among HWCs (13–16).

Prevention is still a recommended safeguard against an epidemic of viral hepatitis. Knowledge and attitudes of the clinician play a key role in prevention and spread of infection. By knowing facts, having proper awareness, and attitudes, the menace of this disease can be prevented to a great extent. Therefore, the objectives of the present study are to assess the knowledge and attitudes of HCWs regarding HBV, and to compare their knowledge and attitude score to the prevalence of HBV infection.

MATERIALS AND METHODS

Study design and setting

This cross-sectional hospital-based study was conducted among HCWs in the Bamenda health district, North West Region (NWR) of Cameroon. Samples were collected between April and September 2017, and included 22 health facilities in this health district (among which were 1 regional hospital, 3 CMAs, 6 mission hospitals, 5 government health centers and 7 private hospitals). Over 70% of HCWs in the various health facilities were recruited for this study. Testing stations were set up in the various wards in the health facilities.

Ethical consideration

Ethical clearance for the study was obtained from the National Ethics Committee of Cameroon (N°2017/02/871/CE/CNERSH/SP). Authorization to carry out research in the NWR was obtained from the regional delegation. Authorizations to access different hospitals were obtained from the directors or the in-charge of the hospitals. Authorization to access health centers was obtained from the District medical officer and the chief of centers of the health facilities. Written informed consent was obtained from each participant.

Study participants

HCWs present in the selected hospitals during the study period were informed and invited to participate in the study. HCWs in the study comprised of medical doctors,

nurses, dentists, pharmacists, laboratory technicians, sanitary workers and biomedical students working in the Bamenda health district during the study period.

Sample Size and Justification

Sample size was determined using the Population Proportion Sample Size formula proposed by Scott Smith (13), X = Z-score * SD * (1 - SD) / MOE. The proportion of HCWs in the North-West Region was obtained from a registry published in 2015 (14) which published the national proportions of HCWs per region. The confidence level was 95% giving a Z-Score of 1.96, a margin of error (MOE) of +/- 5 and a standard deviation (SD) of 0.5. Using this formula, the calculated sample size was 385 persons.

Sample collection

Participants who consented to the study completed a structured questionnaire which was used to collect data on sociodemographic characteristics, HBV exposure risks, HBV vaccination and attitude towards HBV. Stratified sampling technique, which permits estimation of population parameters for groups within population was used for sampling. The questionnaire was self-administered and contained both closed and open-ended questions to assess the perspectives of the respondents towards HBV. Participants who could read and write completed the form by themselves while those who could neither read nor write were assisted. The questionnaire was filled in the presence of the researcher to prevent participants from discussing answers or getting answers online. Pre-designed and pre-tested, semi-structured questionnaire items with response options was developed based on KAP surveys with similar objectives (15–17). Serum was obtained from 4ml of blood collected from study participants into a red cap (dry) tube. Identification number was used to link participant's laboratory results and the questionnaire.

Definition for scoring knowledge

Knowledge on the route of HBV transmission was assessed using 3 questions directly linked with the route of HBV infection. Adequate knowledge was when a correct answer was given to all three questions. This minimum of 3/3 defining a good level of knowledge may seem rigorous. However, this minimum level justified the affordable difficulty of the questions.

Definition for scoring attitude

Attitude was assessed using 6 criteria: attitude towards HBV infected persons, quality of hygiene (how often HCWs wash and/or disinfect their hands), frequency of glove use, frequency of needle stick injury, sexuality, and vaccination status of the HCW. Attitude was considered positive when a participant was able to correctly give at least 5 of the 6 expected answers. Having 5 of the 6 responses correct is deemed as having a positive attitude because HCWs are at the forefront of healthcare provision and should have appropriate attitude towards HBV for others in the population to emulate.

HBV serology

HBsAg was tested using the MONOLISA HBsAg ULTRA ELISA kit from Bio-Rad (Marnes-La-Coquette-France), a fully multivalent assay showing high sensitivity in the detection of HBV mutants to determine those who were positive for HBsAg (6). ELISA assay was performed following the manufacturer's instructions.

Statistical analysis

Data was analyzed using SPSS version 20.0 for Windows (SPSS, Chicago, Illinois, USA). Descriptive statistics for demographic characteristics, percentages for categorical variables, median and interquartile range (IQR) for continuous variables were used to analyse the findings of the study. Pearson's Khi square ($p < 0.05$) was used to assess the significance among study variables.

Patient and Public Involvement Statement: Patients and the public were not involved in designing the questionnaire, collecting and analysing data for this study.

RESULTS

Socio-demographic characteristics of study participants

In each health facility in the Bamenda Health District, over 70% of HCWs consented to participate in this study. Overall, a total of 398 HCWs across the Bamenda Health District participated in this study. Among these, 272 (68.3%) were women; the (16-25) year old age group was the most represented 167 (42.0%), and median age was 27.0 years (IQR, 23 - 32 years) at 95%CI (Table 1). Most participants were nurses (56.6% of

workers and 55.7%% of students), had worked for 2-4 years and lived in an urban setting (84.2%).

Assessment of Knowledge

A total of 3 questions were used to access knowledge of HCWs from different hospitals in this region on the route of HBV transmission (Table 2). 338 (84.9%) participants had heard of HBV. Most participants correctly identified sexual intercourse 313 (78.6%), mother-to-child transmission 292 (73.4 %) and contact with body fluid 324 (81.4 %) as routes of contamination with HBV. Among these, medical doctors were the most knowledgeable regarding HBV 13 (76.5%) while not up to 50% of sanitary workers had heard of HBV before this study (Table 3). Knowledge was significantly associated to the level of education and HCWs category (*P*<.001). Overall, these HCWs had an unsatisfactory level of knowledge on the route of HBV transmission 269 (67.6%). Knowledge on the route of HBV transmission was higher among biomedical students 104 (69.8%) compared to the personnels 165 (66.3%). Prevalence of HBsAg positivity was higher among those with adequate knowledge on the route of HBV transmission 26 (61.9%) (Table 4).

Attitude of HCWS TO HBV

Among the 398 HCWs, 270 (67.8%) HCWs had a positive attitude towards HBV infected persons (Table 5). Majority of HCWs practiced safe hygiene (washed their hands often and/or used a disinfectant) 317 (79.6%) and wore gloves often 310 (77.9%) while administering treatment. Needle stick injury was highest among sanitary workers (3 (6.8%) while promiscuity (defined as having more than 10 sex partners in your life time, having sex with prostitude(s), and/or one night stands was highest among dentist 6(40.0). Only 93(23.4%) of HCWs reported receiving at least one dose of the vaccine, while 175 (44.0) HCWs showed an overall positive attitude towards HBV (Table 5). There was a significant correlation between HCWs category and attitude towards HBV (P=.003) (Table 3). Prevalence of current HBV infection (HBsAg positivity) was lower among those with a positive attitude towards HBV 19 (45.2) (Table 4).

Prevalence of HBsAg among HCWs

The prevalence of HBsAg positivity was 10.6% (Table 3). No statistically significant association was observed between HBsAg positivity and the different classes involved in this study (Table 3). Majority of those infected belonged to the (46-65) year age group 4 (16.7%), had worked for (5-9) years 7 (12.7%), had an SRN/SRM certificate 9 (16.4), were nurses 28 (12.5) and lived in an urban setting 38 (11.3). No significant association was observed between knowledge on the route of HBV infection, attitude towards HBV and being positive for HBsAg (Table 4).

DISCUSSSION

Exposure to blood-borne pathogens such as HBV infection remains a significant occupational hazard to HCWs, especially in countries where the prevalence of this infection is high. KAP studies among HCWs are necessary to evaluate and improve the awareness on the route of transmission, prevention and management of infectious diseases. This study was carried out to assess the knowledge, attitude and prevalence of HBV among HCWs in the Bamenda Health District, NWR, Cameroon.

- **Assessment of Knowledge**

HCWs are at the fore front of health care provision and it is expected that they should know the routes of transmission of different infectious agents in order to protect their patients and themselves from nosocomial infections. Results of the current study revealed a significant association between HCWs category, level of education and knowledge on the route of HBV transmission. This is similar to what was obtained in Sierra Leone (11), Sudan (18) and Northeast Ethopia (19). This may be justified by the fact that education trains individuals to acquire, evaluate and use information (20). This may justify the unequal access to and exploitation of educational resources which increases with level of education (21) as well as role in the health setting.

Even though majority of HCWs in this setting had heard of HBV infection prior to this study 338 (84.9%), only 269 (67.6%) of them had good knowledge on the route of HBV transmission. This is similar to the 62.5% obtained in Northern Tanzania (9) and the 58.7% obtained in the South West Region of Cameroon (22). However, this is higher than the 47.0% obtained in Yaoundé among HCWs (23), 52% obtained in North West, Ethiopia (10), the 29.9% obtained in Sierra Leone (11) and the 42.1% obtained in a

rural population in the North West Region of Cameroon (24). According to Abongwa *et al*. (2016), the most probable reason for the low level of adequate knowledge on the route of HBV transmission could be inadequate health educative programs forcing the population to get information on HBV from friends and/or relatives (24). Getting information from friend, relatives and/or colleagues increases the probability of getting inappropriate information.

The level of current HBV infection was higher among those who had an adequate knowledge on the route of HBV transmission 26 (61.9%). This is contrary to what is anticipated (15) given that better knowledge on the route of disease transmission should help the individual take precautions against getting the infection in question. The disparity observed in this study can be explained by the same principle underlined above; inadequate health educative programs forcing the population to get information on HBV from friends, relatives and/or colleagues (22). This can thus justify the fact that most of the infected HCWs were chronic carriers who after their first diagnosis or exposure to HBV were directed to gastroenterologist for follow-up.

- **Assessment of Attitude of HCWs to HBV**

There was a significant association between HCWs category and attitude towards HBV (*P*=.003) and even though 270 (67.8%) HCWs had a positive attitude (behaviour) towards HBV infected persons, only 175 (44.0%) HCWs showed an overall positive attitude towards HBV. The poor attitude of the majority of HCWs towards HBV in this study may be justified by the level of inadequate knowledge on the route of HBV transmission in this population (8,15).

Prevalence of current HBV infection was lower among those with a positive attitude towards HBV 19 (45.2%). Developing a positive attitude towards a disease is generally associated with acquiring adequate knowledge on that disease as discussed above (8,15). This might justify the lower prevalence of current HBV infection among those with the positive attitude towards HBV.

- **Prevalence of HBV among HCWs**

Various epidemiological and cross-sectional studies have reported marked variation in the prevalence of HBsAg among HCWs. Studies carried out among HCWs in Africa gave 1.8 % in Libya (25), 2.9 % in Rwanda (26), 7.0 % in Tanzania (27) and 8.1 % in Uganda (28). This study revealed a relatively high burden of current HBV infection (10.6%) among HCWs in Cameroon. The high prevalence of HBV in this study population is similar to the HBV prevalence obtained in a similar study carried out in Yaoundé (23) but higher than the 8.7% obtained in the national survey among HCWs (29). The difference in prevalence of HBV could be because of the different diagnostic techniques used. The high prevalence of HBV infection obtained among HCWs in Cameroon may be a reflection of the prevalence of HBV infection in the general Cameroonian population which is estimated at 11.5% (4) or the lack of adequate knowledge on the route of HBV transmission among these HCWs (15).

The prevalence of HBV positivity was low in the (16-25) years age group and could be justified by the expanded immunization between 1990 to 2005, which led to a decrease in HBV infections in most regions particularly Central sub-Saharan Africa (30). Furthermore, most students were in the (16-25) year age group and thus had just started working in the health facilities.

This was a cross-sectional study implying that participants were met only once. There was no follow-up to determine the outcome of the infection. Besides, data on knowledge and attitude were self-reported in this study and could be subject to individual bias. Finally, no serological test was performed to evaluate the level of vaccination coverage in this at-risk population. This implies that, the number of HCWs immune against HBV is lower than what is reported in this study. This negative attitude of HCWs, can be justify by the high cost of the vaccine, the lack of adequate supply and/or the simple fear of receiving the vaccine provoked by the many myths surrounding vaccination in some settings (31).

CONCLUSION

The level of knowledge on the route of HBV transmission observed in this study is fair. This lack of adequate knowledge might justify the relatively high prevalence of HBsAg positivity, the overall negative attitude towards HBV and the low rate of vaccination

among HCWs in this area. Given that knowledge is usually the first step towards modification of a desirable behaviour, HBV campaigns should be organised to sensitize HCWs on this disease. The campaign can include improved mass media program such as broadcasting health talk intermittently online and/or within other television programs. Adequate sensitization will reduce the rate of stigma associated to the disease and probably the rate of new infections among HCWs.

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Statement of Ethics: Ethical clearance for the study was obtained from the National Ethics Committee of Cameroon (N°2017/02/871/CE/CNERSH/SP). Authorization to carry out research in the NWR was obtained from the regional delegation. Authorizations to access different hospitals were obtained from the directors or the in-charge of the hospitals. Authorization to access health centers was obtained from the District medical officer (DMO) and the chief of centers of the health facilities in this region. Written informed consent was obtained from each participant.

Authors' contribution: AE and TC designed the study; AE and FV performed the experiments; AE drafted the manuscript; TC, NR, AL and KJR were involved in editing the manuscript; AE performed the statistical analysis. All authors read and approved the final manuscript.

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Data Availability: Raw data is available on Figshare. Data is open access but authors should be consulted before exploiting data for any use other than better understanding of this paper. The link to raw data is given below: https://doi.org/10.6084/m9.figshare.9641771.

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Table 1: Baseline characteristics in the studied population

Variables		Frequency (398)	Percentage
Sex	Male	126	31.7
	Female	272	68.3
Age Intervals	16-25	167	42.0
	26-35	157	39.4
	36-45	50	12.6
	46-65	24	6.0
Level of Education	Secondary and below	39	9.8
	Diploma	59	14.8
	SRN/SRM	55	13.8
	HND	103	25.9
	BSc	118	29.6
	Post Graduate	24	6.0
Duration In the Occupation	≤ 1 year	72	18.1
	2 – 4 years	218	54.8
	5 – 9 years	55	13.8
	≥ 10 year	53	13.3
HCWs category	Nurses	224	56.3
	Lab Technicians	90	22.6
	Medical Doctors	17	4.3
	Dentist	15	3.8
	Pharmacist	8	2.0
	Sanitary Workers	44	11.1
Role In the Hospital	Biomedical Student	149	37.4
	Biomedical Personnel	249	62.6
Residence	Urban	335	84.2
	Semi-Urban	18	4.5
	Rural	45	11.3

Data are n and %.

Table 2: Knowledge on route of HBV transmission

Questions		Correct Response n (%)						
		Nurses (n-224)	Medical Doctors (n=17)	Lab Technicians (n=90)	Dentist (n=15)	Pharmacist (n=8)	Sanitary Workers (n= 44)	Total (n=398)
Heard of HBV	Yes	199 (88.8)	16 (94.1)	86 (95.6)	12 (80.0)	5 (62.5)	20 (45.5)	338 (84.9)
	No	25 (11.2)	1 (5.9)	4 (4.4)	3 (20.0)	3 (37.5)	24 (54.5)	60 (15.1)

Sexually transmitted	Yes	183 (81.7)	16 (94.1)	82 (91.1)	11 (73.3)	3 (37.5)	18 (40.9)	313 (78.6)
	No	41 (18.3)	1 (5.9)	8 (8.9)	4 (26.7)	5 (62.5)	26 (59.1)	85 (21.4)
Vertical transmission	Yes	179 (79.9)	14 (82.4)	69 (76.7)	9 (60.0)	5 (62.5)	16 (36.4)	292 (73.4)
	No	45 (20.1)	3 (17.6)	21 (23.3)	6 (40.0)	3 (37.5)	28 (63.6)	106 (26.6)
Contact with body fluids	Yes	191 (85.3)	15 (88.2)	84 (93.3)	11 (73.3)	5 (62.5)	18 (40.9)	324 (81.4)
	No	33 (14.7)	2 (11.8)	6 (6.7)	4 (26.7)	3 (37.5)	26 (59.1)	74 (18.6)
Knowledge on HBV	Yes	162 (72.3)	13 (76.5)	68 (75.6)	9 (60.0)	3 (37.5)	14 (31.8)	269 (67.6)
	No	62 (27.7)	4 (23.5)	22 (24.4)	6 (40.0)	5 (62.5)	30 (62.2)	129 (32.4)

Data are n(%).

Table 3: Prevalence of HBV infection among HCWs

Characteristic		Knowledge on route of transmission		Positive attitude		HBsAg Positivity	
		n(%)	p-value	n(%)	p-value	n(%)	p-value
Sex	Male (n=126)	88 (69.8)	0.513	61 (48.4)	0.224	9 (7.1)	0.132
	Female (n=272)	181 (66.5)		114 (41.9)		33 (12.1)	
Age Group	16-25 (n=167)	118 (70.7)	0.169	74 (44.3)	0.456	14 (8.4)	0.532
	26-35 (n=157)	109 (69.4)		72 (45.9)		19 (12.2)	
	36-45 (n=50)	29 (58.0)		17 (34.0)		5 (10.0)	
	46-65 (n=24)	13 (54.2)		12 (50.0)		4 (16.7)	
Level of education	≤ Secondary (n=39)	11 (28.2)	**< 0.001**	14 (35.9)	0.186	3 (7.7)	0.771
	Diploma (n=59)	36 (61.0)		23 (39.0)		6 (10.2)	
	SRN/SRM (n=55)	36 (65.5)		22 (40.0)		9 (16.4)	
	HND (n=103)	79 (76.7)		42 (40.8)		10 (9.7)	
	BSc (n=118)	88 (74.6)		64 (54.2)		12 (10.2)	
	Post Graduate (n=24)	19 (79.2)		10 (41.7)		2 (8.3)	
Duration in the occupation	≤ 1 year (n=72)	45 (62.5)	0.649	30 (41.7)	0.217	7 (9.7)	0.601
	2-4 years (n=218)	157 (72.0)		101 (46.3)		23 (10.6)	
	5-9 years (n=55)	34 (61.8)		21 (38.2)		7 (12.7)	
	≥ 10 year (n=53)	33 (62.3)		23 (43.4)		5 (9.4)	
HCWs category	Nurses (n=224)	162 (72.3)	<**0.001**	87 (38.8)	**0.003**	28 (12.5)	0.640
	Lab Tech (n=90)	68 (75.6)		54 (60.0)		8 (8.9)	
	Medical doctors (n=17)	13 (76.5)		9 (52.9)		1 (5.9)	
	Dentist (N=15)	9 (60.0)		9 (60.0)		2 (13.3)	
	Pharmacist (N=8)	3 (37.5)		2 (25.0)		1 (12.5)	
	Sanitary workers (N=44)	14 (31.8)		14 (31.8)		2 (4.5)	
	Biomedical students (N=149)	104 (69.8)	0.466	65 (43.6)	0.914	13 (8.7)	0.359
	Biomedical personnel (N=249)	165 (66.3)		110 (44.2)		29 (11.6)	

Residence	Urban (N=335)	229 (68.4)	0.523	152 (45.4)	0.408	38 (11.3)	0.492
	Semi-urban (N=18)	10 (55.6)		6 (33.3)		1 (5.6)	
	Rural (N=45)	30 (66.7)		17 (37.8)		3 (6.7)	

Data are n(%); p-value<0.05 is considered significant.

Table 4: Association between knowledge, attitude and prevalence of HBsAg

Characteristics		Reactivity to HBsAg			Unadjusted Risk of HBsAg	
		No	%	p-value	OR	95% CI
Knowledge (n=42)	Adequate	26	61.9	0.405	1.323	0.683 - 2.564
	Poor	16	38.1			
Attitude (n=270	Positive	19	45.2	0.861	0.994	0.497 - 1.795
	Negative	23	54.8			

p-value<0.05 is considered to be significant.

Table 5: Attitude of HCWs towards HBV

Attitudes		Health Care Worker n (%)						
		Nurses (n=224)	MDs (n=17)	Lab Techs (n=90)	Dentist (n=15)	Pharmacist (n=8)	Auxiliary workers (n=44)	Total (n=398)
Attitude towards infected persons	Good	137 (61.2)	13 (76.5)	70 (77.8)	13 (86.7)	5 (62.7)	32 (72.7)	270 (67.8)
	Bad	87 (38.8)	4 (23.5)	20 (22.2)	2 (13.3)	3 (37.5)	12 (27.3)	128 (32.2)
Practice safe hygiene	Yes	193 (86.2)	14 (82.4)	63 (70.0)	14 (93.3)	6 (75.0)	27 (61.4)	317 (79.6)
	No	31 (13.8)	3 (17.6)	27 (30.0)	1 (6.7)	2 (25.0)	17 (38.6)	81 (20.4)
Wears gloves often	Yes	177 (79.0)	15 (88.2)	82 (91.1)	10 (66.7)	4 (50.0)	22 (50.0)	310 (77.9)
	No	47 (21.0)	2 (11.8)	8 (8.9)	5 (33.3)	4 (50.0)	22 (50.0)	88 (22.1)
Frequency of needle stick injury	Often	10 (4.5)	0 (0.0)	1 (1.1)	0 (0.0)	0 (0.0)	3 (6.8)	14 (3.5)
	Rarely	214 (95.5)	17 (100.0)	89 (98.9)	15 (100.0)	8 (100.0)	41 (93.2)	384 (96.5)
Received 1 dose of vaccine	Yes	43 (19.2)	4 (23.5)	28 (31.1)	10 (66.7)	3 (37.5)	5 (11.4)	93 (23.4)
	No	181 (80.8)	13 (76.5)	62 (68.9)	5 (33.3)	5 (62.5)	39 (88.6)	305 (76.6)
Sexually promiscuous	Yes	46 (20.5)	4 (23.5)	10 (11.1)	6 (40.0)	2 (25.0)	16 (36.4)	84 (21.1)
	No	178 (79.5)	13 (76.5)	80 (88.9)	9 (60.0)	6 (75.0)	28 (63.6)	314 (78.9)
General Attitude	Positive	87 (38.8)	9 (52.9)	54 (60.0)	9 (60.0)	2 (25.0)	14 (31.8)	175 (44.0)
	Negative	137 (61.2)	8 (47.1)	36 (40.0)	6 (40.0)	6 (75.0)	30 (68.2)	223 (56.0)

Data are n(%).

STROBE (Strengthening The Reporting of OBservational Studies in Epidemiology) Checklist

A checklist of items that should be included in reports of observational studies. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Section and Item	Item No.	Recommendation	Reported on Page No.
Title and Abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	-1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	-2
Introduction			
Background/Rationale	2	Explain the scientific background and rationale for the investigation being reported	-4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	-5
Methods			
Study Design	4	Present key elements of study design early in the paper	-5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	-5-7
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	N/A
		Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	N/A
		Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	-5-6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed	N/A
		Case-control study—For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	!!!!!-6-7

Section and Item	Item No.	Recommendation	Reported on Page No.
Data Sources/ Measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	N/A
Bias	9	Describe any efforts to address potential sources of bias	-6
Study Size	10	Explain how the study size was arrived at	-6
Quantitative Variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	N/A
Statistical Methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	-7
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed	N/A
		Case-control study—If applicable, explain how matching of cases and controls was addressed	N/A
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	-7
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	N/A
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive Data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	-7-8, -18
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome Data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	N/A
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	N/A
		Cross-sectional study—Report numbers of outcome events or summary measures	-7-9, 18-20

Section and Item	Item No.	Recommendation	Reported on Page No.
Main Results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-8-9, -20
Other Analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-8-9, -19-20
Discussion			
Key Results	18	Summarise key results with reference to study objectives	-8-9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	-11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	-9-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	-9, -11
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

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KNOWLEDGE, ATTITUDE AND PREVALENCE OF HEPATITIS B VIRUS AMONG HEALTH CARE WORKERS: A CROSS-SECTIONAL HOSPITAL-BASED STUDY, BAMENDA HEALTH DISTRICT, NWR, CAMEROON.

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ABSTRACT

Introduction: The Hepatitis B Virus (HBV) is a blood borne virus which can be transmitted via percutaneous and mucocutaneous exposure to infected body fluid. Health care workers (HCWs) who continuously are exposed to different body fluids are at an increased risk of contracting and transmitting this virus. It is thus important to evaluate the knowledge and attitude of HCWs towards HBV, and the prevalence of HBV infection among them.

Method: This cross-sectional study was carried out between April and September, 2017. Overall, 398 HCWs were recruited for this study. Knowledge on the route of HBV transmission and attitude towards HBV was evaluated using a well-structured questionnaire. Hepatitis B surface antigen (HBsAg) positivity was obtained using the Monolisa HBsAg ULTRA kit (Bio-Rad). Data was analyzed using Statistical Package for the Social Sciences version 20 (SPSS v. 20).

Results: Among the HCWs who participated in this study, 338 (84.9%) HCWs had heard of HBV, 269 (67.6%) of them had adequate knowledge on the route of HBV transmission. Medical doctors were the most knowledgeable among biomedical workers and students (76.5%). Stigma rate was highest among nurses 87 (38.8%). Prevalence of HBsAg positivity was high 42 (10.6%) given that there is an efficient and available vaccine. Overall, over 70% of HCWs invited to participate in this study responded.

Conclusion: Knowledge on the route of HBV transmission was fair, the level of stigmatization of HBV infected patients and the prevalence of HBV infection was high in this study. A sensitization campaign should be carried out to educate HCWs on HBV, thus reducing the level of stigma associated with HBV as well as the probability of contacting HBV as a nosocomial infection.

Key words: Health care workers, HBV, HBsAg, Attitude, Knowledge, Vaccination, Cameroon.

Abbreviations: HBV: Hepatitis B virus, MD: Medical doctor, Lab tech: Laboratory technician, HCWs: Health care workers, SRN/SRM: State Registered Nurse/Midwife, NWR: North West Region, KAP: Knowledge, attitude and practice/prevalence, HND: Higher National Diploma, BSc: Bachelor of Science, HBsAg: Hepatitis B surface antigen,

ELISA: Enzyme-linked immunosorbent assay, CMA: Centre medical d'arrondisement (district medical centers), MOE: Margin of error.

Strength:

- Monalisa™ HBsAg ULTRA ELISA kit with 100% sensitivity and specificity of 99.28% was used to determine current HBV infection (HBsAg positivity).
- Questionnaires were answered in the presence of the researcher to prevent participants from discussing answers or getting answers online.
- Stratified sampling technique, which permits estimation of population parameters for groups within population was used for sampling.

Limitation:

- Information on knowledge and attitude were self-reported, and chances of individual bias cannot be completely overruled.
- The present study covers a cross-section of health professionals, so caution should be taken while generalizing the results.

INTRODUCTION

The hepatitis B virus (HBV) is an enveloped virus of the hepadnavirus family that infects the liver, causing hepatocellular necrosis and inflammation. HBV, spread by percutaneous or mucosal exposure to infected blood and various body fluids can either cause an acute or chronic disease (1). An estimated 257 million people are living with HBV (2), and about 20% to 30% of those who become chronically infected will develop complications. Currently available treatments fail to eradicate the virus in most of those treated, necessitating potentially lifelong treatment (3) and approximately 650,000 people die annually due to chronic hepatitis B (CHB) (3). Cameroon, a sub-Saharan African country, is considered hyper-endemic with a prevalence rate of HBV infection estimated at 11.5% (4).

Health care workers (HCW) who are frequently in contact with blood and other body fluids in the course of their work are at higher risk of exposure to blood borne viral diseases such as HBV, Hepatitis C Virus (HCV) and Human immunodeficiency virus (HIV) (5–7). Among the HCWs worldwide, about 2 million HCWs are exposed and about 70,000 are infected with HBV annually (7). The World Health Organization (WHO) global burden of the disease showed that 37% of HBV among HCWs was the result of occupational exposure resulting from sharps injuries to HCWs (2). More than 90% of these infections occur in developing countries (7). The risk of occupational infections in developing countries is intensified by a variety of factors, comprising but not restricted to, overcrowding in hospitals, lower HCWs:patient ratio, insufficient or absence of basic safety and protection equipment, reutilizing/reprocessing contaminated needles and sharp instruments and partial awareness of exposure-risk to blood and body fluid (5).

Although needle stick injury hepatitis sero-conversion is somewhat rare, the costs of treatment and anxiety about the possible consequences of an exposure are serious. This might be why some HCWs refuse to service patients with blood borne viral diseases such as HBV. Prevention through immunization and increasing knowledge thus stand out as the safest strategy against the high prevalence of viral hepatitis among HCWs. Knowing facts and having proper awareness, can influence the attitudes of HCWs and control the menace of the disease (8). A number of studies in Africa have evaluated the level of the knowledge, attitude, and practice of HCWs toward HBV and the vaccination

status of HCWs (9–12). The low level of vaccination and the high prevalence of HBsAg recorded in different studies might be justified by the low level of knowledge on the route of transmission among HWCs (13–16).

Prevention is still a recommended safeguard against an epidemic of viral hepatitis. Knowledge and attitudes of the clinician play a key role in prevention and spread of infection. By knowing facts, having proper awareness, and attitudes, the menace of this disease can be prevented to a great extent. Therefore, the objectives of the present study are to assess the knowledge and attitudes of HCWs regarding HBV, and to compare their knowledge and attitude score to the prevalence of HBV infection.

MATERIALS AND METHODS

Study design and setting

This cross-sectional hospital-based study was conducted among HCWs in the Bamenda health district, North West Region (NWR) of Cameroon. Samples were collected between April and September 2017, and included 22 health facilities in this health district (among which were 1 regional hospital, 3 CMAs, 6 mission hospitals, 5 government health centers and 7 private hospitals). Over 70% of HCWs in the various health facilities were recruited for this study. Testing stations were set up in the various wards in the health facilities.

Ethical consideration

Ethical clearance for the study was obtained from the National Ethics Committee of Cameroon (N°2017/02/871/CE/CNERSH/SP). Authorization to carry out research in the NWR was obtained from the regional delegation. Authorizations to access different hospitals were obtained from the directors or the in-charge of the hospitals. Authorization to access health centers was obtained from the District medical officer and the chief of centers of the health facilities. Written informed consent was obtained from each participant.

Study participants

HCWs present in the selected hospitals during the study period were informed and invited to participate in the study. HCWs in the study comprised of medical doctors,

nurses, dentists, pharmacists, laboratory technicians, sanitary workers and biomedical students working in the Bamenda health district during the study period.

Strategy for Recruiting Target Population

Information was given through the chief medical doctor (where applicable), the general supervisor and the heads of units who were contacted respectively and asked to inform their staff of the project. An information notice was placed on the hospital and ward notice board where applicable, to inform the hospital staff of the study objectives and period during which the study was to be carried out. Finally, a one to one contact was used to reach a number of staff.

Sample Size and Justification

Sample size was determined using the Population Proportion Sample Size formula proposed by Scott Smith (13), X = Z-score * SD * (1 - SD) / MOE. The proportion of HCWs in the North-West Region was obtained from a registry published in 2015 (14) which published the national proportions of HCWs per region. The confidence level was 95% giving a Z-Score of 1.96, a margin of error (MOE) of +/- 5 and a standard deviation (SD) of 0.5. Using this formula, the calculated sample size was 385 persons.

Sample collection

Participants who consented to the study completed a structured questionnaire which was used to collect data on sociodemographic characteristics, HBV exposure risks, HBV vaccination and attitude towards HBV. Stratified sampling technique, which permits estimation of population parameters for groups within population was used for sampling. The questionnaire was self-administered and contained both closed and open-ended questions to assess the perspectives of the respondents towards HBV. Participants who could read and write completed the form by themselves while those who could neither read nor write were assisted. The questionnaire was filled in the presence of the researcher to prevent participants from discussing answers or getting answers online. Pre-designed and pre-tested, semi-structured questionnaire items with response options was developed based on KAP surveys with similar objectives (15–17). Questionnaire was validated following guidelines proposed by Jain *et al*., 2016 (18) Serum was obtained from 4ml of blood collected from study participants into a red cap

(dry) tube. Identification number was used to link participant's laboratory results and the questionnaire. The questionnaire is present online as a supplementary file.

Definition for scoring knowledge

Knowledge on the route of HBV transmission was assessed using 3 questions directly linked with the route of HBV infection. Adequate knowledge was when a correct answer was given to all three questions. This minimum of 3/3 defining a good level of knowledge may seem rigorous. However, this minimum level justified the affordable difficulty of the questions.

Definition for scoring attitude

Attitude was assessed using 6 criteria: attitude towards HBV infected persons, quality of hygiene (how often HCWs wash and/or disinfect their hands), frequency of glove use, frequency of needle stick injury, sexuality, and vaccination status of the HCW. Attitude was considered positive when a participant was able to correctly give at least 5 of the 6 expected answers. Having 5 of the 6 responses correct is deemed as having a positive attitude because HCWs are at the forefront of healthcare provision and should have appropriate attitude towards HBV for others in the population to emulate.

HBV serology

HBsAg was tested using the MONOLISA HBsAg ULTRA ELISA kit from Bio-Rad (Marnes-La-Coquette-France), a fully multivalent assay showing high sensitivity in the detection of HBV mutants to determine those who were positive for HBsAg (6). ELISA assay was performed following the manufacturer's instructions.

Statistical analysis

Data was analyzed using SPSS version 20.0 for Windows (SPSS, Chicago, Illinois, USA). Descriptive statistics for demographic characteristics, percentages for categorical variables, median and interquartile range (IQR) for continuous variables were used to analyse the findings of the study. Pearson's Chi square ($p < 0.05$) was used to assess the significance among study variables while odd ratio was used to evaluate the strength of association between the various variables.

Patient and Public Involvement Statement: Patients and the public were not involved in designing the questionnaire, collecting and analysing data for this study.

RESULTS

Socio-demographic characteristics of study participants

In each health facility in the Bamenda Health District, over 70% of HCWs consented to participate in this study. Overall, a total of 398 HCWs across the Bamenda Health District participated in this study. Among these, 272 (68.3%) were women; the (16-25) year old age group was the most represented 167 (42.0%), and median age was 27.0 years (IQR, 23 - 32 years) at 95%CI (Table 1). Most participants were nurses (56.6% of workers and 55.7%% of students), had worked for 2-4 years and lived in an urban setting (84.2%).

Assessment of Knowledge

A total of 3 questions were used to access knowledge of HCWs from different hospitals in this region on the route of HBV transmission (Table 2). 338 (84.9%) participants had heard of HBV. Most participants correctly identified sexual intercourse 313 (78.6%), mother-to-child transmission 292 (73.4 %) and contact with body fluid 324 (81.4 %) as routes of contamination with HBV. Among these, medical doctors were the most knowledgeable regarding HBV 13 (76.5%) while not up to 50% of sanitary workers had heard of HBV before this study (Table 3). Knowledge was significantly associated to the level of education and HCWs category ($P<.001$). Overall, these HCWs had an unsatisfactory level of knowledge on the route of HBV transmission 269 (67.6%). Knowledge on the route of HBV transmission was higher among biomedical students 104 (69.8%) compared to the personnel 165 (66.3%).

Attitude of HCWS TO HBV

Among the 398 HCWs, 270 (67.8%) HCWs had a positive attitude towards HBV infected persons (Table 4). Majority of HCWs practiced safe hygiene (washed their hands often and/or used a disinfectant) 317 (79.6%) and wore gloves often 310 (77.9%) while administering treatment. Needle stick injury was highest among sanitary workers (3 (6.8%) while promiscuity (defined as having more than 10 sex partners in your life time, having sex with prostitute(s), and/or one night stands was highest among dentist

6(40.0). Only 93(23.4%) of HCWs reported receiving at least one dose of the vaccine, while 175 (44.0) HCWs showed an overall positive attitude towards HBV (Table). There was a significant association between HCWs category and attitude towards HBV (*P*=.003) (Table 3).

Prevalence of HBsAg among HCWs

The prevalence of HBsAg positivity was 10.6% (Table 3). No statistically significant association was observed between HBsAg positivity and the different classes involved in this study (Table 3). Majority of those infected belonged to the (46-65) year age group 4 (16.7%), had worked for (5-9) years 7 (12.7%), had an SRN/SRM certificate 9 (16.4), were nurses 28 (12.5) and lived in an urban setting 38 (11.3). No significant association was observed between knowledge on the route of HBV infection, attitude towards HBV and being positive for HBsAg (Table 4). However, the prevalence of HBsAg positivity was higher among those with adequate knowledge on the route of HBV transmission 26 (61.9%) and lower among those with a positive attitude towards HBV 19 (45.2) (Table 4).

DISCUSSSION

Exposure to blood-borne pathogens such as HBV infection remains a significant occupational hazard to HCWs, especially in countries where the prevalence of this infection is high. KAP studies among HCWs are necessary to evaluate and improve the awareness on the route of transmission, prevention and management of infectious diseases. This study was carried out to assess the knowledge, attitude and prevalence of HBV among HCWs in the Bamenda Health District, NWR, Cameroon.

- **Assessment of Knowledge**

HCWs are at the fore front of health care provision and it is expected that they should know the routes of transmission of different infectious agents in order to protect their patients and themselves from nosocomial infections. Results of the current study revealed a significant association between HCWs category, level of education and knowledge on the route of HBV transmission. This is similar to what was obtained in Sierra Leone (11), Sudan (19) and Northeast Ethopia (20). This may be justified by the fact that education trains individuals to acquire, evaluate and use information (21). This

may justify the unequal access to and exploitation of educational resources which increases with level of education (22) as well as role in the health setting.

Even though majority of HCWs in this setting had heard of HBV infection prior to this study 338 (84.9%), only 269 (67.6%) of them had good knowledge on the route of HBV transmission. This is similar to the 62.5% obtained in Northern Tanzania (9) and the 58.7% obtained in the South West Region of Cameroon (23). However, this is higher than the 47.0% obtained in Yaoundé among HCWs (24), 52% obtained in North West, Ethiopia (10), the 29.9% obtained in Sierra Leone (11) and the 42.1% obtained in a rural population in the North West Region of Cameroon (25). According to Abongwa *et al*. (2016), the most probable reason for the low level of adequate knowledge on the route of HBV transmission could be inadequate health educative programs forcing the population to get information on HBV from friends and/or relatives (25). Getting information from friend, relatives and/or colleagues increases the probability of getting inappropriate information.

The level of current HBV infection was higher among those who had an adequate knowledge on the route of HBV transmission 26 (61.9%). This is contrary to what is anticipated (15) given that better knowledge on the route of disease transmission should help the individual take precautions against getting the infection in question. The disparity observed in this study can be explained by the same principle underlined above; inadequate health educative programs forcing the population to get information on HBV from friends, relatives and/or colleagues (22). This can thus justify the fact that most of the infected HCWs were chronic carriers who after their first diagnosis or exposure to HBV were directed to gastroenterologist for follow-up. Gastroenterologist also have the role of educating the patient on their disease.

- **Assessment of Attitude of HCWs to HBV**

There was a significant association between HCWs category and attitude towards HBV (*P*=.003) and even though 270 (67.8%) HCWs had a positive attitude (behaviour) towards HBV infected persons, only 175 (44.0%) HCWs showed an overall positive attitude towards HBV. The poor attitude of the majority of HCWs towards HBV in this

study may be justified by the level of inadequate knowledge on the route of HBV transmission in this population (8,15).

Prevalence of current HBV infection was lower among those with a positive attitude towards HBV 19 (45.2%). Developing a positive attitude towards a disease is generally associated with acquiring adequate knowledge on that disease as discussed above (8,15). This might justify the lower prevalence of current HBV infection among those with the positive attitude towards HBV.

- **Prevalence of HBV among HCWs**

Various epidemiological and cross-sectional studies have reported marked variation in the prevalence of HBsAg among HCWs. Studies carried out among HCWs in Africa gave 1.8 % in Libya (26), 2.9 % in Rwanda (27), 7.0 % in Tanzania (28) and 8.1 % in Uganda (29). This study revealed a relatively high burden of current HBV infection (10.6%) among HCWs in Cameroon. The high prevalence of HBV in this study population is similar to the HBV prevalence obtained in a similar study carried out in Yaoundé (24) but higher than the 8.7% obtained in the national survey among HCWs (30). The difference in prevalence of HBV could be because of the different diagnostic techniques used. The high prevalence of HBV infection obtained among HCWs in Cameroon may be a reflection of the prevalence of HBV infection in the general Cameroonian population which is estimated at 11.5% (4) or the lack of adequate knowledge on the route of HBV transmission among these HCWs (15).

The prevalence of HBV positivity was low in the (16-25) years age group and could be justified by the expanded immunization between 1990 to 2005, which led to a decrease in HBV infections in most regions particularly Central sub-Saharan Africa (31). Furthermore, most students were in the (16-25) year age group and thus had just started working in the health facilities.

This was a cross-sectional study implying that participants were met only once. There was no follow-up to determine the outcome of the infection. Besides, data on knowledge and attitude were self-reported in this study and could be subject to individual bias. Finally, no serological test was performed to evaluate the level of vaccination coverage

in this at-risk population. This implies that, the number of HCWs immune against HBV is lower than what is reported in this study. This negative attitude of HCWs, can be justify by the high cost of the vaccine, the lack of adequate supply and/or the simple fear of receiving the vaccine provoked by the many myths surrounding vaccination in some settings (32).

CONCLUSION

The level of knowledge on the route of HBV transmission observed in this study is fair. This lack of adequate knowledge might justify the relatively high prevalence of HBsAg positivity, the overall negative attitude towards HBV and the low rate of vaccination among HCWs in this area. Given that knowledge is usually the first step towards modification of a desirable behaviour, HBV campaigns should be organised to sensitize HCWs on this disease. The campaign can include improved mass media program such as broadcasting health talk intermittently online and/or within other television programs. Adequate sensitization will reduce the rate of stigma associated to the disease and probably the rate of new infections among HCWs.

Data Availability: https://doi.org /10.6084/m9.figshare.9641771

APPENDIX

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Statement of Ethics: Ethical clearance for the study was obtained from the National Ethics Committee of Cameroon (N°2017/02/871/CE/CNERSH/SP). Authorization to carry out research in the NWR was obtained from the regional delegation. Authorizations to access different hospitals were obtained from the directors or the in-charge of the hospitals. Authorization to access health centers was obtained from the

District medical officer (DMO) and the chief of centers of the health facilities in this region. Written informed consent was obtained from each participant.

Authors' contribution: AE and TC designed the study; AE and FV performed the experiments; AE drafted the manuscript; TC, NR, AL and KJR were involved in editing the manuscript; AE performed the statistical analysis. All authors read and approved the final manuscript.

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Table 1: Baseline characteristics in the studied population

Variables		Frequency (398)	Percentage
Sex	Male	126	31.7
	Female	272	68.3
Age Intervals	16-25	167	42.0
	26-35	157	39.4
	36-45	50	12.6
	46-65	24	6.0
Level of Education	Secondary and below	39	9.8
	Diploma	59	14.8
	SRN/SRM	55	13.8
	HND	103	25.9
	BSc	118	29.6
	Post Graduate	24	6.0
Duration In the Occupation	≤ 1 year	72	18.1
	2 – 4 years	218	54.8
	5 – 9 years	55	13.8
	≥ 10 year	53	13.3
HCWs category	Nurses	224	56.3
	Lab Technicians	90	22.6
	Medical Doctors	17	4.3
	Dentist	15	3.8
	Pharmacist	8	2.0
	Sanitary Workers	44	11.1
Role In the Hospital	Biomedical Student	149	37.4
	Biomedical Personnel	249	62.6
Residence	Urban	335	84.2
	Semi-Urban	18	4.5
	Rural	45	11.3

Data are n and %.

Table 2: Knowledge on route of HBV transmission

Questions		Correct Response n (%)						
		Nurses (n-224)	Medical Doctors (n=17)	Lab Technicians (n=90)	Dentist (n=15)	Pharmacist (n=8)	Sanitary Workers (n= 44)	Total (n=398)
Heard of HBV	Yes	199 (88.8)	16 (94.1)	86 (95.6)	12 (80.0)	5 (62.5)	20 (45.5)	338 (84.9)
	No	25 (11.2)	1 (5.9)	4 (4.4)	3 (20.0)	3 (37.5)	24 (54.5)	60 (15.1)

Sexually transmitted	Yes	183 (81.7)	16 (94.1)	82 (91.1)	11 (73.3)	3 (37.5)	18 (40.9)	313 (78.6)
	No	41 (18.3)	1 (5.9)	8 (8.9)	4 (26.7)	5 (62.5)	26 (59.1)	85 (21.4)
Vertical transmission	Yes	179 (79.9)	14 (82.4)	69 (76.7)	9 (60.0)	5 (62.5)	16 (36.4)	292 (73.4)
	No	45 (20.1)	3 (17.6)	21 (23.3)	6 (40.0)	3 (37.5)	28 (63.6)	106 (26.6)
Contact with body fluids	Yes	191 (85.3)	15 (88.2)	84 (93.3)	11 (73.3)	5 (62.5)	18 (40.9)	324 (81.4)
	No	33 (14.7)	2 (11.8)	6 (6.7)	4 (26.7)	3 (37.5)	26 (59.1)	74 (18.6)
Knowledge on HBV	Yes	162 (72.3)	13 (76.5)	68 (75.6)	9 (60.0)	3 (37.5)	14 (31.8)	269 (67.6)
	No	62 (27.7)	4 (23.5)	22 (24.4)	6 (40.0)	5 (62.5)	30 (62.2)	129 (32.4)

Data are n (%).

Table 3: Prevalence of HBV infection among HCWs

Characteristic		Knowledge on route of transmission		Positive attitude		HBsAg Positivity	
		n(%)	p-value	n(%)	p-value	n(%)	p-value
Sex	Male (n=126)	88 (69.8)	0.513	61 (48.4)	0.224	9 (7.1)	0.132
	Female (n=272)	181 (66.5)		114 (41.9)		33 (12.1)	
Age Group	16-25 (n=167)	118 (70.7)	0.169	74 (44.3)	0.456	14 (8.4)	0.532
	26-35 (n=157)	109 (69.4)		72 (45.9)		19 (12.2)	
	36-45 (n=50)	29 (58.0)		17 (34.0)		5 (10.0)	
	46-65 (n=24)	13 (54.2)		12 (50.0)		4 (16.7)	
Level of education	≤ Secondary (n=39)	11 (28.2)	**< 0.001**	14 (35.9)	0.186	3 (7.7)	0.771
	Diploma (n=59)	36 (61.0)		23 (39.0)		6 (10.2)	
	SRN/SRM (n=55)	36 (65.5)		22 (40.0)		9 (16.4)	
	HND (n=103)	79 (76.7)		42 (40.8)		10 (9.7)	
	BSc (n=118)	88 (74.6)		64 (54.2)		12 (10.2)	
	Post Graduate (n=24)	19 (79.2)		10 (41.7)		2 (8.3)	
Duration in the occupation	≤ 1 year (n=72)	45 (62.5)	0.649	30 (41.7)	0.217	7 (9.7)	0.601
	2-4 years (n=218)	157 (72.0)		101 (46.3)		23 (10.6)	
	5-9 years (n=55)	34 (61.8)		21 (38.2)		7 (12.7)	
	≥ 10 year (n=53)	33 (62.3)		23 (43.4)		5 (9.4)	
HCWs category	Nurses (n=224)	162 (72.3)	<**0.001**	87 (38.8)	**0.003**	28 (12.5)	0.640
	Lab Tech (n=90)	68 (75.6)		54 (60.0)		8 (8.9)	
	Medical doctors (n=17)	13 (76.5)		9 (52.9)		1 (5.9)	
	Dentist (N=15)	9 (60.0)		9 (60.0)		2 (13.3)	
	Pharmacist (N=8)	3 (37.5)		2 (25.0)		1 (12.5)	
	Sanitary workers (N=44)	14 (31.8)		14 (31.8)		2 (4.5)	
	Biomedical students (N=149)	104 (69.8)	0.466	65 (43.6)	0.914	13 (8.7)	0.359

	Biomedical personnel (N=249)	165 (66.3)		110 (44.2)		29 (11.6)	
Residence	Urban (N=335)	229 (68.4)	0.523	152 (45.4)	0.408	38 (11.3)	0.492
	Semi-urban (N=18)	10 (55.6)		6 (33.3)		1 (5.6)	
	Rural (N=45)	30 (66.7)		17 (37.8)		3 (6.7)	

Data are n (%); p-value<.05 is considered significant.

Table 4: Attitude of HCWs towards HBV

Attitudes		Health Care Worker n (%)						
		Nurses (n=224)	MDs (n=17)	Lab Techs (n=90)	Dentist (n=15)	Pharmacist (n=8)	Auxiliary workers (n=44)	Total (n=398)
Attitude towards infected persons	Good	137 (61.2)	13 (76.5)	70 (77.8)	13 (86.7)	5 (62.7)	32 (72.7)	270 (67.8)
	Bad	87 (38.8)	4 (23.5)	20 (22.2)	2 (13.3)	3 (37.5)	12 (27.3)	128 (32.2)
Practice safe hygiene	Yes	193 (86.2)	14 (82.4)	63 (70.0)	14 (93.3)	6 (75.0)	27 (61.4)	317 (79.6)
	No	31 (13.8)	3 (17.6)	27 (30.0)	1 (6.7)	2 (25.0)	17 (38.6)	81 (20.4)
Wears gloves often	Yes	177 (79.0)	15 (88.2)	82 (91.1)	10 (66.7)	4 (50.0)	22 (50.0)	310 (77.9)
	No	47 (21.0)	2 (11.8)	8 (8.9)	5 (33.3)	4 (50.0)	22 (50.0)	88 (22.1)
Frequency of needle stick injury	Often	10 (4.5)	0 (0.0)	1 (1.1)	0 (0.0)	0 (0.0)	3 (6.8)	14 (3.5)
	Rarely	214 (95.5)	17 (100.0)	89 (98.9)	15 (100.0)	8 (100.0)	41 (93.2)	384 (96.5)
Received 1 dose of vaccine	Yes	43 (19.2)	4 (23.5)	28 (31.1)	10 (66.7)	3 (37.5)	5 (11.4)	93 (23.4)
	No	181 (80.8)	13 (76.5)	62 (68.9)	5 (33.3)	5 (62.5)	39 (88.6)	305 (76.6)
Sexually promiscuous	Yes	46 (20.5)	4 (23.5)	10 (11.1)	6 (40.0)	2 (25.0)	16 (36.4)	84 (21.1)
	No	178 (79.5)	13 (76.5)	80 (88.9)	9 (60.0)	6 (75.0)	28 (63.6)	314 (78.9)
General Attitude	Positive	87 (38.8)	9 (52.9)	54 (60.0)	9 (60.0)	2 (25.0)	14 (31.8)	175 (44.0)
	Negative	137 (61.2)	8 (47.1)	36 (40.0)	6 (40.0)	6 (75.0)	30 (68.2)	223 (56.0)

Data are n (%).

Table 4: Association between knowledge, attitude and prevalence of HBsAg

Characteristics		Reactivity to HBsAg			Unadjusted Risk of HBsAg	
		No	%	p-value	OR	95% CI
Knowledge (n=42)	Adequate	26	61.9	0.405	1.323	0.683 - 2.564
	Poor	16	38.1			
Attitude (n=270	Positive	19	45.2	0.861	0.994	0.497 - 1.795
	Negative	23	54.8			

p-value<.05 is considered to be significant.

Questionnaire

Date: _____ Tel:_____ S/N _____

Instruction: Tick where necessary and fill all blank spaces

A- Demographic Data

1) Age: _____ Sex: Male☐ Female ☐

2) Where do you live? _____

3) Is it an urban, semi-urban or a rural setting: _____

4) Religion: _____ Denomination (If any): _____

5) Profession (specify) _____

6) Duration in the occupation: _____

7) Level of education: Primary ☐ O'level☐ A'level☐ HND☐ BSc☐ MSc☐ PhD☐

Diploma ☐

B- Sexuality

8) Age of first sexual intercourse _____

9) Have you ever had sex with someone you did not know (one-night stand)? Yes☐ No☐

10) Have you ever had sex with a prostitute? Yes☐ No ☐

11) Have you had more than 10 sex partners in your lifetime? Yes ☐ No ☐

C- Knowledge on HBV

12) Have you heard of hepatitis B viral infection before now? Yes ☐ No ☐

13) Can HBV be transmitted sexually? Yes ☐ No ☐

14) Can HBV be transmitted through kissing? Yes ☐ No ☐

15) Can HBV be transmitted from a mother to her unborn child? Yes☐ No☐

16) Can HBV be transmitted through contact with body fluid like blood? Yes ☐ No ☐

Questionnaire

D- Exposure to nosocomial infection

17) How often do you wear gloves when administering treatment? Rarely ☐ Often ☐

18) Have you ever pricked yourself while administering treatment? Yes ☐ No ☐

19) If yes, how often? Rarely ☐ Often ☐

20) What is your attitude towards HBV positive patients? Same as towards other patients ☐ Discreet and scared ☐

21) How often do you wash your hand? After every patient ☐ If I don't put on gloves ☐ When I remember ☐

22) How often do you use a disinfectant? Rarely ☐ Often ☐

E- Medical History

23) Have you been vaccinated against HBV? Yes ☐ No ☐

24) If yes, did you take the complete dose? Yes ☐ No ☐

25) How many times have you been tested for HBV? _____

26) Have you ever been tested positive for HBV? _____

27) Month and year _____

F- Serology Result (Please do not fill)

HBsAg: _____

Thanks for your cooperation

STROBE (Strengthening The Reporting of OBservational Studies in Epidemiology) Checklist

A checklist of items that should be included in reports of observational studies. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Section and Item	Item No.	Recommendation	Reported on Page No.
Title and Abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	-1-2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	-2
Introduction			
Background/Rationale	2	Explain the scientific background and rationale for the investigation being reported	-4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	-5
Methods			
Study Design	4	Present key elements of study design early in the paper	-5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	-5-7
Participants	6	(*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	N/A
		Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	N/A
		Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	-5-6
		(*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed	N/A
		Case-control study—For matched studies, give matching criteria and the number of controls per case	N/A
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	-6-7

Section and Item	Item No.	Recommendation	Reported on Page No.
Data Sources/ Measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	N/A
Bias	9	Describe any efforts to address potential sources of bias	-6
Study Size	10	Explain how the study size was arrived at	-6
Quantitative Variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	N/A
Statistical Methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	-7
		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed	N/A
		Case-control study—If applicable, explain how matching of cases and controls was addressed	N/A
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	-7
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	N/A
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	N/A
Descriptive Data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	-7-8, -18
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) *Cohort study*—Summarise follow-up time (eg, average and total amount)	N/A
Outcome Data	15*	*Cohort study*—Report numbers of outcome events or summary measures over time	N/A
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	N/A
		Cross-sectional study—Report numbers of outcome events or summary measures	-7-9, 18-20

Section and Item	Item No.	Recommendation	Reported on Page No.
Main Results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	N/A
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-8-9, -20
Other Analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	-8-9, -19-20
Discussion			
Key Results	18	Summarise key results with reference to study objectives	-8-9
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	-11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	-9-11
Generalisability	21	Discuss the generalisability (external validity) of the study results	-9, -11
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	N/A

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.