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Seroprevalence of Hepatitis B and C and Associated Risk Factors among HIV-1 Infected Patients in a High Risk Border Region of South West Cameroon

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Abstract

Background: Coinfection of HIV with human retroviruses such as hepatitis B (HBV) and hepatitis C (HCV) has been associated with adverse liver disease outcomes including reduced survival, cancer and antiretroviral induced hepatotoxicity. In this study, we evaluated the prevalence of hepatitis B surface antigen (HBsAg) and hepatitis C antibody (HCVAb) among HIV-infected individuals diagnosed within six months in South West Cameroon and identified risk factors of coinfection.

Methods: We performed a systematic screening for HBsAg and HCVAb among 299 newly enrolled HIV-positive patients South West of Cameroon. Enzyme Linked Immuno-sorbent Assay (ELISA) confirmed the presence of HBV/HCV infection status. Risk factors of coinfection were assessed by logistic regression using SPSS V20 and Epi-Info v7. A P value < 0.05 was considered significant.

Results: The overall prevalence of Hepatitis B/C was 16.05% with 12.0% (95% CI: 1.96-2.03) for HBV and 4% (95% CI: 1.97-2.02) for HCV. Participants in urban environment were less likely to be infected with HBV [aOR: 0.171 (0.044-0.660), P = 0.010] compared to rural environment. A history of blood transfusion increased odds of hepatitis B positivity six times [aOR: 5.8 (2.04-16.94), P = 0.001] and 13 times for hepatitis C [13.14 (3.04-56.81, P = 0.001]).

Conclusions: The seroprevalence of hepatitis B and C among diagnosed HIV patients observed was 12% and 4% respectively. A history of blood transfusion was independently associated with hepatitis B or C infection. Appropriate education and safe blood transfusion might contribute to limit ongoing transmission of viral hepatitis among HIV patients.

Keywords

Hepatitis B, Hepatitis C, HIV, Kumba, Seroprevalence, Coinfection, Cameroon

Background

Viral hepatitis has emerged as an important public health problem globally. It is characterized by high prevalence, high burden of morbidity and mortality, and suboptimal diagnosis and management approaches [1,2]. Hepatitis B (HBV) and C (HCV) are two among the numerous forms of infections whose clinical degeneration, morbidity-mortality and low immune responsiveness in people living with human immunodeficiency virus (HIV) are highly evident. Co-infections between HIV, HBV and/or HCV have been associated with reduced survival, increased risk of progression to liver diseases and increased risk of hepatotoxicity associated to antiretroviral therapy [3,4].

While varying in their transmission efficiencies, HIV, HBV and HCV share common routes of transmission, and as such, the prevalence of HBV and HCV are gener-

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ally higher in HIV-infected individuals [5,6]. Studies have shown that HBV, HCV and HIV are endemic in Africa and especially the sub-Saharan Africa [7]. However, co-infection rates among HIV-infected individuals remain controversial (international journal of infectious diseases, 2010). Scientists have reported that the worldwide prevalence of HBV ranges from 0.1-20% [8,9].

Hepatitis B virus is detected in blood and body fluids (semen, saliva, and nasopharyngeal fluids), and the four major modes of transmission are: Sexual contact, mother to child transmission in pregnancy and at birth, blood to blood contact and through sharing of infected items [10]. The world's predominant mode of transmission of HBV is perinatal. In this case, children born of HBV positive mothers have 90% chance of having the infection too, among whom 25% may die in adult life of chronic liver diseases or cancer [11]. Sub-Saharan Africa (SSA) has the highest burden of infectious diseases and remains the epicenter of the global HIV epidemic [12,13]. Despite this, data for HBV and HCV are lacking due to limited diagnostic capacity and lack of prioritization in public health programs.

In one meta-analysis, HIV/HBV frequency in SSA varied from 0 to 28.4% (median 7.8%) [2]. One study carried out in South Africa among HIV patients receiving anti-retroviral therapy (ART) showed a prevalence of 5% for HBV [14]. Also, a prospective study carried out among HIV patients admitted to a large government hospital in Johannesburg found a co-infection rate of 6% [15]. Further, a retrospective control laboratory-based study showed a HBV rate of 16.2% among the HIV patients from a more rural area of the country [16].

HCV is also detected in blood and body fluids, and transmitted from an infected person to a non-infected person in like manner as for HBV. HIV/HCV co-infection is being recognized as a separate entity from HIV or HCV mono-infections [17]. The prevalence of HCV among the HIV patients taking antiretroviral therapy according to a cohort study carried out in Switzerland is 37.2% [18]. Two systematic reviews suggest an overall HCV prevalence of 3% among people living with HIV in SSA with significant regional variations (0-55.9%) [3,19].

In Cameroon, a hospital prevalence of 8.9% (HBV = 6.1% and HCV = 2.8%; [20]) among HIV patients in two regional facilities was observed. With increasing access to ARV therapy and increasing HBV/HCV infections, the burden of the latter among the HIV patients in resource limited countries are expected to increase in all ages contrary to the case in Europe and North America [21,22]. Understanding the prevalence and disease characteristics of HBV/HCV amongst the HIV patients is thus very essential [23]. Furthermore liver co-morbidities may compromise response to antiretroviral drugs and worsen outcome of HIV patients even when these drugs are efficacious. Although the guideline for the clinical management of HIV patients recommends screening for viral hepatitis among newly diagnosed HIV patients; it is not systematically implemented in Cameroon, as it is not included in the package of baseline laboratory tests [20]. Consequently, the data on hospital prevalence of new HIV infections is lacking, especially in conflict regions and humanitarian settings such as in the Kumba Health District. The aim of this study was to determine the seroprevalence of HBsAg and HCVAb in newly diagnosed HIV-positive patients in Kumba Health District, South West region of Cameroon to contribute to better management of HIV patients in the region.

Methods

Study design and setting

This was a prospective cross-sectional study carried out between November 2018 and January 2019. Newly diagnosed HIV patients or HIV patients diagnosed within six months were consecutively recruited for the determination of the HBV and HCV sero-status. This study targeted selected HIV-positive patients enrolled at the three health facilities that care for HIV patients in Kumba. These were the district hospital Kumba, Kumba integrated health centre and the Apostolic hospital in Banga-Bakundu. Screening was offered free-of-charge to all selected consenting participants. The Kumba district hospital is the referral facility for the health district.

Study population sampling and recruitment

HIV patients were consecutively sampled in each of the three recruitment centres in the Kumba district. Data were collected from the 299 study participants after having completed an informed consent. Those who were newly diagnosed as well as those who reportedly knew their status within six months were also included in the study population. Data on their socio-demographic characteristics as well as clinical data including their WHO HIV defined clinical staging and co-morbidity were collected. Additional data was obtained from participants through a semi-structured questionnaire interview and medical chart review. Selected participants were invited for screening during the routine HIV appointment, during which samples were collected and analyzed in the laboratories at the study sites.

Sample collection and serological assays

For each consenting participant, 3 mls of whole venous blood was collected into heparinised tubes and centrifuged to obtain plasma. Two tests were performed on each of the samples collected to determine circulating HBV surface antigen and HCV antibodies. The samples were first screened using a rapid diagnostic test (RDT) for both HBsAg and HCV antibody using the Diaspot® (Nantong, 226010, P.R. China) HBsAg and Diaspot® (Nantong, 226010, P.R. China) for HCVAb respectively. The procedure was based on manufacturer's instructions. After 15 minutes the RDT test results were read and recorded as either positive (red lines on test

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window and control window) or negative (red line on control window and no line on test window) or invalid (no line on control window irrespective of presentation of test window). Invalid tests were repeated on a new RDT. All HBV and/or HCV RDT positives samples underwent a further ELISA immunoassay (Golden Bio Technology ELISA) to obtain the definitive test outcome.

Sample size

Our sample size calculation used the Normal approximation to the Binomial distribution of our sample population. The sample size is based on the following calculation

n = N*X/(X + N − 1),

Where,

X = $(Z_{\alpha/2})^{2}$*p*(1-p)/e², p = 8.9 based on studies by Luma, et al. [20], e = margin of error estimated at 3.5. By inputting these values, we obtained a sample estimate of 254 participants. We accounted for a non-response rate of 15% and a test sensitivity and specificity of 99% and 100% as reported by the test manufacturers for both HBV and HCV. We therefore estimated that we needed a minimum of 292 participants for the study.

Statistical methods and data analysis

Our primary study outcome was the proportion of newly HIV positive individuals with hepatitis B surface antigen and hepatitis C antibody, as confirmed by ELISA immunoassay. Newly diagnosed HIV patients were defined as HIV infected patients diagnosed during the study or within six months prior to the study starting. The different variables included demographic information like age, sex, marital status, level of education, religion, occupation, setting, civil status and factual information like: Weight, WHO clinical and biological staging, HIV-1 therapy, smoking status, alcohol status, blood transfusion history, hepatitis status. These data were entered into Microsoft Excel 2010. Descriptive statistics were used to summarize the distribution of these data in the study e calculated as the proportion of confirmed HBV and HCV infections in the total number of participants tested. This was presented with the corresponding 95% confidence intervals. We estimated the odds of having hepatitis infection given risk factors fitted in a binary logistic regression model. We first conducted a bivariate analysis and calculated R values of all selected predictors. We found that for all analysis, the R values were less than 0.7. Next we, generated co-linearity diagnostic to check for variance inflation by multi-co-linearity of predictors with tolerance value for all predictors set at P > 0.1. All variance inflation factors were less than 5, indicating together that predictors were not highly inter-correlated. We reported the adjusted odds ratios and their corresponding P values where appropriate. All analyses were done using SPSS version 20 and Epi info version 7.0, and a P value of = 0.05 was used as

the threshold of significance.

After conducting a bivariate analysis using chi-square, the following variables were entered in to a multivariate binary logistic regression model to control for the effects of other explanatory variables: Area of residence, history of blood transfusion, educational level, take ART regularly, level of knowledge categories on HCV, level of knowledge categories on HBV.

Ethical considerations

The ethical clearance for this study was obtained on the 15th November 2018, from the Faculty of Health Science Institutional Review Board, University of Buea following the protocol number 814-05.

Results

Sociodemographic characteristics of the study participants

A total of 299 HIV positive patients were screened for HBV and HCV in the Kumba Heath District. A majority of the study participants were from the District hospital Kumba 257 (86.0%), were female (208/299, 69.6%), aged 35-44 (99/299, 33.1%), and with a primary level of education (126/299, 42.1%). In addition, a majority of the study participants were Single/Cohabiting/Separated (160/299, 53.5%), Christians (282/299, 94.3%), (100/299, 33.4%), from rural areas 202 (202/299, 67.6%) and 89.3% (267/299) reported no history of blood transfusion (Table 1).

Table 1: Sociodemographic characteristics of the study participants.

Variables	Frequency	Percentage (%)
Treatment centers		
Kumba District hospital	257	86.0
Kumba Apostolic hospital	8	2.7
Kumba Sub-divisional hospital	34	11.3
Gender		
Female	208	69.6
Male	91	30.4
Age group		
< 15	9	3.0
15 to 24	17	5.7
25 to 34	93	31.1
35 to 44	99	33.1
45 to 54	45	15.1
≥ 55	36	12.0
Educational level		
No formal education	88	29.4
Primary	126	42.1
Secondary	64	21.4
Tertiary	21	7.1

Marital status		
Single/Cohabiting/Separated	160	53.5
Married	129	43.1
Widow	10	3.4
Religion		
Christians	282	94.3
Muslims	17	5.7
Occupation		
Applicants	40	13.4
Business	73	24.4
Famer	100	33.4
Civil servants	16	5.3
Informal sectors	22	7.4
Students	19	6.4
Drivers/Bike riders	29	9.7
Area of residence		
Urban	97	32.4
Rural	202	67.6
Have you ever received blood from someone		
Yes	32	10.7
No	267	89.3

Prevalence of HBV/HCV among newly infected HIV patients

Our primary outcome was the prevalence of HBV and HCV infections among newly diagnosed HIV patients in the Kumba health district. Out of the 299 HIV positive patients screened for HBV and HCV within the study period, a total of 48 newly infected HIV patients were infected with either the HBV or HCV virus, giving a seroprevalence of 16.0%. Of this 36/299 (12.0%) were positive for HBV and 12 (4%, 95% CI: 1.97-2.02) were infected with the HCV by the ELISA immunoassay. In addition the prevalence of hepatitis B virus was higher in participants with no formal education (18/88 (20.5%), X^2 = 11.139, P = 0.011) (Table 2). The prevalence of hepatitis B virus was significantly higher in participants who live in rural areas, 33/202 (16.3%) compared to those who live in urban areas, 3/97 (3.1%) (X^2 = 10.853 P = 0.001) (Table 2); among males 13/91 (13.4%) compared with females 23/208 (11.05%).

The prevalence of hepatitis C virus was significantly higher in participants from Kumba urban hospital (Table 2).

As pertaining to blood transfusion, the prevalence

Table 2: Prevalence of HBV and HCV by socio-demographic characteristics and other associative factors.

VARIABLES	Hepatitis B virus		Hepatitis C virus	
	Positive, n/N (%)	Chi-square (X^2) and P-value	Positive, n/N (%)	Chi-square (X^2) and P-value
Treatment centers				
Kumba District hospital	31/257 (12.1%)	X^2 = 4.968 P = 0.083	7/257 (2.7%)	X^2 = 1.713 P = 0.425
Kumba Apostolic hospital	1/8 (12.5%)		0/8 (0.0%)	
Kumba Sub-divisional hospital	4/34 (14.7%)		5/34 (20.6%)	
Gender				
Female	23/208 (11.05%)	X^2 = 0.251 P = 0.616	8/208 (3.8%)	X^2 = 0.050 P = 0.824
Male	13/91 (13.4%)		4/91 (4.4%)	
Age group				
< 15	0/9 (0%)		0/9 (0.0%)	
15 to 24	1/17 (5.9%)		0/17 (0.0%)	
25 to 34	17/93 (18.3%)	X^2 = 9.563 P = 0.089	3/93 (3.2%)	X^2 = 5.108 P = 0.403
35 to 44	9/99 (9.1%)		7/99 (7.1%)	
45 to 54	7/45 (15.6%)		2/45 (4.4%)	
≥ 55	1/36 (2.8%)		0/36 (0.0%)	
Educational level				
No formal education	18/88 (20.5%)	**X^2 = 11.139** **P = 0.011**[*]	2/88 (2.3%)	X^2 = 2.424 P = 0.489
Primary	8/126 (6.3%)		7/126 (5.6%)	
Secondary	6/64 (9.4%)		3/64 (4.7%)	
Tertiary	4/21 (19.0%)		0/21 (0.0%)	
Marital status				
Single/Cohabiting/Separated	19/160 (11.9%)	X^2 = 0.059 P = 0.971	6/160 (3.8%)	X^2 = 0.583 P = 0.747
Married	16/129 (12.4%)		6/129 (4.7%)	
Widow	1/10 (10.0%)		0/10 (0.0%)	

Religion				
Christians	33/282 (11.7%)	$X^2 = 0.535$	12/282 (4.3%)	$X^2 = 0.754$ P = 0.385
Muslims	3/17 (17.6%)	P = 0.464	0/17 (0.0%)	
Occupation				
Applicants	7/40 (17.5%)		1/40 (2.5%)	
Business	6/73 (8.2%)		4/73 (5.5%)	
Famer	13/100 (13.0%)	$X^2 = 6.872$	4/100 (4.0%)	$X^2 = 2.937$
Civil servants	4/16 (25.0%)	P = 0.333	0/16 (0.0%)	P = 0.817
Informal sectors	3/22 (13.6%)		0/22 (0.0%)	
Students	2/19 (10.5%)		1/19 (5.3%)	
Drivers/Bike riders	1/29 (3.4%)		2/29 (6.9%)	
Area of residence				
Urban	3/97 (3.1%)	**$X^2 = 10.853$ P = 0.001***	4/97 (4.1%)	$X^2 = 0.005$
Rural	33/202 (16.3%)		8/202 (4.0%)	P = 0.946
Have you ever received blood from someone				
Yes	13/32 (40.6%)	**$X^2 = 27.648$**	6/32 (18.8%)	**$X^2 = 20.202$**
No	23/267 (8.6%)	**P < 0.0001***	6/267 (2.2%)	**P < 0.0001***
Take ART regularly				
No	15/68 (22.1%)	**$X^2 = 8.342$**	3/68 (4.4%)	$X^2 = 0.036$
Yes	21/231 (9.1%)	**P = 0.004***	9/231 (3.9%)	P = 0.849
Knowledge categories on HBV				
Good level of knowledge	10/219 (4.6%)	**$X^2 = 43.172$**	▮	▮
Poor level of knowledge	26/80 (32.5%)	**P < 0.0001***	▮	▮
Knowledge categories on HCV				
Good level of knowledge	▮	▮	3/220 (1.4%)	**$X^2 = 15.176$**
Poor level of knowledge	▮	▮	9/79 (11.4%)	**P < 0.0001***

*Statistically significant values.

of both HBV (13/32 (40.6%), P < 0.0001) and HCV (6/32 (18.8%), $X^2 = 20.202$, P < 0.0001) virus was significantly higher in participants who reported that they have received blood from someone. Furthermore, participants who reported that they do take their anti-retroviral therapy (ART) regularly significantly had a low prevalence of hepatitis B, 21/231 (9.1%) compared to those who do not take their ART regularly 15/68 (22.1%) ($X^2 = 8.342$, P = 0.004) (Table 2). As regarding the level of participant's knowledge on the modes of transmission and the cardinal signs/symptoms of hepatitis viruses, participants who recorded poor level of knowledge on hepatitis B virus significantly had a high prevalence of hepatitis B virus, (26/80 (32.5%) compared to those who recorded good level of knowledge on hepatitis B virus, 10/219 (4.6%) ($X^2 = 43.172$, P < 0.0001). In addition, participants who recorded poor level of knowledge on hepatitis C virus significantly had a high prevalence of hepatitis C virus, 9/79 (11.4%), compared to those who recorded good level of knowledge on hepatitis C virus, 3/220 (1.4%) ($X^2 = 15.176$, P < 0.0001) (Table 2).

Risk factors of Hepatitis B and Hepatitis C viruses

Participants that have ever received blood from someone were 5.88 times more likely to be infected with hepatitis B (95% CI: 2.04-16.94, P-values: 0.001), and 13.14 times more likely to be infected with hepatitis C (95% CI: 3.04-56.81, P-values: 0.001), than participants who have never received blood from someone (Table 3). Participant's area of residence also had a significant effect on hepatitis B virus prevalence. Participants from rural areas were 5.84 (1/0.171) times more likely to be infected with hepatitis B than those from urban areas (95% CI: 0.044-0.660, P-values: 0.010) (Table 3). Also, the prevalence of HBV and HCV were higher in males than female i.e for HBV, females 23/208 (11.05%) ($X^2 = 0.251$, P = 0.616) and males 13/91 (13.4%) ($X^2 = 0.251$, P = 0.616) and for HCV, females 8/208 (3.8%) ($X^2 = 0.050$, P = 0.824) and males 4/91 (4.4%) ($X^2 = 0.050$, P = 0.824), which were not statistically significant. Furthermore, participant's treatment centres had a significant effect on hepatitis C virus prevalence. The odds are low for participants from Kumba District hospital (0.24 times that of those from Kumba Subdivisional hospital). Thus, participants from Kumba Subdivisional hospital 4.14 (1/0.24) times more likely to be infected with hepatitis C virus than those from Kumba District hospital (95% CI: 0.06-0.84, P-values: 0.027) (Table 3).

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Table 3: Risk factors of Hepatitis B and Hepatitis C viruses.

Variables	Hepatitis B virus		Hepatitis C virus	
	AOR (95% CI)	P-values	AOR (95% CI)	P-values
Ever received blood from someone				
Yes	**5.8 (2.04-16.94)**	**0.001**	**13.14 (3.04-56.81)**	**0.001**
No	*Reference*	*Reference*	*Reference*	*Reference*
Area of residence				
Urban	**0.171 (0.044-0.660)**	**0.010**	3.65 (0.82-16.19)	0.088
Rural	*Reference*	*Reference*	*Reference*	*Reference*
Treatment centers				
Kumba District hospital	1.47 (0.42-5.08)	0.543	**0.24 (0.06-0.84)**	**0.027**
Kumba Apostolic hospital	1.47 (0.13-16.39)	0.751	0.00 (0.00-0.00)	0.999
Kumba Sub-divisional hospital	*Reference*	*Reference*	*Reference*	*Reference*
Educational level				
No formal education	0.74 (0.17-3.15)	0.688	0.00 (0.00-0.00)	0.998
Primary	2.53 (0.56-11.29)	0.223	0.00 (0.00-0.00)	0.998
Secondary	2.15 (0.43-10.65)	0.348	0.00 (0.00-0.00)	0.998
Tertiary	*Reference*	*Reference*	*Reference*	*Reference*
Take ART regularly				
No	0.55 (0.22-1.39)	0.211	1.22 (0.24-6.14)	0.806
Yes	*Reference*	*Reference*		
Knowledge categories on HBV				
Poor level of knowledge	2.05 (0.26-16.28)	0.495	■	■
Good level of knowledge	*Reference*	*Reference*	■	■
Knowledge categories on HCV				
Good level of knowledge	■	■	0.23 (0.003-17.28)	0.507
Poor level of knowledge	■	■	*Reference*	*Reference*

AOR: Adjusted odd ratios; CI: Confidence Interval; ART: Antiretroviral Treatment; HBV: Hepatitis B Virus; HCV: Hepatitis C Virus.

Discussion

Guidelines for clinical management of HIV patients recommends screening for viral hepatitis, unfortunately this is not standard practice in Cameroon, as it is not included in the package of baseline laboratory tests [20]. Given the limited resources available for population screening efforts, the present study is aimed to establish the prevalence of hepatitis B and C virus, and the associated risk factors among the HIV patients placed on highly active anti-retro viral therapy (HAART), which could contribute towards the understanding of the burden of the viral hepatitis-co-infections in Kumba Health District and to guide prioritisation for testing of key at-risk and geographic populations.

Demographic characteristics

A total of 299 HIV patients taking ART in three different treatment centres in Kumba Health District were interviewed. The differences in the recruitment rate at the various selected treatment centres respected the patient's population sizes. The highest number of participants was recruited from the Kumba District hospital because of the high HIV patient's population density of the health facility. A total of 208 (69.6%) females and 91 (30.4%) males were involved in the research with a significant different. This different may be due to the fact that females visited health facilities more frequently than men. Concerning the educational level of the participants, the majority of them had very low level of education since 42.1% had attended only primary level. Among the participants, majority came from the rural area (67.6%).

Also, a majority of these participants were cohabiting/single/separated (53.5%). On the perspective of the occupation, a variety of occupations were presented among the participants. The predominance of farmers was remarkable because most of the participants were from the rural areas highly involved in farming.

Knowledge on hepatitis B and C virus

Only 9.4% of the participants knew the signs and symptoms of hepatitis B and C leaving 90.6% who did not know any signs and symptoms of these infections. This proportion was not good because it means that the participants had a very poor knowledge of these health threats, which means that the infections may continue to spread among the people in the community and may lead to poor management. Only 9.4% of the par-

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ticipants knew that hepatitis B and C are transmitted through contact with infected blood meanwhile 90.6% did not know the cause of these infections. For the majority of the participants not knowing the cause of these infection could be attributed to the high level of very low level of education and illiteracy discovered among this people since 42.1% has attended only primary level of education while 29.4% had never attended school. In addition, the poor knowledge among the participants could also be linked to inadequate counseling during follow up for HIV therapy as well as implementation of social groups among HIV patients which limit regular contact between the care giver and the clients.

Prevalence of hepatitis B virus

The prevalence of HBV was 12% among HIV patients, which was higher than that obtained in a similar studied carried out in South African in HIV patients receiving ARV therapy 5% [14], Buea and Limbe regional hospitals in HIV patients of age 21 years and above 6.1% [20] and National hospital of Tropical Disease in Vietnam 8.4% [24].

On the other hand, this prevalence was slightly lower than that documented from a retrospective control laboratory-based study carried out in South Africa among the HIV patients from a more rural area of the country at 16.2% [16]. In similar manner, this prevalence was slightly similar to that obtained in Australia 13.1% [25]. 3/97 (3.1%) (X^2 = 10.853 P = 0.001) and this is consistent with a study conducted in Rwanda [7]. As pertaining to blood transfusion, the prevalence of hepatitis B virus (13/32 (40.6%), X^2 = 27.648, P < 0.0001) was significantly higher in participants who reported to have been transfused blood. Furthermore, participants who reported that they do take their ART regularly significantly had a low prevalence of hepatitis B, 21/231 (9.1%) compared to those who do not take their ART regularly 15/68 (22.1%) (X^2 = 8.342, P = 0.004).

The prevalence of hepatitis B virus was higher in participants with no formal education (18/88 (20.5%), X^2 = 11.139, P = 0.011). This prevalence was also significantly higher in participants who live in rural areas, 33/202 (16.3%) compared to those who live in urban areas, where the population get more educative talks directly from all the radio stations and other health partners carrying out multiple health activities in the community 3/97 (3.1%) (X^2 = 10.853 P = 0.001) and this is consistent with a study conducted in Rwanda [7]. As pertaining to blood transfusion, the prevalence of hepatitis B virus (13/32 (40.6%), X^2 = 27.648, P < 0.0001) was significantly higher in participants who reported to have been transfused blood. Furthermore, participants who reported that they do take their ART regularly significantly had a low prevalence of hepatitis B, 21/231 (9.1%) compared to those who do not take their ART regularly 15/68 (22.1%) (X^2 = 8.342, P = 0.004). Lamivudine use in the

treatment of HIV may have an effect on HBV and therefore prevent the infection from being established as scientists have demonstrated this molecule have effect on HVB [26].

As regarding to the level of participant's knowledge on the modes of transmission and the cardinal signs/symptoms of hepatitis viruses, participants who recorded poor knowledge on HBV significantly had a high prevalence of HBV 26/80 (32.5%) compared to those who recorded good level of knowledge about the infection, 10/219 (4.6%) (X^2 = 43.172, P < 0.0001), which is raised a high need to carryout effective education/sensitization in the different communities.

Prevalence of hepatitis C virus after laboratory analysis

The prevalence of HCV was 4% which was much lower than that obtained among the HIV patients taking antiretroviral therapy according to a study carried out in Switzerland with 37.2% [18], but was slightly lower than that obtained at the Buea and Limbe regional hospitals in HIV patients of age 21 years and above 2.8% [20]. On the other hand, this prevalence was slightly similar to that obtained in two systematic reviews among people living with HIV in SSA 3% [3,19].

The prevalence of HCV was significantly higher in participants from Kumba Sub-divisional hospital (4/11 (8%), X^2 = 6.178, p = 046). In the same light with HBV, as pertaining to blood transfusion, hepatitis C virus (6/32 (18.8%), X^2 = 20.202, P < 0.0001) was also significantly higher in participants who reported to have been transfused blood. In addition, participants who recorded poor level of knowledge on hepatitis C virus significantly had a high prevalence of hepatitis C virus, 9/79 (11.4%), compared to those who recorded good level of knowledge on hepatitis C virus, 3/220 (1.4%) (X^2 = 15.176, P < 0.0001).

The result showed that participants that have ever received blood from someone were 5.88 times more likely at risk to be infected with hepatitis B (95% CI: 2.04-16.94, P-values: 0.001), and 13.14 times more likely at risk to be infected with hepatitis C (95% CI: 3.04-56.81,P-values:0.001), than participants who have never received blood from someone. There is thus a high need for hospitals to improve on the quality of screening for blood products with strict respect of screening protocols. The participant's area of residence also had a significant effect on HBV prevalence. The odd ratios were low for participants from urban areas (0.171 times that of those from rural areas). Therefore, participants from rural areas are 5.84 (1/0.171) times more at risk to be infected HBV than those from urban areas (95% CI: 0.044-0.660, P-values: 0.010). This different could be due to the low level of education in the rural areas, limited to tele-communication networks which has attributed to very low knowledge of the participants on the infection. Further-

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more, participant's treatment centers had a significant effect on hepatitis C virus prevalence. The odds are low for participants from Kumba District hospital (0.24 times that of those from Kumba Urban hospital). Thus, participants from Kumba Urban hospital 4.14 (1/0.24) times more likely to be infected with hepatitis C virus than those from Kumba District hospital (95% CI: 0.06-0.84, P-values: 0.027). This could be due to inadequate counseling of the patients. As we found; reported rates of co-infections are considerably low in children of age less than 15 years [7,24]. Our study found that the rate of hepatitis B and C co-infections in HIV patients was very low in children and individuals of age less than 24 years. This could be due to improvement in the awareness on the importance of complete vaccination coverage among children in Cameroon. Furthermore, the rate of co-infection with hepatitis B and C was high in individual of age 25-34 years and 34-44 year respectively.

Conclusion

The prevalence is respectively 12% and 4% for hepatitis B and C in Kumba Health District. Despite the high prevalence of these infections, the population of Kumba Health District does not still have a good understanding of the causes, signs/symptoms and the mode of transmission. Participants that have ever received blood from someone were more likely to be infected with HBV and HCV, than participants who have never received blood from someone which explained a high need of improving blood screening in the health facilities. We equally found that participant's area of residence also had a significant effect on hepatitis B virus prevalence and patients who do not take their ART regularly were found to be risk factors for hepatitis B than those who take their therapy regularly. The result obtained could be used for health decision making and proper follow up of patients of this nature.

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Authors' Contributions

Conception and design of the study: CBT, and IMA.

Investigation and acquisition of data: ANN, JMN, and JBS.

Analysis, interpretation of data and manuscript writing: JMN, IMA, and JBS.

Review and edition of the final version of the article: all authors.

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Availability of Data and Materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

The ethical clearance for this study was obtained on the 15th November 2018, from the Faculty of Health Science Institutional Review Board, University of Buea following the protocol number 814-05.

Consent for Publication

All authors agreed to publish in this journal.

Competing Interests

The authors have indicated they have no competing interests.

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