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ORIGINAL ARTICLE

Epidemiologic Patterns of HIV, Hepatitis B and C Virus Infections Among Refugees of the Mbile Camp in the East Region of Cameroon (Hepatitis and HIV among refugees)

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ABSTRACT

AIM: This study aimed to determine the prevalence and risk factors of HIV, HBV and HCV among refugees of the Mbile camp in the East Region of Cameroon.

MATERIALS AND METHODS: This was a cross-sectional study conducted in 2019 in the Mbile refugee camp. All recruited subjects were interviewed and provided blood samples for the screening of Hepatitis B Surface Antigen (HBsAg), anti-HIV and anti-HCV antibodies.

RESULTS: A total of 970 were included in this study, 57% being females and the median age was 27.0 years old (standard deviation: 19.2). Among this study population, 75 (7.7%) reacted to HBs antigen, 24 (2.5%) to HCV antibodies, and 17 (1.8%) to HIV antibodies. The identified risk factors for HBV infection were age group 20-39 years ($p = 0.005$), being self-employed ($p=0.003$), Past medical history of surgery ($p = 0.014$), multiple sex partners ($p < 0.001$). For HCV infection, a history of previous surgery ($p = 0.022$) and sexually transmissible infection ($p = 0.021$) were identified as risk factors. For HIV infection, age > 40 years ($p = 0.010$), injectable drug use ($p = 0.042$) and history of multiple sex partners ($p = 0.010$) were identified as risk factors.

CONCLUSION: This study revealed an intermediate prevalence of HIV, HBV and HCV infections among refugees residing in the Mbile refugee camp. However, many risk factors for HIV, HBV and HCV infections have been identified in this specific population and could favor the spreading of these viruses. There is an urgent need to improve health policies in order to better control the current situation.

Key words: Hepatitis B and C; HIV; Mbile Refugee camp

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INTRODUCTION

Hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV), infections are major public health concerns worldwide. According to WHO recent estimates, about 257 million, 71 million, and 37.9 million people are living with chronic HBV, HCV and HIV infections, respectively^[1,2]. The estimation of the burden of these infections and the improvement of preventive measures require knowledge of its epidemiologic patterns in both the general population and the “high-risk” population groups. Migrants are particularly vulnerable because of promiscuity, malnutrition, physical and moral violence and lack or inadequate availability of health care facilities, and are therefore one of the ‘high-risk group’ for HBV, HCV and HIV infections^[3]. Cameroon is home to refugees from different neighboring countries, including about 264,578 refugees from the Central African Republic (CAR) according to a 2018 UNHCR report with a majority residing in the East Region of Cameroon^[4]. Several studies in Cameroon have been published on the HBV and HCV infection prevalence amongst high-risk population groups including blood donors, healthcare workers, hemodialysis patients, and HIV infected persons^[5-10]. To the best of our knowledge, no published data on the serological status for HBV, HCV and HIV of the migrant populations in general and refugees, in particular, are available. The aim of our study was therefore to assess the prevalence of HBs antigen, HCV antibodies, HIV antibodies and investigate the risk factors among refugees at the Mbile Refugee camp in the East Region of Cameroon.

METHODS

Study setting

This study was carried out in the Mbile Refugee camp which was officially opened on the 16th of April 2014 by the representative of the UNHCR in Cameroon. Situated 38 Km from the CAR borders, it is located in the Kadey Division of the East Region of Cameroon. It has a total surface area of 49.6 hectares, and host 13,136 CAR refugees (as of April 2018) distributed in a total of 4,401 households. More than half (53.8%) of this population are aged < 18 years old, and 49.7% are females. This population is predominantly dominated by Muslims (98.9%) and its ethnic sub-divisions include the Peuhl (92.4%), Hausa (3.6%), Arab (1.43%), Baya (1.4%) and others (1.2%)^[4].

Study design and population

This was a cross-sectional study carried out in the Mbile Refugee camp (East Region, Cameroon). The study sample size was calculated using the Cochran’s sample size formula^[11]. Using an overall pooled seroprevalence of 11.2% in Cameroon, with a 95% power to detect significant associations or differences, and a 2% margin of error, the minimal sample size was estimated at 956 participants.

Eligible participants were inhabitants of the Mbile refugee camp for at least three months, irrespective of their age or gender, and who provided proof of refugee status. Sensitization was done on HBV, HCV and HIV transmission and the importance of screening by the investigator and a cultural mediator. Using random sampling, we recruited 970 participants in the three different sectors of the Mbile refugee camp. Based on the list of refugees present in each sector

during the study and applying a sampling interval of 10, about 1/3 of the total population study (327 participants) was recruited in each sector. Informed consent was obtained from all those included in the study. Group pre-test counseling was provided to all consenting persons by the principal investigator, with assistance from the local health staff and translators.

Sample collection and processing

For each participant who met the inclusion criteria, blood samples were collected by venipuncture in 5 mL ethylene diamine tetraacetate (EDTA) tubes and identified with a corresponding code for each participant to ensure confidentiality.

At the field site (the laboratory of the integrated Mbile health center), plasma was separated from cellular blood components by gravity. Rapid tests were performed using Determine® HIV1/2 for HIV testing, DiaSpot® HBsAg Rapid test strips and HCV rapid testing using ELINE® Cassette Style ANTI-HCV Rapid test respectively for HBV and HCV testing. The positive samples for each infection were carefully labeled then stored in a lone solar-powered refrigerator at the Mbile integrated health center at a temperature between +2°C and +6 °C before their transportation to the hematology laboratory of the Batouri District Hospital.

Once in the hematology laboratory of the Batouri district hospital, the plasma was separated by centrifugation (3000 rpm) and aliquoted into a 1 mL aliquot, each bearing the participant’s code and clearly distinguishing the three concerned infections. Aliquots were first stored at -20°C until transportation the following day to the hematology laboratory of the Centre for Research on Filariasis and other Tropical Diseases (CRFiMT) of Yaounde where HBV and HCV ELISA testing and HIV confirmation using OraQuick® Rapid HIV-1/2 Antibody test were performed (Figure 1).

Statistical analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS Inc, Chicago, Illinois, USA) V.20.0 and EPI-INFO V.7.2.2.16 software. We have presented discrete variables as counts and

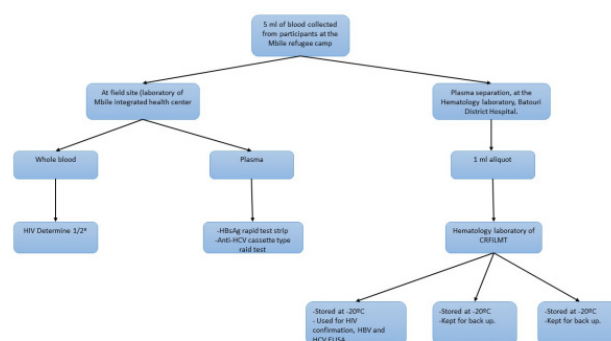


Figure 1 Sample management at study sites.

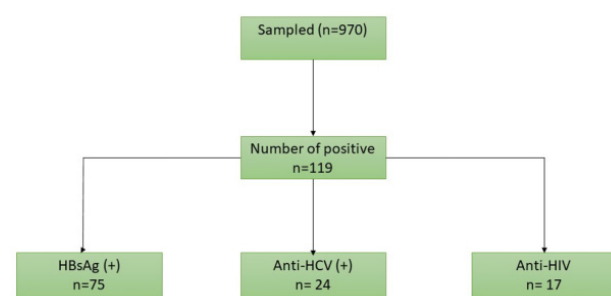


Figure 2 Participant flow chart.

percentages with 95% confidence interval (CI), and continuous variables as mean with standard deviation. Data on sociodemographic characteristics (age in years, gender, profession), knowledge status for these infections (classified into low: < 25% of good answers; insufficient: between 25 to 50% of good answers; average: between 50 to 70% of good answers or good: > 70% of good answers) and potential risk factors for HBV, HCV and HIV infections (history of abortion, dental care, surgery, hospitalization, sexually transmitted infections (STIs), injectable drug use, blood transfusion, multiple sex partners, scarifications, tattooing and family viral infection) were collected via a standardized questionnaire. Group comparisons were performed with Chi-square test and equivalents for qualitative variables; Student t-test, and ANOVA where appropriate. Factors associated with Hbs antigen, HCV antibodies and HIV antibodies carriage were determined using Odds ratios. P values <0.05 were considered statistically significant.

RESULTS

A total of 970 refugees of the Mbile refugee camp were enrolled in this study (Figure 2). Of these 970 participants, 417 (43.0%) were males. The median age of our participants was 29 (ranging from 2-87) years old, individuals aged 20-39 years old being the most represented (34.5%). The majority (66.1%) of the study participants were married, and 59.6% were self-employed. All the

970 participants were from the Central African Republic, most of them being Muslims. Knowledge status on HIV, hepatitis B and C infections was poor (88.0% of the subjects recruited had unsatisfactory baseline knowledge levels).

A total of 116 (12.0%) participants tested positive for at least one of the infections, 75 (7.7%) for hepatitis B, 24 (2.5%) for Hepatitis C, and 17 (1.8%) for HIV. No case of coinfection was recorded. Figure 3 presents the distribution of these three diseases according to the different age groups. Also, no significant difference between males and females for HBV infection.

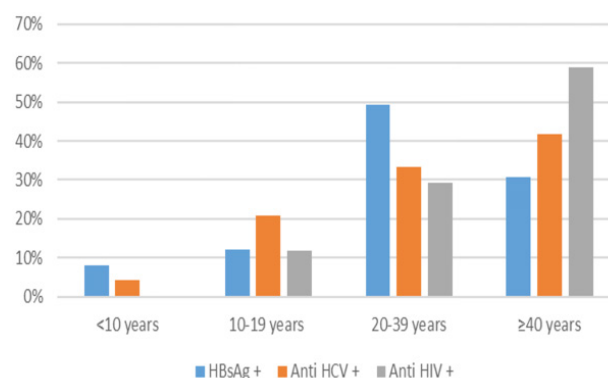


Figure 3 Distribution of HBsAg, anti-HCV, and anti-HIV according to age groups of enrollees.

Table 1 Risk factors for HBsAg positivity.

Characteristics	Frequency (n)	HBsAg (+) [n (%)]	HBsAg (-) [n (%)]	OR (95% CI)	P value
Gender					
Males	417	36 (8.6)	381 (91.4)	1.2 (0.8 - 1.9)	0.362
Females	553	39 (7.0)	514 (93.0)	0.8 (0.5 - 1.3)	
Age (Years)					
< 10	170	6 (3.5)	164 (96.5)	0.4 (0.2 - 0.9)	0.023
[10-19]	170	9 (5.3)	161 (94.7)	0.6 (0.3 - 1.3)	0.19
[20-39]	335	37 (11.1)	297 (88.9)	1.9 (1.2 - 3.1)	0.005
≥ 40	295	23 (7.8)	273 (92.2)	1.0 (0.6 - 1.7)	0.976
Profession					
Self Employed	545	56 (10.3)	489 (89.7)	2.2 (1.3 - 3.9)	0.003
Student	215	4 (1.9)	211 (98.1)	0.2 (0.1 - 0.5)	<0.001
Civil Servant	11	1 (9.1)	10 (90.9)	1.1 (0.1 - 9.0)	0.902
Unemployed	144	13 (9.0)	131 (91.0)	1.2 (0.6 - 2.1)	0.652
Matrimonial Status					
Single	139	22 (15.8)	117 (84.2)	1.9 (1.1 - 3.2)	0.02
Married	475	50 (10.5)	425 (89.5)	1.0 (0.6 - 1.7)	0.907
Divorced	48	2 (4.2)	46 (95.8)	0.4 (0.1 - 1.5)	0.142
Widow/Widower	48	0 (0.0)	48 (100.0)	NA	0.014
Cohabitation	9	1 (11.1)	8 (88.9)	1.1 (0.1 - 8.7)	0.946
History of Abortion	83	9 (10.8)	74 (89.2)	1.5 (0.7 - 3.2)	0.267
History of dental procedure	31	1 (3.2)	30 (96.7)	0.4 (0.1 - 2.9)	0.34
History of Hospitalization	504	42 (8.3)	462 (91.7)	1.2 (0.7 - 1.9)	0.466
History of Injectable drug use	19	3 (15.8)	16 (84.2)	2.3 (0.7 - 8.0)	0.184
History of surgery	130	17 (13.1)	113 (86.9)	2.0 (1.1 - 3.6)	0.014
History of multiple sex partners	114	26 (22.8)	88 (77.2)	4.8 (2.9 - 8.2)	<0.001
History of Scarification	192	18 (9.4)	174 (90.6)	1.3 (0.8 - 2.3)	0.341
History of STIs	36	2 (5.6)	34 (94.4)	0.7 (0.2 - 2.9)	0.619
History of tattooing	17	1 (5.9)	16 (94.1)	0.7 (0.1 - 5.7)	0.773
History of blood Transfusion	47	6 (12.8)	41 (87.2)	1.8 (0.7 - 4.4)	0.186

Regarding risk factors associated with these infections, a history of hospitalization was found in 504 (52.0%), while 192 (19.8%) confessed scarification. Also, 130 (13.4%) of the participants had undergone surgery previously and 114 (11.8%) of them admitted having multiple sexual intercourse. A history of tattooing or injectable drug use was not common in this population. The identified risk factors for HBV infection were age group 20-39 years (OR: 1.9, [95% CI: 1.2 - 3.1], $p = 0.005$), being self-employed (OR: 2.2, [95% CI: 1.3 - 3.9], $p = 0.003$), history of surgery (OR: 2.0, [95% CI: 1.2 - 3.6], $p = 0.014$), and a notion of multiple sex partners (OR: 4.8, [95% CI: 2.9 - 8.2], $p < 0.001$) (Table 1). For HCV infection, only history of previous surgery (OR: 2.8, [95% CI: 2.2 - 6.7], $p = 0.022$) and of sexually transmissible infection (OR: 3.9, [95% CI: 1.1 - 13.9] $p = 0.021$) was identified as risk factors (Table 2). For HIV infection, the following risk factors were identified: age > 40 years (OR: 3.3, [95% CI: 1.3 - 8.9], $p = 0.010$), injectable drug use (OR: 7.3, [95% CI: 1.6 - 34.6], $p = 0.042$) and history of multiple sex partners (OR: 4.3, [95% CI: 1.5 - 11.8] $p = 0.010$) (Table 3).

DISCUSSION

A cross-sectional study was carried out at the Mbile refugee camp in the East Region of Cameroon to investigate the prevalence and risk factors of HIV, HBV and HCV infections among refugees. This study is, to our knowledge, the first analysis of the HBV, HCV and HIV prevalence of a specific population of refugees in Cameroon.

We found a prevalence of 7.7% for HBV infection, 2.5% for HCV infection and 1.8% for HIV infection. The identified risk factors for HBV infection were age group 20-39 years, being self-employed, history of surgery, and the notion of multiple sex partners. For HCV infection, history of previous surgery and STIs history were identified as risk factors. For HIV infection, age > 40 years, injectable drug use and history of multiple sex partners were identified as risk factors.

The study population was predominantly young (median age: 27.0 years; interquartile range: 32), and the sex-ratio was female-biased. This was similar to a study carried out by Ugwu, in 2008, on refugees in Minnesota whose participants had a mean age of 19 years^[12]. Children below 10 years represented 17.5% of the study population, while the rest (82.5%) were adolescents and adults. Males represented 43% of the study population while females contributed 57%. This is due to the fact that women and children are the most vulnerable and are more susceptible to be displaced.

A large proportion of the refugees involved in this study was self-employed (59.6%), and this can be attributed to their migration status which leads to a poor socioeconomic status, thus the need for survival via petty jobs in their host country as was previously demonstrated^[13].

Hepatitis B prevalence and risk factors

The HBsAg prevalence among refugees of the Mbile camp was 7.7%, indicative of an intermediate endemicity of the hepatitis B viral infection in this camp. This prevalence is lower than the overall prevalence of HBV infection in Cameroon (11.2%) and the

Table 2 Risk factors for Anti-HCV positivity.

Characteristics	Frequency (n)	Anti-HCV (+) [n (%)]	Anti-HCV (-) [n (%)]	OR (95% CI)	p value
Gender					
Males	417	11 (2.6)	406 (97.4)	1.1 (0.5 - 2.5)	0.776
Females	553	13 (2.4)	540 (97.6)	0.9 (0.4 - 2.0)	
Age (Years)					
< 10	170	1 (0.6)	169 (99.4)	0.2 (0.03 - 1.5)	0.081
[10-19]	170	5 (2.9)	165 (97.1)	1.2 (0.5 - 3.4)	0.666
[20-39]	335	8 (2.4)	326 (97.6)	0.9 (0.4 - 2.2)	0.909
≥ 40	295	10 (3.4)	286 (96.6)	1.7 (0.7 - 3.8)	0.23
Profession					
Self Employed	545	13 (2.4)	532 (97.6)	0.8 (0.4 - 1.8)	0.585
Student	215	5 (2.3)	210 (97.7)	0.9 (0.3 - 2.3)	0.755
Civil Servant	11	0 (0.0)	11 (100.0)	NA	0.584
Unemployed	144	6 (4.2)	138 (95.8)	1.8 (0.7 - 4.7)	0.207
Matrimonial Status					
Single	139	8 (5.8)	131 (94.2)	2.2 (0.9 - 5.1)	0.077
Married	475	15 (3.2)	460 (96.8)	0.9 (0.4 - 1.9)	0.708
Divorced	48	1 (2.1)	47 (97.9)	0.6 (0.1 - 4.5)	0.617
Widow/Widower	48	0 (0.0)	48 (100.0)	NA	0.183
Cohabitation	9	0 (0.0)	9 (100.0)	NA	0.575
History of Abortion	83	2 (2.4)	81 (97.6)	0.9 (0.2 - 4.2)	0.968
History of dental procedure	31	2 (6.5)	29 (93.5)	2.9 (0.6 - 12.8)	0.147
History of Hospitalization	504	13 (2.6)	491 (97.4)	1.1 (0.5 - 2.5)	0.826
History of Injectable drug use	19	0 (0.0)	19 (100.0)	NA	0.483
History of surgery	130	7 (5.4)	123 (94.6)	2.8 (1.1 - 6.8)	0.022
History of multiple sex partners	114	3 (2.6)	111 (97.4)	1.1 (0.3 - 3.7)	0.908
History of Scarification	192	6 (3.1)	186 (98.9)	1.4 (0.5 - 3.5)	0.517
History of STIs	36	3 (8.3)	33 (91.7)	3.9 (1.1 - 13.9)	0.021
History of tattooing	17	1 (5.9)	16 (94.1)	2.5 (0.3 - 19.9)	0.362
History of blood Transfusion	47	2 (4.3)	45 (95.7)	1.8 (0.4 - 7.9)	0.42

Table 3 Risk factors for Anti-HIV positivity.

Characteristics	Frequency (n)	Anti-HIV (+) [n (%)]	Anti-HIV (-) [n (%)]	OR (95% CI)	p-value
Gender					
Males	417	7 (1.7)	410 (98.3)	0.9 (0.4 - 2.5)	0.879
Females	553	10 (1.8)	543 (98.2)	1.1 (0.4 - 2.9)	
Age (Years)					
< 10	170	0 (0.0)	170 (100.0)	NA	0.045
[10-19]	170	2 (1.2)	168 (98.8)	0.6 (0.1 - 2.8)	0.529
[20-39]	335	5(1.5)	329 (98.5)	0.8 (0.3 - 2.3)	0.66
≥ 40	295	10 (3.4)	286 (96.2)	3.3 (1.3 - 8.9)	0.01
Profession					
Self Employed	545	12 (2.2)	533 (97.8)	1.6 (0.6 - 4.7)	0.35
Student	215	2 (0.9)	213 (99.1)	0.4 (0.1 - 1.9)	0.25
Civil Servant	11	0 (0.0)	11 (100.0)	NA	0.646
Unemployed	144	3 (2.1)	141 (97.9)	1.2 (0.3 - 4.1)	0.827
Matrimonial Status					
Single	139	5 (3.6)	134 (96.4)	1.8 (0.6 - 5.1)	0.346
Married	475	11 (2.3)	464 (97.7)	0.9 (0.3 - 2.6)	0.905
Divorced	48	1 (2.1)	47 (97.9)	0.9 (0.1 - 6.7)	1
Widow/Widower	48	0 (0.0)	48 (100.0)	NA	0.62
Cohabitation	9	0 (0.0)	9 (100.0)	NA	1
History of Abortion	83	0 (0.0)	83 (100.0)	NA	0.388
History of dental procedure	31	1 (3.2)	30 (96.8)	1.9 (0.2 - 14.9)	0.427
History of Hospitalization	504	6 (1.2)	498 (98.8)	0.5 (0.2 - 1.4)	0.165
History of Injectable drug use	19	2 (10.5)	17 (89.5)	7.3 (1.6 - 34.6)	0.042
History of surgery	130	0 (0.0)	130 (100.0)	NA	0.15
History of multiple sex partners	114	6 (5.3)	108 (94.7)	4.3 (1.5 - 11.8)	0.01
History of Scarification	192	3 (1.6)	189 (98.4)	0.9 (0.2 - 3.04)	1
History of STIs	36	1 (2.8)	35 (97.2)	1.6 (0.2 - 12.7)	0.477
History of tattooing	17	0 (0.0)	17 (100.0)	NA	1
History of Blood Transfusion	47	0 (0.0)	47 (100.0)	NA	1

HBsAg prevalence in the Central African Republic (10.5%)^[5,14]. This might be due to a difference in the diversity and specificity of the sample populations in the meta-analysis. Our results are however similar to that of Spearman, which showed that sub-Saharan Africa had a Hepatitis B prevalence of 6.1%^[15]. These similarities can be explained by the fact that developing countries like Cameroon which falls in this geographical area have almost the same early vertical and horizontal means of transmission^[16]. Also taken into consideration is the fact that the country of origin of these refugees falls in the same scope. Similarly, Coppola, on undocumented migrants (60% of them were from Sub-Saharan Africa), found a hepatitis B prevalence of 8.8% with a tendency to increase with age^[13]. These results are similar to that of Tafuri, which found an HBsAg prevalence of 8.3%^[3]. Ugwu, on refugees in Minnesota, had findings similar to those from our study (7.1% of hepatitis B prevalence, with 71.1% of refugees from Africa)^[12].

The HBsAg prevalence was relatively higher in males (8.6%) than females (7.6%), even though this difference was not statistically significant, similar to Coppola and Tafuri^[3,13]. Risk factors for the Hepatitis B infection included the age group 20-39 years, being self-employed, history of surgery and notion of multiple sex partners. The age group was similar to that of Owiti and seems to be the reflection of the population and the HBsAg distribution in the Central African population^[14,17]. Komars reported the association of small trading with HBsAg carriage in the Central African population, which was the case of almost all the participants who declared being self-employed^[14]. A

history of multiple sex partners was also significantly associated with the presence of HBsAg, similar to findings by Ugwu^[12].

Hepatitis C prevalence and risk factors

Our study revealed an anti-HCV prevalence of 2.5% among these refugees in Mbile, similar to results obtained by Ankouane on blood donors in Cameroon (3.2%), but lower of that obtained after a meta-analysis of previous studies carried out on various risk groups and the general population in Cameroonians by Bigna (6.5%)^[7,9]. This could be explained by the specific nature of the targeted groups reviewed in the meta-analysis. These findings were similar to the anti-HCV prevalence in CAR (2.4%) and Sudan (2.8%)^[18]. This similarity reflects the origin of this population. HCV infection prevalence among immigrants and refugees from sub-Saharan Africa seems to be similar in Italy. Coppola and Majori found respectively an anti-HCV prevalence of 4% and 2.7%^[13,19]. The Chernet meta-analysis revealed a pooled prevalence of 3.0% in contrary to Greenway findings (1.9%)^[20,21].

Identified risk factors for HCV infection among our study population were a history of surgery and STIs. These findings were similar to that of Coppola who reported unsafe sexual intercourse and invasive surgical procedures (surgery, dental care, and abortion) as the major risk factors^[13]. The identification of a history of STIs as a risk factor of the HCV infection reinforces the possibility of sexual transmission^[22]. The rest of the evaluated risk factors showed no significant association with HCV infection.

HIV infection and risk factors

The prevalence of HIV in our study population was 1.8%. This result was lower than the HIV prevalence in the East region (5.9%), in the general Cameroonian population (3.7%) and even to the HIV prevalence in the Central African Republic (4%)^[23,24]. This discrepancy could be explained by selection bias or the differences (refusal of HIV patients to present themselves) in the screening and sampling techniques used in the respective studies or the possibility that most of HIV patients have died before arriving to the refugee camp given the rude conditions they faced on the road to the Cameroon. Similar HIV prevalence (1.8% in 2015 and 1.7% in 2017) were obtained by Coppola among refugees in Italy^[13,25]. This was in contradiction with Shandera's meta-analysis which found an HIV prevalence of 6.5%^[26]. This could be related to screening techniques.

As found by Shandera, a higher prevalence of HIV infection was observed for females (1.8%) than for males (1.7%)^[26]. This was also consistent with the findings of the 2018 CAMPHIA report in which HIV prevalence among females was 5.0 % comparatively to 2.3% among males^[23]. These results support the fact that women are more vulnerable to HIV infection than men and hence more emphasis need to be laid on screening females.

Risk factors for HIV infection included: age > 40 years, injectable drug use and history of multiple sex partners were identified as risk factors. The age group of > 40 years constituted 58.8% of the infected population, thus the need for proper attention to be shifted towards the aging population of these refugees in terms of HIV screening and management. On the other hand, the age of < 10 years was a protective factor against the presence of anti-HIV antibodies. This is a clear indication of a successful mother to child transmission prevention strategy applied both in their country of origin and in Cameroon initiated a couple of years back^[27]. A history of multiple sex partners was also identified as a risk factor among Afghan refugees by Khanani^[28]. Another significant risk factor was a history of injectable drug use. These two risk factors could be explained by the poor financial, social and psychological conditions of refugees and immigrants which led them to engage in such precarious habits.

This study provides some data on the prevalence and correlates of HBV, HCV and HIV among CAR refugees of the Mbile Camp in The East region of Cameroon. However, our findings should be interpreted in light of some limitations. The inability for a majority of our participants to speak or write English or French necessitating translation to Fulbe probably affected our results causing an involuntary reporting bias. Another limitation was the screening for anti-HCV antibody. The presence of a negative HCV screening test is common in immunosuppressed individuals (HIV infection) and during the window period of the disease. Hence assays do not exclude the possibility of HCV infection for individuals with negative results. So negative anti-HCV antibody individuals needed verification using other suitable tests. However, the high cost of the screening tests was restrictive.

CONCLUSION

The prevalence of the HBsAg and anti-HCV antibody in the study population was 7.7% and 2.5% respectively. The prevalence of anti-HIV antibody in the study population is low at 1.8%. Age group 20-39 years, being self-employed, history of surgery, the notion of multiple sex partners for HBV infection, history of previous surgery and STIs history of HCV infection and for HIV infection, age > 40 years, injectable drug use and history of multiple sex partners were identified as risk factors. There is a need for a systematic

“Screening-on-arrival” method for refugees at all the Cameroonian borders targeting key infectious diseases like HBV, HCV and HIV and implementation of effective treatment and vaccination strategies for refugees who do not have serologic evidence of immunity to Hepatitis B.

Declarations

Authors' contribution: Conception and Design: CNF, MPK, SRSN, AWNN, FAA, JK. Data collection: CNF, MPK, SRSN, AWNN, FAA, JK. Administrative support: MPK, JK. Data analysis and Interpretation: CNF, MPK, LDY, HCND, SRSN, AWNN, FAA, JK. Drafting of the manuscript: SRSN, CNF, AWNN, MPK, FAA, LDY, HCND, JK. Reviewing Manuscript: SRSN, CNF, AWNN, CNF, MPK, FAA, LDY, HCND, JK. All the authors read and approved the final draft for publication.

Availability of data and materials: The dataset analyzed during this study is not publicly available due to individual privacy issues. It could be available from the corresponding author on a reasonable request.

Ethical considerations: This work was approved by the Institutional Review Board of the Faculty of Medicine and Biomedical Sciences, University of Yaoundé I, Yaoundé, Cameroon (registration number: 052/UY1/FMSB/VDRC/CDS). Administrative authorization was granted by the East Regional Representative of the United Nations High Commissioner Refugees, the East Regional Delegate of Public Health and Chief of the Mbile Integrated Health Centre. This study was carried out in accordance with the Helsinki declaration [29]. All ethical rules involving research on disadvantaged groups such as prisoners and refugees have been respected [30]. Patients were free to attend the study without any outside constraint. We obtained informed and signed consent form from each participant. For children, a consent of a parent or the legal guardian was obtained. The participants were then offered to be screened free of charge while respecting anonymity. Those diagnosed from any medical condition during the study were referred to the attending physician for proper management. We report this work following the STROBE checklist.

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