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Research article

Screening and linkage to care for medical students with hepatitis B virus infection in Sierra Leone

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ABSTRACT

Purpose: Hepatitis B virus (HBV) infection is considered a major public health concern for Sierra Leone. Although medical students are at increased occupational risk for HBV infection, little is known about the burden of HBV infection amongst medical students in Sierra Leone.

Methods: As part of a screening and vaccination campaign, a cross-sectional study on prevalence of HBV among medical students in Freetown was conducted in December 2019. Antigen point of care test was used for HBV screening and data on students' risk history and demographics were collected. Additionally, for students diagnosed positive with HBV, linkage to care and initial assessment data after diagnosis was collected from the HBV clinic they were linked to.

Results: One hundred and fifty-seven medical students (77.3%) from year three to six were screened for HBV infection. Almost all students (98.1%) had never been vaccinated against HBV and more than half (56.7%) reported a history of needle stick injuries. The prevalence of HBV infection (Hepatitis B surface antigen (HBsAg) positivity) was 10.2% (n = 16). Among HBsAg positive students, 75% (n = 12) were successfully enrolled at chronic HBV clinic within three months of diagnosis. Only one student had evidence of liver cirrhosis and was started on treatment with Tenofovir diproxil fumarate.

Conclusion: The prevalence of HBV infection is high among medical students in Sierra Leone. Despite the high prevalence, most of the students linked to care had no evidence of severe liver disease.

1. Introduction

Hepatitis B virus (HBV) infection is a considerable public health threat causing significant morbidity and mortality across the globe. In 2015, 257 million people were living with chronic HBV infection worldwide [1]. Without adequate access to care, 15–25% of chronic HBV patients dies mainly from cirrhosis and hepatocellular carcinoma [2]. Sub-Saharan Africa has one of the highest HBV prevalence globally, estimated at 6.1% in 2015, and one of the highest mortality rates for the virus [3], which can be explained by limited access to vaccination, late diagnosis and the limited access to HBV care and treatment [4, 5, 6].

While no population-based HBV sero-prevalence study exists for Sierra Leone, facility-based studies report high prevalence rates among different population groups: 9.7% among blood donors, 8.7% and 10% among health care workers, 13% among febrile admitted patients over 5 years old, and 21.7% among people living with HIV [7, 8, 9, 10, 11]. Access to screening and care for HBV is very limited [7].

Health care workers, including medical students, belong to HBV high-risk groups. Medical students face particularly high occupational risk during their clinical training years, when first being exposed to blood and other body fluids [12, 13]. Furthermore, medical students are more prone to needle stick injuries and other exposures and are less likely to report occupational exposures than other more experienced health care workers [14, 15].

To eliminate chronic HBV infection as a public health threat by 2030, programs aimed at screening, case identification and improved access and linkage to care for HBV patients are advocated [16]. As part of this strategy, medical students need to be prioritized for infection control, including screening and provision of immunization against HBV [16]. Despite recommendations that health care workers and medical students should be screened and vaccinated against HBV, there is no policy for HBV screening and vaccination among medical students in Sierra Leone [17].

To date, the prevalence of HBV infection among medical students in Sierra Leone is unknown. Against this background, this study report the

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prevalence of HBV infection among medical students during a vaccination campaign conducted in December 2019. Additionally, clinical follow-up and initial assessment after linkage to care was collected from a treatment facility for students who tested positive for HBV. We hope that the results of this study will help in the introduction of programs focused on HBV screening and care amongst medical students in Sierra Leone.

2. Main text

2.1. Methods

2.1.1. Setting and type of study

This study measured the prevalence of HBV infection among medical students who participated in an HBV vaccine campaign in Freetown, Sierra Leone, in December 2019. Additionally, for students diagnosed positive with HBV, clinical follow-up and initial clinical assessment data after diagnosis was collected from the HBV clinic.

2.1.2. Hepatitis B vaccination campaign

The HBV campaign was a two-day event organized by the Sierra Leone College of Medicine and Allied Health Sciences, the Ministry of Health and Sanitation and a non-governmental organization called Partners In Health. The free campaign aimed at screening for HBV, after which negatively tested students received HBV vaccine, while those who tested positive were linked to care. At the time, the medical school had around 460 medical students enrolled from year 1 to year 6. Due to limited resources, funding was available for only 203 medical students. As a result, all students in clinical years were prioritized (year four to six) for the campaign. Since the number of students in clinical years did not reach the target, medical students in their third year were also invited.

Prior to the screening, all eligible medical students aged 18 years and above received information on HBV and the plan of the screening campaign. This included a teaching session on HBV followed by reminders on social media platforms. Participation in the campaign was voluntary. To ensure confidentiality, the event was conducted at a separate venue away from the college campus and students were given an appointment time for the screening. A team of two vaccinators, one phlebotomist, two nurses and one clinician were trained to conduct the campaign.

After collecting demographic data and obtaining informed consent, students received pre-counselling and were asked about their relevant risk history. Venous blood was collected for the HBV point of care test. Using an aseptic technique, at-least 3 mL of venous blood were collected. After centrifuging the sample for 5 min at 12,000 rpm at room temperature, a one-step rapid immunochromatographic test (Right sign rapid diagnostic test by Hangzhou Biotest Biotech Co., Ltd, China) to detect hepatitis B surface antigen (HBsAg) was done. The sensitivity and specificity of the rapid diagnostic test is 99.8% and 99.6% respectively [18]. The results, which were recorded as positive and negative, were read after 15–20 min.

Upon receipt of the results, all negatively tested students received the first dose of the HBV vaccine (rDNA hepatitis B vaccine) on the same day and received appointments for the remaining two doses, scheduled for month one and six. Students that tested positive were referred to the clinician who provided post-test counselling and were referred to HBV clinic at Koidu Government Hospital in Kono District, which is five hours away by road from Freetown. Counselling also included advice for screening for family members and/or other sexual partner (s). To support their travel, arrangements were made to provide free transport to the clinic. As far as known, this was the only clinic in Sierra Leone providing free HBV care in Sierra Leone. In the HBV clinic, all students received standardized and protocol based care based on the Sierra Leone National Guidelines on Management of Chronic Hepatitis B infection. Based on national guidelines at the time, chronic HBV patients were started on tenofovir diproxil fumarate if they had cirrhosis on abdominal scan, an APRI score of over two, or if they were co-infected with HIV [19].

2.1.3. Sample collection and laboratory measurements

2.1.3.1. Measurements and outcomes. Data were collected on a paper based chart; after which they were transferred to a Microsoft Excel Spreadsheet. The variables collected included age, gender, year group in medical school, marital status, history of HBV vaccine and history of needle stick injuries. Based on Sierra Leone national guidelines, we regarded a single HBsAg positive test without recent signs and symptom of infection as a confirmatory diagnosis for chronic HBV infection [19].

For those tested positive, at least one visit to the clinic within three months after the screening was used to indicate referral and linkage to care. Additional information on HBV viral load, HIV test, Aspartate Transaminase to Platelet Ratio Index (APRI) score, alanine transaminase (ALT), ultrasound results and treatment based on severe liver disease were collected. HBV viral load was performed on Cepheid GeneXpert® system using Xpert HBV viral load cartridges.

2.1.4. Data management and statistical analysis

Data cleaning and analysis was done using STATA version 15. Descriptive statistics were used to describe the variables. For inferential statistics, Fishers exact test and Mann-Whitney test were used. $P < 0.05$ showed statistical significance.

3. Ethics approval and consent to participate

The study received ethical approval from the Office of Sierra Leone Ethics and Scientific Review Committee. Informed consent was obtained from the participants. Only anonymized data was provided to co-authors.

4. Results

Among the 203 medical students that were invited to the HBV screening campaign, 157 (77.3%) were screened. The median age was 26 years (Interquartile range [IQR] 24–28) and the majority were males (n = 100, 63.7%) (Table 1). Most students were in year three (n = 72, 45%) and 92.4% (n = 145) have never been married. Almost all medical students have never been vaccinated (n = 154, 98.1%) and only 3 (1.9%) had previously received incomplete HBV vaccination. Over half of the students (n = 89,56.7%) had history of needle stick injuries (Table 1).

Among the 157 students that were screened for HBV, 141 (89.8 %) had a negative HBsAg test. 16 students had a positive HBsAg test, hence sero-prevalence of HBV infection was 10.2%. There were no significant differences in baseline demographic information and risk history between students with and without HBV infection. For needle stick injuries, students with HBV had a higher injury rate than students without HBV (68.8% vs 55.3%), however the difference was not statistically significant (p = 0.43). None of the students with prior exposure to HBV vaccine had a positive HBsAg.

Among the 16 students diagnosed with HBV infection, 12 (75%) were successfully linked to a HBV clinic (Table 2). After assessment in the clinic, half of the students (n = 6) had elevated ALT and all students had APRI score of less than two. In general, higher ALT levels was not correlated with higher viral load.Eight of the 12 students were tested for HIV and the results were negative. The median HBV viral load was 871 IU/ml (IQR 44–2440). The majority of the students had HBV viral load of less than 2,000 IU/ml (n = 8, 72.7%). Only one student had evidence of liver cirrhosis on abdominal scan and was started on treatment with tenofovir diproxil fumarate. The rest of the students (n = 11,91.7%) did not have evidence of severe liver disease and were scheduled to be followed up in six months.

5. Discussion

HBV continuum of care emphasizes the importance of reaching key population groups for prevention, testing, linkage to care, treatment and

Table 1. Baseline characteristics of medical students who were screened for Hepatitis B virus infection in Sierra Leone.

		Total (n = 157)	HBsAg Negative (n = 141)	HBsAg Positive (n = 16)	p-value[#]
Age-years (median, IQR)		26 (24–28)	26 (24–28)	26 (23.5–29.5)	0.6
Age category	Under 30	134 (85.3)	122 (86.5)	12 (75)	0.23
	30 or over	23 (14.7)	19 (13.5)	4 (25)	
Gender-n/%	Female	57 (36.3)	54 (38.3)	3 (18.8)	0.17
	Male	100 (63.7)	87 (61.7)	13 (81.2)	
School class-n,%	Year 3	72 (45.8)	65 (46.1)	7 (43.8)	0.26
	Year 4	34 (21.7)	33 (23.4)	1 (6.2)	
	Year 5	27 (17.2)	23 (16.3)	4 (25.0)	
	Year 6	24 (15.3)	29 (14.2)	4 (25.0)	
Marital status-n/%	Never Married	145 (92.4)	129 (91.5)	16 (100.0)	0.61
	In union (married, cohabiting)	12 (7.6)	12 (8.5)	0 (0.0)	
Have children-n/%	Yes	32 (20.4)	29 (20.6)	3 (18.8)	1.0
	No	125 (79.6)	112 (79.4)	13 (81.2)	
Previous exposure to vaccine-n/%	Yes	3 (1.9)	3 (2.1)	0 (0.0)	1.0
	No	154 (98.1)	138 (97.9)	16 (100.0)	
History of needle stick injury –n/%	Yes	89 (56.7)	78 (55.3)	11 (68.8)	0.43
	No	68 (43.3)	63 (44.7)	5 (31.2)	

HBV hepatitis B virus IQR Interquartile range. HBsAg, hepatitis B surface antigen test.
[#] For age, Mann-Whitney test was used to show differences between patients with and without HBV. For all other variables, Fishers exact test was used.

Table 2. Linkage to HBV clinic and clinical outcomes.

Variable	Parameters	Number	Percentage
Linked to care	Yes	12	75.0
	No	4	25.0
ALT	Median, IQR	26.3 (18.6–48.8)	
ALT Level	Normal	6	50.0
	Elevated	6	50.0
APRI Score	≤2	12	100
	>2	0	0
Ultrasound scan results	No cirrhosis	11	91.7
	Cirrhosis	1	8.3
HIV test	Positive	0	0
	Negative	8	66.7
	Not done	4	33
HBV viral load	Median, IQR	871 IU/ml (44–2440)	
HBV viral load category	<2000 IU/ml	8	72.7
	2000–20000 IU/ml	2	18.2
	>20000 IU/ml	1	9.1
Significant liver disease	Cirrhosis and started on treatment	1	8.3
	Follow up and monitoring in the clinic	11	91.7

Normal ALT <19 IU/mL for women and <30 IU/mL for men. APRI, Aspartate Transaminase (AST) to Platelet Ratio Index, ALT, alanine transaminase. HBV, hepatitis B viral load IQR Interquartile range.

provision of longitudinal care [16]. This study has described efforts to provide such a continuum of care services for medical students at the only medical university in Sierra Leone.

Awareness, testing and uptake of HBV vaccination are low among medical students in low and middle income countries [20, 21, 22]. To improve education and awareness, this HBV campaign provided education and testing to medical students in their third to sixth year. Almost all students who attended the campaign had never received any HBV vaccine doses prior to the event. This may partially be explained by the fact that HBV vaccine was only added to routine childhood immunization program 14 years ago [19]. Additionally, over half of the students reported needle stick injuries, confirming this group's high occupational risk.

Although the vaccination campaign was open to all students in year three to year six, some students did not participate in the campaign. We do not know why some students did not attend the campaign. However, the campaign reached 77 % of our intended target students. This is higher than the health care workers that voluntarily participated in a screening program in a study by Massaquoi et al, in Sierra Leone, where 72% accepted to be screened [7]. It is also higher than coverage for community screening in one study done in Gambia, where 69% accepted to be screened [23]. In future campaigns, other strategies will need to be put in place to reach the remaining students.

As far as we know, this is the first study to explore the prevalence of HBV and linkage to care among medical students in Sierra Leone. Two

previous studies by Massaquoi et al and Qin et al looked at other groups of health care workers, mainly nurses and doctors, in two urban facilities. In those two studies, the prevalence of HBV was 8.7% and 10% [7, 8]. This is similar to the prevalence found in this study. However, the health care workers in the previous studies were older than participants in this study. For example, 71% of participants in the study by Qin et al were aged 30 years and above, while in our study only 14.7% were aged 30 years and above [8].

It is recommended to provide HBV screening and HBV vaccine to medical students, ideally before they begin their clinical training. Campaigns during pre-clinical training years do not only improve awareness of HBV status, but also help provide vaccination to HBV negative students. Such programs are particularly critical, given the prevalence found amongst this population group through this study. Against this background, screening and vaccinating all medical students not included in this study should be prioritized. Currently, efforts are underway to identify more resources for the vaccination of the remaining students; although the progress has been slow with the shifting priorities as a result of coronavirus 19 pandemic.

This study also explored linkage to care, initial assessments and treatment at the HBV clinic, which was not on a focus in previous HBV studies from Sierra Leone [7, 8]. In this study, 75% of HBV positive students were successfully linked to a free HBV clinic. We do not know why the other four students did not attend the HBV clinic. It is possible they enrolled for care in other clinics although we are not aware of any public facilities providing free HBV care in Sierra Leone. Efforts are underway to trace these students. Additionally, 11 out of 12 students with HBV infection did not have severe liver disease requiring treatment, mirroring findings from other studies in Africa [7, 23].

The study has some limitation worth mentioning. The study is a descriptive study with a small sample size. Since participation was voluntary, we did not screen all targeted medical students. Due to limited funding, we could not screen medical students in year one and year two, as this could have provided an opportunity for screening to this group of medical students. Similarly, we could not screen students from other health fields attending the same medical school. Therefore, the results may not be generalizable. Additionally, the diagnosis of HBV infection was made using one single HBsAg rapid test, hence making differentiation between acute and chronic HBV challenging.

6. Conclusions

The study found a high HBV prevalence of 10.2% among medical students in Sierra Leone. The linkage to care among the students was also high. Based on the current Sierra Leone national guidelines, only one out of 12 medical students with HBV infection was eligible for treatment. Based on these results, we recommend provision of HBV screening and vaccination as well as care among medical students in Sierra Leone.

Availability of data

All data to the study can be provided upon a reasonable request to the corresponding author.

Declarations

Author contribution statement

C. Kachimanga: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

M. Bangura: Conceived and designed the experiments; Performed the experiments.

E. Nyama and V. Reed: Performed the experiments.

M. Mhango: Performed the experiments; Contributed reagents, materials, analysis tools or data.

M. Patiño Rodriguez: Conceived and designed the experiments; Wrote the paper.

M. Lado: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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