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Hepatitis B Knowledge, Risk Perception, Behavioral Skills, and Infection Burden among Students and Staff at Victoria University, Kampala, Uganda

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: The global efforts concertedly endorsed towards eliminating viral hepatitis as a public health challenge necessitate the provision of adequate and pertinent information related to hepatitis B virus (HBV) infectivity, which will help in tackling the lingering chronicity of HBV infection in

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developing countries. This study aimed to assess the burden of HBV infection and the underlying predictors of HBV infection risk among students and staff of Victoria University, Uganda.

Methods: We captured data from 164 conveniently selected participants. Surface antigen for HBV (HBsAg) was detected using rapid tests. Analysis of variance (ANOVA), regression analysis, and chi- square tests were performed to ascertain the study hypotheses at a cut-off of ($p<0.05$).

Results: The respondents' mean age was 24.25 ± 25.64 years. Relatively half (56.1%) were males. Students (85.4%) were predominant. Regarding the burden of hepatitis B virus infection, HBsAg prevalence was 4.3%, observed among unmarried, first-year students, and residents of Central Uganda. Students' year of study ($\chi2 = 10.323$, $p =<0.035$) was significantly associated with HBsAg status. Furthermore, the respondents obtained mean scores of 3.45±4.10, 3.71±4.44, and 10.90±11.80 for knowledge, risk perception, and behavioral skills, respectively. Similarly, inadequate HBV-specific knowledge ($F = 13.85$, $p<0.001$), low risk perception ($F = 13.22$, $p<0.001$), and bad behavioral skills ($F = 64.05$, $p<0.001$) all predicted the risk of HBV infection.

Conclusion: The findings affirm the lingering high endemicity of HBV infection in Uganda and imply an immediate need for targeted university-based hepatitis-B-related education and relevant vaccination policies such as mass vaccination in academic institutions to prevent HBV infection effectively in Uganda.

Keywords: hepatitis B virus infection; HBV-specific knowledge; risk perception; behavioral skills; University.

1. INTRODUCTION

Hepatitis B virus infection globally ranks among the leading public health challenges [1,2]. The infection is believed to be caused by the hepatitis B virus (HBV), an enclosed deoxyribonucleic acid (DNA) virus with a strong affinity for attacking the liver [2,3]. Compared to the human immunodeficiency virus (HIV), HBV has higher potency and infectivity [4]. Estimates from the World Health Organization showed that globally, only in 2015, 257 million individuals were chronically infected with HBV infection and nearly three million people had HIV co-morbidity [1, 5,6-8]. Based on the progressive trend in the HBV infection epidemiology, HBV accounts for 1.5 million new cases every year. More recently, in 2019, 296 million people were estimated to be living with chronic HBV infection of which in the same year, it led to death cases totaling 820,000, resulting primarily from hepatic cirrhosis and carcinoma of the liver [2]. Generally, HBV-specific mortality equates to deaths caused by tuberculosis and is significantly higher than deaths due to malaria or HIV [5, 9].

Moreover**,** the WHO African region bears the highest burden of HBV infection after the Western Pacific Region, with more than 80 million chronically infected people [5,10]. Further, relatively one-fifth of the inhabitants of developing and low-income nations are carriers of chronic HBV infection [11,12]. Transmission of Hepatitis B occurs perinatally in endemic areas [13,14], although horizontal transmission via exposure to infected body fluid, sexual transmission among unvaccinated individuals with unsafe sexual practices, and percutaneous transmission through needle stick injury, piercing, tattooing, reuse of needles, and infected blood transfusion, among others, also contribute greatly to the spread of the infection [2]. Additionally, countries with HBV infection prevalence greater than 2% are to incorporate the safe vaccine launched by the World Health Organization in 1992 into their national immunization programs for an effective prevention of the disease [15]. While the availability of the vaccine is ascertained within the expanded immunization program in these countries, general population remains short of freely available vaccines [16].

In Uganda, the highly endemic burden of hepatitis B infection stands at a national prevalence of approximately 10%, where 72% of the population are believed to have a lifetime risk of HBV infection exposure [17]. Furthermore, while regional variation exists in the magnitude of HBV infection across the country, northern Uganda still boasts the highest prevalence of HBV infection [18]. However, there is an ostensible paucity of data on the epidemiology of HBV infection in Central Uganda among populations within the university environment. University populations, especially students, are vulnerable sub- population groups given their risky behaviors [19]. Studies on the disease

dynamics and characterization in Uganda and East Africa have been narrowed down generally to sub-groups including pregnant women, blood donors, and healthcare workers, among others [20-24]. These studies have also reported arrays of antecedent and putative predictors contributing to the infection burden, encompassing demographic, biological, socio-cultural, and behavioral factors. Currently, underlying factors that could predict behavioral change towards HBV prevention and better health outcomes have not been adequately explored among university populations in Uganda, yet these predictors like knowledge of HBV infection, perception of risk, and self-efficacy have been reported to influence prevention practices such as HBV screening and vaccination either positively or negatively [25-28]. This is a clear assertion about the pervasiveness of these variables in HBV prevention. Therefore, to provide adequate information pertinent to the reduction of HBV infection burden and related mortality in this highly endemic region, this present study sought to discover ways through which the magnitude of the infection could be explained by the demographic characteristics, knowledge of HBV infection, HBV risk perception, and behavioral skills towards HBV prevention among University populations. The study hypothesized that beyond demographic characteristics, the risk of HBV infection would be predicted by these underlying factors.

2. METHODS

2.1 Study Design and Population

This study employed a university-based cross-sectional survey design. It was carried out at Victoria University situated at Victoria Towers, Kampala, Uganda, from the 9th of April 2022 to the 13th of May 2022. The institution has four faculties with over 30 different undergraduate and postgraduate programs. The population was students and staff of the university who consented to be tested for HBsAg seropositivity and receive HBV vaccine upon a negative surface antigen test result. The study employed Cochran's formula for sample size computation [29] to estimate a minimum sample size of 138 based on the reported national HBV prevalence of 10% [17]. A total sample size of 164 was employed after adding an attrition rate of approximately 20%. The 164 consenting students and staff were then drawn using convenience sampling, given that the number of people taking the testing and vaccination services depends on the daily patronage level and available population at the university.

2.2 Instruments and Data Collection

A four-sectioned questionnaire was developed and provided to the participants to capture data on the study variables, including demographic characteristics, HBV infection knowledge, risk perception, and behavioral skills. The instrument was initially pretested using a pilot study on 20 students from Cavendish University (4km away from the study site); the same participants were then followed up for a re-test of the instrument for reliability checks. The statistical analysis of the data from the pilot-test showed a Cronbach alpha score of 0.751 and adjustments to the instrument were made where necessary. After completing the questionnaire, Hepatitis B surface antigen was measured using advanced quality™ one step HBsAg test (InTec Products Inc., USA) with a known sensitivity and specificity of 100% and 99.43% respectively.

2.3 Independent and Dependent Variables

The independent variables measured in the study included demographic data, which elicited information on age, gender, cadre of respondents, year of study, marital status, religion, and residence. Similarly, we measured information-adequacy related to **HBV knowledge** dichotomously as follows: *awareness of HBV infection with 2 questions*; *transmission and risk factors with 3 questions*; *cause*, *sign and symptoms*, and *consequences*; and *prevention with 1 question, respectively.* The questions related to the diseases specific-knowledge (7) were scored at a point each on a 7-point reference scale.

HBV risk perception was measured with three items on a 4-point Likert scale (*very high, high, low, and very low; the least being 0 and the highest being 3*). The 3 items were: lifetime risk= "*what is the likelihood that you will get HBV infection in your lifetime?"*, conditional risk= "*what is the likelihood that you will develop liver cancer in your lifetime if you get infected with HBV infection?*"; and comparative risk= "*what is the likelihood that you will get liver cancer in your lifetime compared to an acquaintance of your age?*". Thus, risk perception was measured on a 9-point rating scale. Further, the **behavioral skills** defined operationally as the confidence of

the respondents to embark on and initiate HBV prevention behaviors like early screening and vaccination were measured with six items having a Likert scale of 4-responses (*strongly agree, agree, disagree, and strongly disagree; the highest being 3 and the least being 0*) on the following constructs: i. perceived severity= "*I am confident that HBV is more dangerous than other complications that could endanger life and worsen individual's status financially*", ii. Outcome expectancy on HBV screening= *"I am confident that testing for HBV early will help in finding and managing the infection before resulting to liver cancer"*, iii. Outcome expectancy on vaccination: "*I am confident that if I get completely vaccinated for HBV, I will have no worries about developing liver cancer in the future*", iv. Perceived barrier= *"I am confident that I am not in need of HBV testing and vaccination services if I do not experience liver complication related symptoms"*, v. Perceived self-efficacy on vaccination= *"I am confident that I will get vaccinated even if the vaccination center is far from our school"*, vi. Perceived self-efficacy on screening= *"I am confident that I will go for HBV screening even if I have to pay for it"*. Altogether, behavioral skills was measured on 18-points rating scale. The dependent variable was hepatitis B surface antigen (HBsAg) status, measured categorically as thus; ("positive" = 1 and "negative" = 0).

2.4 Data Analyses

The data derived from the ratings of the study variables were computed by transformation and analyzed to derive standard measures such as means, standard deviations and 95% confidence intervals using SPSS, i.e., Statistical Package for Social Sciences version 23. Following the computation of the responses of perception and behavioral skills, the following responses were merged: i. *"very high and high= High"*, ii. *"very low and low = Low"*, iii. *"strongly agree and agree= Agree*", iv. *"strongly disagree and disagree= Disagree"*. Descriptive analysis in terms of frequency and proportion was employed to represent the categorical variables, and chi-square goodness-of-fit was evaluated to explain differences in the proportion of dichotomous responses. Analysis of variance (ANOVA) was conducted to assess how demographic characteristics influenced the responses of participants on knowledge, risk perception and behavioral skills, and how these variables predict the risk of HBV infection. Linear regression analysis was further performed to assess the relationships between the continuous predictor variables. We dichotomized the predictor variables based on the mean score obtained on the rating scales, and a chi-square test of association was employed to determine the factors associated with HBsAg status, with a cut-off point set for all statistics at ($p \leq 0.05$) level of significance.

3. RESULTS

3.1 Socio-Demographic Characteristics of the Respondents

At the university, 164 students and staff participated in the study. The mean age of the study participants was 24.9 years (SD = 4.5, 95% CI = 24.25±25.64), with the oldest being 42 years while the youngest was 17 years. More than half of the respondents were males (56.1%), and students were predominant (85.4%), with 41.5% of them being in their first year of study (41.5%). Upon the assessment of the mean scores for the predictors, the following participants reported better HBV infection knowledge: older respondents (4.1), females (4.0), lecturers (6.0), fourth-year students (6.0), unmarried respondents (3.8), and residents of Central Uganda (3.8). Further details on perception and behavioral skills scores across the demographic attributes are presented in Table 1.

3.2 HBV infection awareness, knowledge, perception, and behavioral skills of the respondents

The study revealed that 97% of the respondents were aware of HBV infection, and three-quarters of them (72.6%) heard about the infection from school. Regarding the information related to the adequacy of knowledge of HBV infection, 7 out of every 10 respondents (70.7%) understood that HBV infection could be transmitted through contact with body fluid of an infected person. Two-thirds of them (68.3%) affirmed that HBV infection is not caused by consuming a high intake of sugar, and more than half of the participants (58.5%) know that HBV infection may be prevented by engaging in safe sexual practices.

Table 1. Demographic characteristics of the study participants

	Respondents in the study N=164				
Variables	**Frequency (n)**	**Percentage (%)**	**Mean scores and 95% CI on HBV Infection Knowledge**	**Mean scores and 95% CI on perception of risk towards HBV Infection**	**Mean scores and 95% CI on Behavioral Skills**
Age (in years)					
17-26	119	72.6	3.7 (3.3±4.1)	4.2 (3.7±4.6)	11.4 (10.8±11.9)
27-36	42	25.6	4.1 (3.5±4.7)	3.8 (3.0±4.5)	11.3 (10.3±12.2)
≥37	3	1.8	4.0 (-3.5±11.5)	5.0 (2.5±7.5)	11.7 (10.2±13.1)
Gender					
Male	92	56.1	3.6 (3.2±4.1)	4.2 (3.7±4.7)	11.0 (10.4±11.5)
Female	72	43.9	4.0 (3.5±4.5)	4.0 (3.4±4.5)	11.9 (11.2±12.6)
Cadre					
Student	140	85.4	3.9 (3.5±4.2)	3.9 (3.5±4.3)	11.3 (10.8±11.8)
Lecturer	3	1.8	6.0 (1.7±10.3)	7.0 (4.5±9.5)	12.3 (6.1±18.6)
Other Staff	21	12.8	2.8 (2.0±3.6)	4.9 (3.9±5.9)	11.5 (10.8±12.2)
Students' year of study					
First	68	41.5	3.5 (3.0±4.1)	4.4 (3.9±5.0)	10.3 (9.4±11.1)
Second	49	29.9	3.9 (3.4±4.5)	3.4 (2.7±4.0)	12.0 (11.4±12.7)
Third	21	12.8	4.7 (3.8±5.6)	3.1 (2.1±4.2)	12.9 (11.7±14.1)
≥ Fourth	2	1.2	6.0 (6.0±6.0)	6.0 (6.0±6.0)	12.0 (12.0±12.0)
NA	24	14.6	-	-	-
Marital status					
Single	146	89.0	3.8 (3.5±4.2)	4.1 (3.7±4.4)	11.4 (10.9±11.8)
Married	18	11.0	3.5 (2.5±4.5)	4.3 (3.3±5.3)	11.3 (10.3±12.3)
Religion					
Catholic	70	42.7	3.2 (2.8±3.7)	4.2 (3.6±4.8)	10.7 (9.9±11.5)
Protestant	42	25.6	3.6 (2.9±4.3)	4.4 (3.6±5.2)	11.2 (10.3±12.1)
Islam	39	23.8	4.6 (4.0±5.2)	3.5 (2.7±4.2)	12.3 (11.7±12.9)
Other religions	13	7.9	4.9 (4.1±5.6)	4.3 (3.3±5.3)	12.5 (11.6±13.5)
Residence					
Central	141	86.0	3.8 (3.5±4.2)	4.0 (3.6±4.4)	11.3 (10.8±11.8)
West	19	11.6	3.4 (2.4±4.4)	4.6 (3.6±5.6)	11.2 (9.9±12.4)
North	4	2.4	3.5 (-2.1±9.1)	5.0 (3.7±6.3)	13.5 (9.5±17.5)

Note: NA= response "not applicable" to those who are not students i.e., lecturers and other staff.

Regarding the perception of risk towards HBV infection, ninety-three participants (56.7%) reported having a low perceived absolute life time risk; hence they believed that they were not likely to get HBV infection in their lifetime. Further, less than half of them (45.1%) reported having a high perceived conditional risk towards hepatitis B and liver cancer by admitting that they had a high probability of developing liver cancer in their lifetime should they get infected with HBV infection. The analysis of the data further showed that below one-fifth of the respondents (13.4%) disagreed on the severity of HBV infection compared to other complications that could endanger life and worsen individual's financial status. Furthermore, on the outcome expectancy of HBV vaccination, two-thirds of the respondents (64.6%) believed they do not need testing and vaccination services if they do not experience liver-complication related symptoms (*refer to Table 2 for full details*).

Table 2. HBV infection awareness, knowledge, perception and behavioral skills of the respondents

Number of respondents= 164				
Variables	**Frequency (N)**	**Percentage (%)**	**χ^2**	**p-value**
HBV awareness				
Yes	159	97.0	144.610	<0.001*
No	5	3.0		
Source of information on HBV				
School	119	72.6	33.390	<0.001*
Media/worship places	45	27.4		
HBV infection specific-knowledge				
Transmission via contact with body fluid of infected person				
Yes	116	70.7	28.195	<0.001*
No	48	29.3		
Caused by high sugar intake				
Yes	52	31.7	21.951	<0.001*
No	112	68.3		
Protection by safe sexual Practices				
Yes	96	58.5	4.780	0.029*
No	68	41.5		
Fever as a relevant symptom of HBV infection				
Yes	72	43.9	2.439	0.118
No	92	56.1		
Liver complications from HBV				
Yes	99	60.4	7.049	0.008*
No	65	39.6		
Nosocomial transmission			1.195	0.274
Yes	75	45.7		
No	89	54.3		
Scarification/tattooing as notable risk factors			26.561	<0.001*
Yes	49	29.9		
No	115	70.1		
Perception of risk towards HBV infection				
Perceived lifetime risk				
Low	93	56.7	2.951	0.086
High	71	43.3		
Perceived conditional risk				
Low	90	54.9	1.561	0.212
High	74	45.1		

Number of respondents= 164				
Variables	**Frequency (N)**	**Percentage (%)**	**χ^2**	**p-value**
Perceived comparative risk				
Low	99	60.4	7.049	0.008*
High	65	39.6		
Behavioral skills towards HBV infection prevention				
Perceived severity				
Agree	142	86.6	87.805	<0.001*
Disagree	22	13.4		
Outcome expectancy on HBV Screening				
Agree	141	86.0	84.902	<0.001*
Disagree	23	14.0		
Outcome expectancy on HBV Vaccination				
Agree	102	62.2	9.756	0.002*
Disagree	62	37.8		
Perceived barrier				
Agree	106	64.6	14.049	<0.001*
Disagree	58	35.4		
Perceived self-efficacy on HBV vaccination				
Agree	132	80.5	60.976	<0.001*
Disagree	32	19.5		
Perceived self-efficacy on HBV screening				
Agree	132	80.5	60.976	<0.001*
Disagree	32	19.5		

Note: p-value is significant at p≤0.05 (all p-values=0.000 were reported as p<0.001)*

3.3 Prevalence of hepatitis B virus infection among the respondents

The study revealed 4.3% hepatitis B surface antigen (HBsAg) prevalence among the respondents. Further analysis from chi-square goodness-of-fit test showed a significant difference in the proportions of the positive and negative cases (χ^2=137.2, p<0.001). Upon assessing the mean scores for the underlying predictors, respondents who tested positive consistently displayed the poorest score for HBV infection knowledge ($\bar{X}$ =1.0, F=13.85, p<0.001), risk perception ($\bar{X}$ =1.0, F=13.22, p<0.001), and behavioral skills ($\bar{X}$ =4.0, F=64.05, p<0.001) (*refer to Table 3*).

3.4 Predictor Variables Scores Among the Respondents

Regarding the information adequacy related to hepatitis B virus infection knowledge measured on an aggregate weighted 7-point reference scale, the respondents scored a mean of 3.77, which denotes a prevalence of 53.85%. On a 9-point reference scale, respondents scored an overall mean of 4.07 for risk perception, depicting 45.22% of the total perception expected from the respondents. Furthermore, the aggregate weighted score for the behavioral skills of the respondents was observed to be 11.35 on an 18-point reference scale. Upon assessing the linear relationship between knowledge, perception and behavioral skills, it was revealed on the one hand that a positive significant linear relationship exists between knowledge and behavioral skills (B=0.572, p<0.001), while on the other hand, perception of risk did not significantly predict behavioral skill (B=-0.018, p=0.836) (see Table 4).

3.5 Factors Associated with HBV Infection Status Among the Respondents

Demographically, students' year of study is significantly associated with hepatitis B infection status (χ^2=10.323, p=0.035). Similarly, while no association exists between awareness of HBV infection (p=0.198), source of HBV information (p=0.675) and HBsAg status, knowledge of HBV infection (χ^2=10.857, p=0.001), perception of risk (χ^2=10.323, p=0.002), and behavioral skills towards HBV prevention (χ^2=16.201, p=<0.001) on the other hand, were significantly associated with HBV infection status (*see Table 5*).

Table 3. Prevalence of HBV infection among the study respondents

	Respondents in the study N=164							
HBsAg status	Frequency (n)	Percentage (%)	χ^2	p-value	$\bar{\bar{X}}$ and (95% CI) on HBV Infection Knowledge	$\bar{\bar{X}}$ and (95% CI) on perception	$\bar{\bar{X}}$ and (95% CI) on Behavioral Skills	F-value (p-value)[abc]
Positive	7	4.3	137.195	<0.001*	1.0 (0.1±1.9)	1.0 (0.5±1.5)	4.0 (2.3±5.7)	13.85[a] 13.22[b]
Negative	157	95.7			3.9 (3.6±4.2)	4.2 (3.8±4.6)	11.7 (2.3±5.7)	64.05[c]

Note: a= p-value significant at <0.001 for knowledge, b=significant at <0.001 for perception and c=significant at <0.001 for behavioral skills

Table 4. General descriptive statistics (mean scores) of the study respondents

	Respondents in the Study N= 164				
Variables	**Score on Rating Scale**	**$\bar{\bar{X}}$(SE) ± SD**	**Percentage (%)**	**95% Confidence Interval**	**B (p-value)**
HBV infection-specific Knowledge	7	3.77 (0.16) ± 2.09	53.85	3.45 ± 4.10	0.572 (<0.001*)
Perception of risk towards HBV	9	4.07 (0.19) ± 2.37	45.22	3.71 ± 4.44	-0.018 (0.836)
Behavioral skills[a]	18	11.35 (0.23) ± 2.9	63.05	10.90 ±11.80	

*Note: a is the dependent variable tested against knowledge and perception, B=regression coefficient, *p-value significant at <0.001*

Table 5. Factors associated with HBV infection status among the study participants

Variables	HBV Infection		χ^2	p-value
	Positive n (%)	Negative n (%)		
Age (in years)			0.160	0.923
• 17-26	5 (71.4)	114 (72.6)		
• 27-36	2 (28.6)	40 (25.5)		
• ≥37	--	3 (1.9)		
Gender			0.003	0.634
• Male	4 (57.1)	88 (56.1)		
• Female	3 (42.9)	69 (43.9)		
Cadre of respondents			1.254	0.534
• Student	7(100.0)	133 (84.7)		
• Lecturer	--	3 (1.9)		
• Others	--	21 (13.4)		
Students' year of study			10.323	0.035*
• First	7 (100.0)	61 (38.9)		
• Second	--	49 (31.2)		
• Third	--	21 (13.4)		
• ≥ Fourth	--	2 (1.3)		
• NA	--	24 (15.3)		
Marital Status			3.159	0.436
• Single	7 (100.0)	139 (88.5)		
• Married	--	18 (11.5)		
Religion			5.857	0.119
• Catholic	6 (85.7)	64 (40.8)		
• Islam	--	39 (24.8)		
• Protestant	1 (14.3)	41 (26.1)		
• Others	--	13 (8.3)		
Place of residence			1.193	0.551
• Central	7 (100.0)	134 (85.4)		
• West	--	19 (12.1)		
• North	--	4 (2.5)		
HBV Awareness			3.124	0.198
• Yes	6 (85.7)	153 (97.5)		
• No	1 (14.3)	4 (2.5)		
Source of HBV information			0.635	0.675
• Media/worship places	1 (14.3)	44 (28.0)		
• School	6 (85.7)	113 (72.0)		
Knowledge of HBV			10.857	0.001*
• High	--	98 (62.4)		
• Low	7 (100.0)	59 (37.6)		
Perception of risk			10.323	0.002*
• High	--	96 (61.1)		
• Low	7 (100.0)	61 (38.9)		
Behavioral skills			16.201	<0.001*
• Good	--	113 (72.0)		
• Bad	7 (100.0)	44 (28.0)		

*Note: *p-value significant at ≤0.05*

4. DISCUSSION

According to the 2016 endorsed WHO Health Sector Strategy that proposed to eliminate viral hepatitis as a global public health threat by 2030 [30], adequate and accurate information related to hepatitis B infectivity is a pertinent focused point of intervention that can be geared towards understanding the reason why chronic HBV infection persists in developing countries and the best way it can be significantly tackled. This study investigated ways in which the burden of

HBV infection could be explained by the demographic characteristics, knowledge of HBV infection, risk perception, and behavioral skills toward HBV prevention among populations within academic settings. Evidence from this study underscores the imperativeness of some of these factors in ensuring a reduction in the burden of HBV infection, associated complications, and mortality.

The findings on the burden of HBV infection among our study respondents revealed an overall prevalence of 4.3% for hepatitis B surface antigen positivity (HBsAg). Predominantly, all the infected respondents were students in their first year of study, unmarried, residing in the Central region, and aged between 17 and 36 years. This prevalence is consistent with the global cut-off points for intermediate endemicity based on the regional classification of HBV infection endemicity [31,32]. The prevalence of hepatitis B virus infection seropositivity in this study is lower than the findings from student populations in Australia [33], healthcare workers in central Africa [34], and medical students in Uganda [24]. The discrepancy could be because of the population and the convenience sampling approach employed in our study, as individuals with a higher risk of HBV might choose not to be available for the study procedures. However, findings from the studies conducted among university students in West Africa [26] and youths in northern Thailand [35] support the report from this study.

Nevertheless, the findings indicate that vaccination uptake among this population is modest, which could have translated to the prevailing intermediate burden of HBV infection in the country. This is perhaps due to the inadequate HBV infection knowledge among this population, the widespread incorrect perceptions of risk towards HBV and liver cancer, and the poor behavioral skills displayed by the general population. Corroboratively, our findings revealed that HBV-positive respondents consistently display the poorest scores for knowledge of HBV infection, risk perception, and behavioral skills toward HBV infection prevention.

Demographically, our findings revealed students' year of study to be significantly associated with hepatitis B virus infection status. This could be further explained by the fact that all infected participants were in their first year of study, and they scored the lowest score for knowledge of HBV infection and behavioral skills. The poor level of knowledge displayed by this category of respondents might have significantly predicted their bad behavioral skills, which predisposed them to the risk of the infection. Evidence from a previous study highlighted a significant relationship between early detection and vaccination against HBV and the number of years spent in school, where those in higher levels of study were more likely to embark on prevention approaches like vaccination compared to the first-year students [25].

Furthermore, the findings on the underlying behavioral predictors of the risk of HBV infection, including awareness, knowledge, perception, and behavioral skills, showed that an overwhelming proportion of the respondents displayed high awareness of HBV infection, and they got their information from school. This is consistent with the findings from previous university-based studies reporting high awareness of HBV infection and its vaccination [25, 27]. In line with a previous study conducted in West Africa by Adoba et al. [36], the high awareness displayed by our study respondents did not translate to adequate knowledge of HBV infection. Regarding HBV infection knowledge, the respondents displayed unsatisfactory knowledge, with a mean score of 3.77 when measured on a rating scale of 7. This unsatisfactory HBV infection knowledge is consistent with the reports trending from previous studies conducted in sub-Saharan Africa [37,38] and other HBV-endemic regions of the world [39,40]. However, Osei et al. [25] and Abdela et al. [41] contrastingly reported adequate knowledge of HBV infection among their study participants in similar geographical regions.

Surprisingly, about a third of our respondents wrongly asserted that HBV infection is caused by a high intake of sugar, despite the general knowledge that in the adult population, HBV infection is often transmitted sexually [42]. Furthermore, 4 in 10 respondents did not know that HBV infection may be prevented by engaging in safe sexual practices. This lucidly indicates the existence of a knowledge gap regarding the cause, transmission, and behavioral prevention of the infection. Findings from this study on the link between hepatitis B infection and liver cancer revealed that nearly two-thirds of the participants admitted that untreated HBV infection could lead to liver cancer. This report contradicts the findings of 80% respondents knowing the consequences of

HBV on the liver from the study conducted by [41]. The discrepancy in the findings could be attributed to the study population employed in the studies given that their study focused mainly on students of medicine and health sciences compared to ours, which was neither discipline-specific nor limited to student population. The poor knowledge displayed by this study's respondents is alarming and may hinder their health-promoting behaviors and predispose the respondents to the risk of HBV infection. Therefore, it implies a need to alleviate the gaps in HBV-specific knowledge through robust health education.

In terms of the risk perception towards HBV infection and liver cancer among the respondents, our findings highlight a low and negative risk perception of HBV infection among our respondents, a report contrary to the high perception of risk reported in studies conducted in Nigeria [27], Cameroon [43], and France [44]. On the other hand, Nankya-Mutyoba et al. [20] reported a relatively similar incorrect risk perception towards HBV infection in a previous study conducted in Uganda. Hence, this implies a need for efforts to be geared towards shaping the perception of this population to a positive one that could inform better prevention behavior and, in turn, help reduce the burden of HBV infection in the region.

Regarding behavioral skills toward HBV prevention, respondents obtained a percentage mean score of 63.5%, which denotes overall good behavioral skills displayed by the respondents and will be required to embark on health-promoting behaviors towards HBV prevention given that self-efficacy, one of the measured constructs of behavioral skills, has been linked with the intention to initiate HBV prevention practices like early screening and vaccination, among others, and is also associated with the adoption of healthy behaviors towards health-related issues [20, 28, 45]. In addition, our present study showed a positive link between knowledge of HBV infection and behavioral skills. This implies that efforts geared towards improving the knowledge of HBV will directly help enhance the population's confidence towards embarking on HBV prevention behavior.

Lastly, while awareness and information adequacy related to HBV infection knowledge and its preventive approaches have been reported to influence the intention to vaccinate and promote prevention behaviors [45–48], awareness of HBV infection and the source of HBV information in our study were not associated with HBsAg status. However, knowledge of HBV infection, perception of risk, and behavioral skills toward HBV prevention were significantly associated with the risk of HBV infection. This indicates that to scale up the testing and vaccination uptake interventions directed towards preventing HBV infection, efforts need to be geared towards improving the level of these underlying variables that could influence behaviors towards initiating preventive measures, as previous empirical studies have highlighted [19, 25].

Conclusively, the Ugandan national strategies for hepatitis B prevention and control recently incorporated multi-sectoral and stakeholder collaborations to initiate widespread awareness campaigns, free HBV screening programs, vaccination, and treatment services to ensure health equity, allowing all people to benefit from hepatitis elimination in the country [49]. However, while these concerted efforts have been effective in increasing the information adequacy related to HBV infection and the diagnosis of the virus among high-risk populations such as pregnant women, health workers, and people living with HIV, among others, in the country [49, 50], university populations, on the other hand, have not been a focus of attention for these strategies. Therefore, this study, which reported an endemic figure of HBV infection linked with students' year of study, poor HBV knowledge, incorrect perception of HBV infection, and inadequate behavioral skills, has underscored that to meet the target of the WHO's global health sector strategy for HBV elimination by 2030, HBV infection prevention efforts should be equally embraced and prioritized in university settings.

5. LIMITATIONS

This study was limited to the use of only HBsAg positivity to characterize the infection among the respondents, the viral load test for HBV was not performed to further describe the infectivity of the virus, and consequently, the burden of the infection among this vulnerable population could have been underestimated considering the variability in the sensitivity of the rapid test. Additionally, the study could not further provide the odds ratio for the infection due to the few observed cases among the participants.

However, to our knowledge, this is the first university-based study to combine the

characterization of HBV infection with behavioral change-related predictors in an academic setting in Uganda. Hence, while similar studies among a larger sample size of university populations are required in this region, this present study has undoubtedly provided pertinent and usable evidence on the reasons why HBV infection lingers chronically in the country, lucidly pointing out the relevant focal points of interventions that can be prioritized to reduce the burden of HBV infection in this highly endemic region.

6. CONCLUSION

This study reveals an endemic burden of HBV infection among a university population in Uganda, which is associated with students' level of study, inadequate HBV infection knowledge, low perception of risk, and bad behavioral skills. The findings imply an immediate need for targeted university-based hepatitis-B-related health education and relevant vaccination policies that will positively shape students' behavior toward satisfactory uptake of HBV vaccines and help reduce HBV infection burden in the region.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONSENT AND ETHICAL APPROVAL

Ethical clearance to conduct the study was obtained from the Victoria University Research Ethical Committee. Written consent of the participants was obtained before allowing their participation in the study-specific procedures, and the utmost confidentiality was attached to the collected data.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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