Structural Equation Modeling for Magnitude, Association and Predictors of Knowledge, Attitude and Practice towards Hepatitis B among Tepi Community, Ethiopia

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Abstract

Hepatitis B Virus (HBV) infection is a potentially life-threatening liver infection. It also possesses a serious global public health concern. Increasing perception and awareness about HBV helps in reducing the disease burden. However, very little is known about knowledge, attitudes, and practice (KAP) towards HBV infection among university community. Hence, the study is aimed in determining the KAP towards HBV among Tepi campus community. A cross-sectional study was conducted at Tepi campus, Mizan Tepi University, Ethiopia. A total number of 1426 Tepi campus community were selected by simple random sampling. KAP of was assessed using a structured questionnaire. Data were processed in Epi-data 4.6 and exported to STATA 14 and Amos. Structural equation modeling was employed to estimate the relationship among variables. The total response rate was reported to be 100% (1426/1426). Out of the 1426 respondents, 50.60%, 68.79% and 65.68% were within the poor knowledge, attitude and practice respectively. In structural equation modeling, residence, income and educational level were not associated with mean score. As such, KAP about HBV among Tepi campus community was found to be very poor. In the end, proactive and sustainable efforts are needed among communities to reduce the disease burden caused by HBV.

Introduction

Infection associated with HBV is a potentially life-threatening liver infection and a vaccine-preventable infection caused by the HBV, which is a DNA virus classified in the virus family of Hepadnavirida^{1,2}. After the virus enters the human body, there is an incubation period on an average of 4 months until illness begins. During the acute phase, most of the persons show symptoms. However, during chronic phase, HBV usually progresses silently, with no symptoms at all during the first 10–20 year³. For some of the peoples, HBV infection becomes chronic. Developing chronic hepatitis B increases the risk of developing liver cancer, liver failure or cirrhosis a condition that permanently scars the liver. Most of the adults with HBV infection recover fully, even if the symptoms and signs are severe. Less than 5% of adult cases become chronically infected by the HBV. Unlike adults, infants and children are more likely to develop a chronic (long-lasting) HBV infection (in about 95%). If any persons are infected, taking certain precautions can help in reducing the spread of virus to other^{2,4}.

HBV can be prevented by vaccines that are safe, available, and effective². But there's no cure if you have the condition⁴. A safe and effective vaccine that offers 98–100% protection against hepatitis B is available¹. Thus, preventing HBV averts the development of complications including the development of chronic disease and liver cancer².

Viral hepatitis is a world public health problem affecting several individuals every year, causing disability and death around 300 million individuals chronically infected with hepatitis B virus (HBV) within the world. Approximately 786,000 people die from complications of HBV disease each year⁵. Globally, more than two billion people have been infected with HBV. Of these, about 1.5 million deaths occur from HBV

related liver diseases, and 350 million people remain infected chronically and become carriers of the virus, including hepatocellular carcinoma and end-stage cirrhosis each year. It was estimated that liver cancer represents approximately 4% of all new cancer cases diagnosed worldwide and that more than 50% of liver cancers were attributable to HBV⁶.

The prevalence of HBV infection varies widely, since 2012, the rates ranged from 0.9–1.1 per 100,000 populations in different parts of the world. The prevalence of HBV is less than one percent in Australia, North America and New Zealand, whereas in Japan it is 2–4%, while in China ranges from 5–18% but the Asian region its variable with the highest rates in Taiwan (15–20%)⁷.

Almost 8% of this global hepatitis B burden is in Sub-Saharan Africa, with over 80 000 new infections of HBV occurring each year. Prevalence of infection varies widely among HBV positive communities: more than 7.4% in Ethiopia, 8.54% in Kenya and 8.45% those in Uganda. About 3.5 million infected individuals and 9.5% in Senegal affected by HBV^{8, 9}.

In the study setting, teachers, students and administrative staff can play an important role in order to educate the overall community about HBV infections symptoms, prevention and vaccination. To implement an effective strategy, teachers, students and administrative staff should have a basic understanding of the disease and its various implications on the patients. Several studies suggest that health-related behaviors are affected by knowledge, attitude and practice^{10, 11}. However, there are no studies examining the KAP level of the Tepi campus community towards HBV infection in Mizan Tepi University. KAP related research have been widely implemented in public health and have been reported to be the most commonly used study tools in health-seeking behavior research¹².

KAP studies have been used to collect information on what the participants believe, know, and do in relation to a given topic^{8, 10, 12, 13}. The knowledge refers to the understanding of symptoms, treatment, and vaccine-related questions^{14, 15}. Attitude refers to their feelings towards this subject, preconceived ideas that they may have towards it, intention to a particular behavior^{13–15}. Practice refers to the ways in which they do their knowledge and attitude through their actions¹⁵. Therefore, the aim of this study was to examine the KAP towards HBV infection among Tepi campus community, which could help to inform the strategies for prevention and control of HBV infection in the developing country like Ethiopia which are in the widely affected zone of HBV due to lack of relevant information among communities. This work is the first approach to determine the KAP towards the HBV at community level especially in the developing country like Ethiopia, where infection associated with HBV are alarming.

Results

Socio-demographic Characteristics of the Participants

A total of 1426 participants with 100% response rate from the Tepi campus were enrolled during the study. The mean age was 26.99 years (SD = 6.155), and the median age was 26 (IQR: 18 to 49 years). The

educational status showed that 838 (58.58%) were attending graduate class while, 346 (18.26%) were post graduate holder. The majority of those participants were single 1362 (95.51%). In addition, 643 (45.09%) of them were found to be student (Table 1).

Table 1
Socio-demographic characteristics of the study participants from Tepi community, Mizan Tepi University, Ethiopia

Variable	Categories	Frequency	Percent (%)
Sex	Male	1279	89.69
	Female	147	10.31
Age	18–25	548	38.43
	26–35	750	52.59
	36–46	110	7.71
	46–49	18	1.26
Marital status	Single	1362	95.51
	Married	41	2.88
	Divorced	20	1.40
	Widowed	3	0.21
Occupation	Student	643	45.09
	Teacher	264	18.51
	Administrative	519	36.40
Educational status	Diploma and lower	272	19.07
	Undergraduate	838	58.53
	Postgraduate	346	18.26

Knowledge Related Characteristics towards HBV

Less than one fourth i.e. 228 (15.99%) of the study participants heard of a disease termed as hepatitis B. The majority of respondents i.e. 886 (62.02%) believed that HBV cannot cause liver cancer. Of the study participants, 540 (37.80%) were believed that early symptoms of Jaundice is one of the common symptoms of HBV infection. Study participants were asked to give their perception on about nausea; vomiting and loss of appetite are common symptom of HBV infection. Most of the participants i.e. 757 (53.09%) reported that they are symptom of HBV. 710 (49.79%) reported that HBV can be transmitted by unsafe sex and 844 (59.19%) suggest that no specific diet required for treatment (Table 2).

Table 2
Knowledge related characteristics of study participants towards HBV from Tepi community, Mizan Tepi University, Ethiopia

Variable	Categories	Frequency	Percent (%)
Have you heard of a disease termed as Hepatitis?	Yes	228	15.99
	No	1198	84.01
Is hepatitis B a viral disease?	Yes	543	61.92
	No	883	38.08
Can hepatitis B affect liver function?	Yes	540	37.87
	No	886	62.13
The early symptoms of Hepatitis B Jaundices one of the common symptoms of Hepatitis B?	Yes	539	37.80
	No	887	62.02
Are nausea, vomiting and loss of appetite common symptom of hepatitis B?	Yes	757	53.09
	No	669	46.91
Can Hepatitis B transmitted by unsterilized syringe needle and surgical instrument?	Yes	263	18.50
	No	1159	81.50
Can Hepatitis B transmitted by contaminated Blood and Blood product?	Yes	887	62.20
	No	539	37.79
Can Hepatitis B transmitted by unsafe sex?	Yes	710	49.79
	No	716	50.21
Can Hepatitis B transmitted by mother to child?	Yes	693	48.60
	No	733	51.40
Is Hepatitis B curable/treatable?	Yes	857	60.10
	No	569	39.90
Can Hepatitis B self-cured by body?	Yes	823	59.82
	No	573	40.18
Is vaccination available for Hepatitis B?	Yes	866	60.73
	No	560	39.27
Is specific diet required for treatment of Hepatitis B?	Yes	844	59.19
	No	582	40.81

Attitude related factors towards HBV

The majority of the respondent i.e. 786 (55.16%) believed that they can get infected with HBV. 640 (63.1%) respondents stated that they will not go to anywhere if they get infected with HBV, 256 (17.95%) worried isolation from the community. Whereas, 742 (47.72.6%) of them will referred to health facility as soon as they realized the symptoms of HBV (Table 3).

Table 3

Attitude related responses among participants towards HBV from Tepi community, Mizan Tepi University, Ethiopia

Variable	Categories	Frequency	Percent (%)
Do you think you can get Hepatitis B?	Yes	786	55.16
	No	639	44.84
What would be your reaction if you found that you have Hepatitis B?	Fear	107	7.5
	Shame	68	13.7
	Surprise	127	25.6
	Sadness	139	28
	Health facility	101	20.3
Do you have Hepatitis B?	Yes	562	39.41
	No	864	60.59
Who would you talk to about your illness?	Physician	142	28.6
	Spouse	355	71.4
What will you do if you think that you have symptoms of Hepatitis B?	Go to health	742	47.72
	Go to physician	285	18.09
	Not got any where	314	22.02
	Go to traditional healer	112	7.85
If you had symptoms of Hepatitis B, at what stage you will go to the health facility?	Own treatment fails	313	21.95
	3-4 weeks	300	21.04
	Soon as I	500	35.06
What worries you most if you will be diagnosed with Hepatitis B?	Fear of death	402	28.19
	Spread of family	256	17.95
	Cost of treatment	512	35.91
	Isolation	256	17.95

Practice related factors about HBV

Majority of the respondents, 873 (61.22%) had never screened for HBV and 869 (60.94%) stated that they got vaccinated against HBV. 828 (58.23%) and 989 (69.35%) never asked for a new syringe, screening of blood before transfusion respectively while, majority of the respondent 731 (51.26%) agreed with that they avoid meeting a person infected with HBV and majority of the study participants i.e. 768 (53.86%) were ready to go for further investigation and treatment if they are infected with HBV. In addition, a highest number of respondents i.e. 731 (51.33%) has never attended any educational program on HBV (Table 4).

Table 4
Practice related characteristics of study participants towards HBV from Tepi community, Mizan Tepi University, Ethiopia

Variable	Categories	Frequency	Percent (%)
Have you done screening for Hepatitis B?	Yes	553	38.78
	No	873	61.22
Have you got yourself vaccinated against Hepatitis B?	Yes	869	60.94
	No	557	39.06
Do you ask for a new syringe before use?	Yes	594	41.77
	No	828	58.23
Do you ask for screening of blood before transfusion?	Yes	437	30.65
	No	989	69.35
In case you are diagnosed with Hepatitis B, would you go for further investigation and treatment?	Yes	768	53.86
	No	658	46.14
Do you avoid meeting Hepatitis B patients?	Yes	695	48.74
	No	731	51.26
Have you ever participated in health education program related to Hepatitis B?	Yes	694	48.67
	No	732	51.33

Knowledge, Attitude and Practice related Factors towards HBV

Out of the 1426 participants, majority of the respondents i.e. 722 (50.60%) were within the poor knowledge range with the mean and SD level of 7.24 ± 2.83 whereas, 628 (44.06%) showed moderate knowledge about HBV. However, small number of participants has enough knowledge about HBV.

As shown in the Fig. 1, 936 (65.68%) of those participants with negative practice towards HBV, which was relatively higher percent when compared to having good practice and moderate level of practice. Those

with moderate level of practice participant's relatively possess higher percent when compared to having food level of practice.

Majority of the respondents respondent 981 (68.79%) were within the poor attitude towards HBV. Which is range with the mean and SD level of 2.51 ± 1.62 whereas, 628 (44.06%) showed moderate attitude about HBV. Still small number of participants has enough attitude towards HBV (Fig. 1).

In the fitted model (Fig. 1), the majority of path co-efficient in the diagram was statistically significantly at 5% level of significant. Accordingly, the model included exogenous variables like age and educational level, 12 knowledge related variables, 8 attitude related variables and practice related variables. 2 exogenous variables (age and educational level) were both indirectly and directly related with KAP via the mediator variables.

Test of the goodness of fit of the hypothetical model

The results of the analysis of the structural equation model produced using the study variables in the hypothetical model were as follows: goodness of fit test ($P < 0.05$, $df = 48$), CFI = 0.941, RMSEA = 0.042, NFI = 0.812, GFI = 0.901, RMR = 0.055, and PNFI = 0.42 (Table 5). All of the GFI indices indicated they are satisfied as shown in Table 5. Thus, the hypothesized model for KAP towards HBV had a good fit and is acceptable. The structural model between the socio-demographic factor and domain of knowledge, attitude and practices towards HBV is shown in Figure S3.

Table 5
Goodness of fit indices

χ^2/df	2.52	< 3
Comparative Fit Index (CFI)	0.941	> 0.90
Goodness of Fit Index (GFI)	0.902	> 0.90
Root Mean Square Error of Approximation (RMSEA)	0.042	< 0.10
Normed Fit Index (NFI)	0.812	> 0.90
Root Mean Square Residual (RMR)	0.054	< 0.08

Direction and Extent of Relationship between KAP

The direction and extent of relationships of knowledge and attitude towards HBV and their direct effects on the practices model is shown in Table 6. Knowledge about HBV has a positive and significant relationship ($\beta_1 = 0.0924$; $P = -0.33$ which is less than 0.05) with community practices towards HBV so we fail to reject hypothesis 1. The findings clearly indicate that knowledge about HBV directly affects practices of the community towards HBV. Based on the magnitude (i.e. $\beta_1 = -0.284$; $P > 0.05$) and direction (i.e. positive relationship) of the model, practices of the community towards HBV will possibly increase by 0.0924 units with each unit increase in knowledge. The second hypothesis postulates that attitude directly affects practices of the community towards HBV. HBV attitude and practice are sustained

as the SEM demonstrates a positive and significant relationship between the two variables ($\beta_1 = 0.22$; $P = 8.27 \times 10^{-10}$) (Table 6). There is an insignificant relationship between HBV knowledge and attitude in this study ($\beta_1 = 0.005$; $P > 0.05$) thus it is rejected as shown in Table 7.

Table 6

Indirect, direct and total effect of socio-demographic and KPA related factors towards HBV from Tepi community, Mizan Tepi University, Ethiopia

Characteristics Direct Effect (95% CI); Indirect effect (95% CI); Total Effect (95% CI)						
DV: Dependent Variable						
Practice 0 0 0						
Knowledge	0.092357	.0311023	2.97	0.003	.0313977	.1533163
Attitude	0.2200664	.0358771	6.13	0.000	.1497487	.2903842
DV Knowledge domain						
k15 0 0 0						
age <-	-0.0587092	.041706	-1.41	0.159	– .1404514	.023033
k1 <-	0.0337253	.023231	1.45	0.147	– .0118066	.0792572
k2 <-	0.044878	.0306862	1.46	0.144	– .0152658	.1050218
k3 <-	0.0148465	.030657	0.48	0.628	– .0452402	.0749332
k4 <-	0.0631882	.0307271	2.06	0.040	.0029642	.1234122
k5 <-	0.061363	.0317435	1.93	0.053	– .0008531	.1235792
k6 <-	0.011809	.0246036	0.48	0.631	– .0364132	.0600312
k7 <-	0.1994665	.0314384	6.34	0.000	.1378483	.2610846
k8 <-	0.0840375	.032469	2.59	0.010	.0203993	.1476756
k9 <-	0.1292775	.0326067	3.96	0.000	.0653695	.1931856
k10 <-	0.0638946	.0310156	2.06	0.039	.0031052	.1246841
k11 <-	0.1837986	.0317816	5.78	0.000	.1215077	.2460894
k13 <-	0.239089	.0313876	7.62	0.000	.1775704	.3006076
k14 <-	1.007177	.0323856	31.10	0.000	.9437023	1.070652
DV Practice domain						
P8 0 0 0						
P1 <-	0.1610399	.0330497	4.87	0.000	.0962637	.2258161
P2 <-	0.0586927	.0330442	1.78	0.076	– .0060727	.1234581
P3 <-	0.2239752	.0376417	5.95	0.000	.1501989	.2977516
P4 <-	0.0360087	.0305066	1.18	0.238	– .0237831	.0958004

Characteristics Direct Effect (95% CI); Indirect effect (95% CI); Total Effect (95% CI) DV: Dependent Variable
P5 <- 0.8959817 .0433106 20.69 0.000 .8110945 .9808688
P6 <- 0.1702566 .0355009 4.80 0.000 .1006761 .2398372
P7 <- 0.1015536 .0337613 3.01 0.003 .0353826 .1677246
DV Attitude domain
A1 0 0 0
edu<- -0.1324032 .0846813 -1.56 0.118 – .2983755 .0335691
A2 <- 0.0051662 .0188417 0.27 0.784 – .0317629 .0420953
A3 <- 1.150448 .0306181 37.57 0.000 1.090438 1.210459
A4 <- 0.0354706 .0397118 0.89 0.372 – .0423631 .1133043
A5 <- -0.0097031 .0294468 -0.33 0.742 – .0674177 .0480115
A6 <- 1.147406 .0307992 37.25 0.000 1.087041 1.207772
A7 <- 0.0061791 .0319373 0.19 0.847 – .0564169 .0687751

Table 7
Relationship among KAP towards HBV

Paths	Estimate	P value	Standard error
Knowledge → Practice	0.093	0.0034	0.031
Attitude → Practice	0.22	8.27e-10	0.032
Knowledge <→ Attitude	0.0095	0.0595	0.0294

Discussion

The current study evaluates the role of KAP towards HBV among Tepi campus community from Mizan Tepi University, Ethiopia. Results of the study revealed poor knowledge, attitude and practice towards HBV. The mean knowledge score was 7.24 ± 2.83 indicating low level of knowledge towards HBV and the mean attitude score was 2.51 ± 1.62 indicating negative attitude towards HBV. This lack of knowledge and attitude may influence the practice of the respondents towards interventions and prevention that could reduce the risk of disease transmission.

The results of the findings show that 50.06% of the respondents had poor knowledge, whereas, another study conducted in China in 2017 showed that 21% of participants were able to answer all the general knowledge-related questions correctly¹⁷. Similarly, a study conducted in Ghana showed that less than

half of the participants (46.2%) knew about HBV¹⁸. Moreover, a study conducted in the Buea Health District, Cameroon reported that less than 20% of the participants had good knowledge about HBV¹⁹. On the other hand, in a study conducted in Addis Ababa, below half of the respondent (39.2%) had adequate knowledge about HBV²⁰.

According to our result where measures towards HBV depend on whether people hear about hepatitis, only 15.99% of the respondents hear about HBV, 62.20% of respondents aware that HBV is can be transmitted by contaminated blood and blood products, 49.79% through unsafe sex, and 48.60% through vertical transmission (from mother to child during pregnancy) (Table 2). This is in line with a study conducted by ul Haq et al. from Pakistan²¹ and Bayuh from Addis Ababa, Ethiopia²⁰. Lack of knowledge about HBV transmission and prevention can be attributed in increasing the risk and the frequency of HBV in the population at all. This is particularly important in the view that adults in Tepi town have poor education on HBV virus transmission, prevention and available services despite radio talk shows among community can outreaches to overcome HBV outbreak. On contrary, a study conducted in Nigeria in 2015 showed that 72.9% of the respondents know that HBV transmitted from mother to child²² and a study conducted in Vietnam showed that 75.3% of the participants were aware that HBV is transmitted through unprotected sex²³. Condoms can act as major barrier for preventing sex transmitted diseases and hence, implying awareness campaign will help to promote condom use as a major preventive message for HBV prevention among communities^{23, 24}.

Results of our study predicted that, only 37.87% of our study participants believed that HBV can cause liver cancer; similarly, low level of knowledge was reported from Japan (18.5%)²⁴, from Pakistan (28.2%)²⁵ and from Gondar comprehensive specialized hospital, northwest Ethiopia, which is 28.5%²⁶. However, it contradicts findings of Wah et al. from China who found that 87% of the study participants believed that HBV can cause liver cancer¹⁷. Such lack of knowledge is considered to be serious since, it is one of the easiest ways of transmission of HBV²⁷.

In our study, 5.34% of the respondents had positive attitude towards HBV. Our study has very high difference with the studies conducted in Honiara, Solomon Islands (35.3%)²⁸ and a study conducted in Gondar comprehensive specialized hospital, Northwest Ethiopia²⁶. In addition, a study conducted in Bangladesh showed that 50% of study participants had positive attitude towards HBV²⁹. This difference may have been brought due to difference in study population, study design, population size and sampling technique.

According to our study, 5.45% of study participants had good practice. This is very lower than a study conducted in Honiara, Solomon Islands, which showed that 26.3% of study participants had good practice²⁸ and the study conducted in Gondar comprehensive specialized hospital, northwest Ethiopia¹³. But a high rate of good practice towards HBV was reported by Bayuh from Addis Ababa (42.7%)²⁰. In our study, 61.22% had not screened for HBV, while a study conducted in China in 2017 showed that 68.5% of study participants had not screened¹⁷. This differences was due to limited availability of healthcare, low

awareness towards the availability of vaccines, unknowing the importance of screening for HBV prevention and control, and educational status of the participant in Tepi town.

Area of residence, unable to read and write, and income were insignificantly associated with mean KAP scores. In contrast, the study conducted by ul Haq et al. from Pakistan²¹, Cheung et al. in 2005 among Chinese and South Asian Canadians³⁰, and Wu et al. in 2007 among Americans³¹. In contrast, reports from Addis Ababa, Ethiopia²⁰ and Guangdong Province, China¹⁷, showed that higher education level was associated with better knowledge and attitude scores.

Health workers play an important role in both public health and community health when it comes to combat the spread of HBV by spreading information on protective measures, such as vaccination and information about the transmission of the disease³². The supply of educated and informed health care workers is therefore crucial to minimize the consequences acquired through HBV infection.

In the end, the overall knowledge of the participants was found to be poor and their attitude and practice towards HBV were also limited. In this study, most of the participants had poor knowledge about the symptom, transmission and prevention of hepatitis B. Moreover, most were not vaccinated due to lack of knowledge about the presence of HBV vaccine in the study area. The KPA of HBV was not associated with any one of socio-demographic characteristics, suggesting that any effort to increase knowledge and attitude may improve individuals' negative practice towards HBV.

Inadequate knowledge is probably an important factor in HBV infection, 138 (60.8%) of the study participants were within the poor knowledge, since those with better knowledge were more likely to be tested for HBV. According to these findings there is a lack of understanding of the basics of infection prevention and control of transmission of HBV. The structural equation modeling showed a good fit on knowledge, attitude and practice about HBV. Within SEM, although respondents are generally having moderate knowledgeable about HBV, this translate directly into practices of HBV. And also, attitude has been identified as a significant factor in influencing practices of HBV. An insignificant relationship between knowledge and attitude suggests that the attributes affect practices of HBV independently. Good practices, good knowledge and good attitude toward HBV play a critical role in protecting individuals and households from HBV, contribute to an overall improved social and quality of life and reduce the incidence of HBV.

Methodology

Study Settings

An institution based cross-sectional study was conducted from October to December 2021 at Tepi campus of Mizan-Tepi University, Ethiopia which is approximately 611 km far from Addis Ababa towards southwest direction. The study place is located at a mean elevation of 1,097 meters above sea level at latitude of 7° 12' N and longitude of 35° 27'E (Figure S1). The study was conducted among Tepi campus

staff members, teachers and students who were settled one year and above in Tepi town. The campus has served more than 7 thousand people (staff members, teachers and students) and people of the neighboring city. The campus consists of college of natural and computational science, school of computing, engineering and technology and many more departments.

Study Population, Sample Size, and Sampling Technique.

All Tepi campus teachers, administrative staffs and one year and above students were referred for data collection throughout the study. The number of free parameters to be estimated excluding those factor loadings (path coefficients) fixed to unity 1, which is three in our case, there are 118 free parameters to be estimated such as all regression coefficients between observed exogenous variables or latent variables (54 in our case), all factor loadings on indicator variables except those paths fixed to 1 (27 in our case), all variances of independent variables (31 error variances in our case) and all covariance between independent variables (6 error covariance in our case) yielding a total of 118 parameters to be estimated. Thus, degree of freedom is calculated as number of available inputs minus number of free parameters to be estimated which is equal to $446 - 118 = 328$. This implies that the above model is structurally identified, specifically it is over-identified model. Using 1:10 ratio of respondents to free parameters to be estimated has been recommended¹⁶. Accordingly, considering the 118 free parameters to be estimated based on the hypothesized model, taking participants to free parameters ratio of 20 and a non-response rate of 10%, the required minimum sample size is estimated to be 1475.

Final sample size (n_f) = Effective sample size (n_o) / (1 - non response rate anticipated)

$$n_f = \frac{n_o}{(1 - \text{non response rate})}$$

$$n_f = \frac{1180}{(1 - 0.2)} = \frac{1180}{0.8}$$

$$n_f = 1475$$

Finally, total sample size allocates proportionally for Tepi campus community using stratification and simple random sampling technique was employed to withdraw samples from study population. Thus, studied sample size constitutes 783 students, 181 teachers and 462 administrative staffs which is in sum equal to 1426 samples. All methods followed were performed in accordance with the relevant guidelines and regulations as stated in the ethics form.

Data Collection Tool and Technique

Socio-demographic characteristics like sex, educational background, residence, age and occupation and other variables related to KAP like source of information, accessibility of health service, screening for HBV, availability of vaccine, and sharing of needles and blades were collected using a pretested structured questionnaire.

Data Quality control and Assurance

Initially a semi-structured questionnaire was prepared in English version, then translated into Amharic (local language) and translated back in to English by another person to check the consistence. Next, it was pre-tested for its accuracy, completeness, and consistency prior to actual collection on five percent of the sample population Tepi Campus. The questionnaire was rechecked by principal investigators for its completeness, accuracy and clarity of the collected data carefully and any error was addressed and resolved.

Data Analysis

The returned data were arranged and organized in to meaningful ways and data were coded and entered into Epi Data 4.6 statistical packages and then exported to STATA version 14. Categorical variables were calculated as percentages while, continuous variables were expressed as mean $\pm$ standard deviation. Reliability was also assessed for each domain of KPA using the Cronbach's α coefficient and values of 0.7 or higher were considered as satisfactory. The score of each domain of KPA was obtained by averaging their corresponding items for each participant. Knowledge was assessed by questions related with HBV, symptoms and sign, treatment and transmission. Each response was scored as "yes" or "no." The scoring range of the questionnaire was 1 to 15. A cutoff level ≤ 7.5 was considered poor whereas, >7.5 was quoted as adequate knowledge about HBV. Knowledge scores for individuals were measured and were added to give up the total knowledge score.

Practices towards HBV were assessed by asking 8 questions as listed in Table 4. Each question was labeled with good, moderate or poor practice. A score of 1 was given to good while, 0 was considered as bad practice with a score range of 0 to 8. The scale classified practice as positive with score > 4 and negative for ≤ 4 .

The Structural Equation Modeling (SEM) was employed to examine the relationship between various dependent and independent or mediating variables. Structural equation modeling (SEM) is a confirmatory, multivariate technique that looks at causal relationships between variables in a diagrammatic form. Because KPA and its domain were latent variables which constitute items with ordered responses, their measurement model was analyzed using SEM because multivariate normality assumption was satisfied¹⁶. The analysis was started with the hypothesized model (Figure S2) and

modification were performed iteratively by adding path links or including mediator variables, if theoretically supported and Root Mean Square Error (RMSE) as well as comparing the Comparative Fit Index (CFI) of approximation RMSE of each model fitted. Finally, an over identified model with value $RMSE < 0.05$ and $CFI \geq 0.95$ was retained. Diagrammatically, the effect of each exogenous or mediating variable on the respective dependent variable was represented by the path coefficient along with single headed arrow and the correlation among disturbances (residual errors that reflect the unexplained variances in the latent endogenous variables due to all unmeasured causes) was indicated by double arrows. When mediation of effects was present, the direct, indirect and total effects were determined using the non-linear combination of estimator technique. The final model (Figure S3) that fitted the data well and appeared theoretically meaningful was built by analyzing the hypothesized model (Figure S2) and inspecting iteratively the statistical significance of path coefficients and the relevance of relationships in the model.

Ethical Consideration

Ethical approval was obtained from Mizan Tepi university institutional review board. Permission was obtained from the Tepi campus, Mizan Tep University, Ethiopia. The reason for conducting and importance of the study was explained to each study participant. Written consent was obtained from all the participants. Apart from these, all respondents were asked to fill out the questionnaire. To adequate the confidentiality of participant's information and knowledge, anonymous typing was used whereby, names of the participants and any other identifiers were excluded from the questionnaire. All the data gathered were stored in the computer through secured password. Only principle investigator and research members are permitted to access the data throughout the work.

Operational Definition

Knowledge: Information stored in memory assessed in terms of what the participants know about HBV.

Knowledgeable: Study participants who correctly answered greater than or equal to 70% of knowledge-related questions.

Not knowledgeable: Study participants who answered less than 70% of knowledge-related questions.

Attitude: Complex interaction of beliefs, feelings and values to respond in a manner towards HBV.

Positive attitude: Study participants who answered correctly greater than or equal to 70% of the attitude-related questions about HBV.

Negative attitude: Study participant who answered less than 70% of the attitude-related questions about HBV.

Practice: What the respondents actually practice for prevention and control of HBV.

Data availability

All data generated or analysed throughout the study is fully available in this article. However, complete dataset can be accessed from corresponding author upon reasonable request.

Declarations

Author contributions

Concept, designing and coordinating the research: STH, NMC, MMG; Conducted the study and analyzed the data: SSJ, BDA, MMG; Questionnaire design and analysis: MMG, NMA; Manuscript drafting: STH, MMG, NMA; Review and editing: NMC; All authors read and finally agree to approve the manuscript.

Competing of Interests

The Authors states that they don't have any conflict of interest.

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Figures

Figure 1

Fitted model for KAP towards HBV. A: Knowledge related factors; B: Attitude related factors; C: Practice related factors

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