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Exploring Disease Manifestations and Influencing Factors in Acute and Chronic Hepatitis B

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Abstract

Scope and Aims: The investigation into disease manifestations and influencing factors of both acute hepatitis B (AHB) and chronic hepatitis B (CHB) is relatively limited and with varied results. This study was to investigate the influencing factors and disease manifestations of AHB and CHB in a Ghanaian population, in order to come out with a control strategy. **Methods**: A retrospective study was conducted on 569 admitted hepatitis B cases. Demographic data and disease manifestations were compared between AHB and CHB patients. **Results**: There was a significant difference in median age as well as hospitalization duration for AHB and CHB patients. The variations in age, gender, educational level and occupational distributions between AHB and CHB patients were statistically significant ($P < 0.05$). Fever, nausea, polydipsia, palpitation, anicteric, anorexia, itching were less common ($P < 0.05$), abdominal, jaundice and enlarged liver was more frequent ($P < 0.05$), aspartate aminotransferase, viral load, bilirubin, prothrombin time, partial thromboplastin time, HBeAg, albumin, abdominal ultrasound, globin levels were significantly higher ($P < 0.05$), and HBsAg

and liver function test levels were significantly lower ($P < 0.05$) in CHB patients than in AHB patients. Logistic regression revealed that age, gender, occupation, educational level, and hospitalization duration were the influencing factors. **Conclusion**: The males, as well as the adult population, constituted a higher percentage of CHB patients with a significant association of higher prevalence of clinical and laboratory characteristics. Age, gender, occupation, educational level and hospitalization duration were established as influencing factors.

Keywords: Acute hepatitis B, chronic hepatitis B, disease manifestations, control strategy, logistics regression

Introduction

Hepatitis B (HB) is a human viral infectious disease that can manifest in either acute or chronic communicable disease and result into global health problem. It is estimated that between 500,000 to 1.2 million people die every year as a result of chronic hepatitis, cirrhosis and hepatocellular carcinoma (Lavanchy et al., 2004). Hepatitis B is an inflammation of the liver, caused by the HB virus (HBV). The virus is spread through contact with infected body fluids, for instance by insecure sexual contact, blood transfusion, mother to child at birth, cut wounds and use of contaminated needles (RIVM, 2013). When the virus is deposited on a surface, it can stay infectious for about a week (WHO, 2002). In developing countries with a greater number of HB infections, for example in Sub Saharan Africa and East Asia, the commonest transmission routes are from mother to child during birth and person to person during childhood. In the countries with high standard of living, including Western Europe and North America, the transmission is mostly due to insecure sexual contacts and injection by drug users (WHO, 2013). There are several clinical stages involved in the infection of hepatitis B; the time between infection and symptoms onset, incubation time and initial viral dose takes about 6 to 26 weeks (RIVM, 2013).

Acute hepatitis B (AHB) can manifest with the following symptoms; tiredness, fever, joint complaints, and jaundice or acute infection with mild or even without any symptom (RIVM, 2013). Almost two-thirds of patients infected with HB virus will have an asymptomatic acute infection and AHB average time of infection is three to four months (van Ballegooijen et al, 2009) and afterwards, most patients recover and obtain lifetime immunity. About one percent (1%) of patients with acute infection develop fulminant hepatitis, unexpected but extremely infectious, which often results in death (van de Laar et al, 2000). Chronic hepatitis B (CHB) develops when there is a persistent acute infection for over six months. This is believed to happen in five percent (5%) of all cases (van de Laar et al, 2000), although a recent

study (van Houdt et al, 2012) has suggested 23% and 28% for the male to male sex and drug-users respectively. 25 to 35% of patients who are infected chronically develop cirrhosis and eventually, result in an early death for 15-25% of the patients (RIVM, 2013). The likelihood that an acute infection develops to chronic carriers differs between patients, based on their age, immune status, and gender. Again, asymptomatic acute infection is more likely to develop a chronic infection. 70 to 90% new-borns who are infected become chronically infected with 25 to 50% for children under five years and 5 to 10% for older children and adults. Additionally, the possibility of developing a chronic infection is six times higher for men than for women. For acutely infected patients with less immunity, the virus replication continues and results in the chronic carrier. In such cases, the virus replication is increased but the severity of the infection is less (van de Laar et al, 2000). The possibility of manifestation of the infections in HB patients is sometimes predictable by certain changes in laboratory features (Kumar et al, 2008). Preventing, controlling and treating the HB infection and its complications in patients call for programs and strategies to be put in place to curb HB from spreading. Though the aim of treating patients with CHB is to increase life satisfaction, the quality of life in patients, especially patients treated with interferon, is often lower than normal, and such patients suffer from fatigue, loss of self-esteem, and inability to perform daily activities (Asadi Noghabi et al, 2010). Several studies have assessed the risk factors of HB in different groups of the population and their role in the progression of the disease and its consequences. Features vary among people and the incidence rate of severe complications of the disease is sometimes associated with the clinical and laboratory manifestations of the patients (Kumar et al, 2008; Salimi et al, 2014).

The prevalence of Hepatitis B in Ghana is high (Averhoff et al., 2016; Howell et al, 2014) and needs greater public health consideration (Mkandawire et al, 2013; Owusu-Ansah, 2014). Ghana is considered to be part of the areas of the world in which the prevalence of chronic HBV infection is high (Averhoff, 2016; Howell et al, 2014). Indeed, some studies have indicated the prevalence rate of HBV in Ghana to be 10–15 % (GhanaWeb, 2013; Teye, 2015) whiles other studies have also estimated the HBV prevalence rate of 6.7% to 11% among blood donors (Dongdem et al, 2012; Walana et al, 2014), 6.4% among pregnant women (Acquaye et al, 1994) and 15.6% among children in the general population (Martinson et al, 1996). A three-year retrospective study conducted among 3402 blood donors showed an overall seroprevalence of HB surface antigen of 9.6% (Walana et al, 2014). Currently, no study has looked at the influencing factors and disease manifestations on both AHB and CHB patients for a control strategy in the study area. This study, therefore, investigates the influencing factors

and disease manifestations of AHB and CHB in a Ghanaian population, in order to come out with a control strategy.

Methods and Results

Patients

This eight-year retrospective study recruited 569 patients with HB cases from Tamale Teaching Hospital, Ghana. Patients who had tested positive for HBV and had developed into either acute or chronic infections were included in this study. Patients who were diagnosed with liver disease or any other disease other than hepatitis B, such as hepatitis C and autoimmune hepatitis were excluded. The required demographic data on HB were searched from patients' folders at the hospital. This study sought to categorize occupations into children, students, traders, fishermen/farmers, housewives, businessmen, professionals (teachers, health professionals, etc.) and others (unskilled labour, unemployed, etc.). The outcome of the HB at the hospital was based on whether the patient was discharged or died. This study also classified educational levels into illiterate (none), primary, junior high school (JHS), senior high school including technical/vocational (SHS) and tertiary. The hospitalization duration was noted as the date the patient was admitted and eventually discharged or died at the hospital. The hospital approved this study and since data were analysed and reported anonymously, there was no need to request the consent of the participants involved.

Collection of Clinical and laboratory data

Qualified medical doctors (gastroenterologist) reviewed and extracted clinical and laboratory features from patients' records. The American Association for the Study of Liver Disease (AASLD) practice guidelines regarding the diagnostic criteria were followed in order to determine the disease manifestations of the patients (AASLD, 2011). Clinical manifestations such as jaundice, enlarged liver, variceal bleed, abdominal pain, icterus, portal hypertension, anicteric, constipation, dark stool, fatigue, nausea, fever, anorexia, itching, palpitation, polyuria, and polydipsia were selected for this study. Laboratory manifestations were revealed mainly through the following; liver function test (LFT), renal function test (RFT), abdominal ultrasound test (USG), aspartate aminotransferase (AST) test, alanine aminotransferase (ALT) test, Viral load (HBV DNA- using Polymerase Chain Reaction) test, Hepatitis B surface antigen (HBsAg) test, hepatitis B e-antigen (HBeAg) test and lipid profile. The laboratory features were recorded as AST, ALT, prothrombin time (PT), partial thromboplastin time (PTT), bilirubin, globulin, albumin, hemoglobin, abdominal USG, RFT, LFT, HBsAg, HBeAg, viral load (HBV DNA) concentration and total cholesterol.

Statistical analysis

SPSS version 21 was used to analyze the data. Continuous variables were described as median with inter-quartile range (median (IQR)) for skewed distributions. Categorical variables were also indicated in percentages. Comparisons between continuous variables were conducted using the Student's t-test or independent-samples Mann-Whitney U test. Chi-square test or fisher's exact test and Spearman correlation were used for the categorical variables. Binary logistic regression was used to find out the influencing factors of HB diagnosis and the results recorded. The odds ratio of each related factor was assessed. The clinical and laboratory features as well as demographic characteristics were compared between AHB and CHB patients. $P < 0.05$ was used to indicate the significance level.

Results

A total of 569 patients were diagnosed with the majority being AHB representing 355(62.4%) and a little above one third (214(37.6%)) constituting CHB patients. A greater number of patients 455(80%), who visited the hospital facility with HB cases within the study period were discharged leaving 114(20%) dead at the facility. Most of the patients 204(35.9%) who presented cases of HB to the Tamale Teaching Hospital were farmers/fishermen. Persons belonging to the business community recorded fewer cases of 11(1.9%). HB cases were high 388(68.2) among patients without formal education but fewer among patients with at least primary to tertiary education (31.8%). The Northern region registered the highest number of patients 470(82.6%) who visited the facility. Hardly did the hospital receive HB patients from Oti region 2(0.4%) (Table 1).

Variables	Frequency (%)
Disease Outcome	
Dead	114(20)
Discharge	455(80)
Hepatitis Diagnosis	
Acute	355(62.4)
Chronic	214(37.6)
Educational level	
None	388(68.2)
Primary	38(6.7)
JHS	17(3.0)
SHS	44(7.7)
tertiary	82(14.4)
Occupation	
Child	34(6.0)

Student	67(11.8)
Trader/stop attendant	70(12.3)
Fishermen/Farmer	204(35.9)
House wife	19()3.3
Businessman	11(1.9)
Professional	72(12.7)
Others	92(16.2)
Residence(region)	
Northern	470(82.6)
Savanna	31(5.4)
Upper East	41(7.2)
Upper West	6(1.1)
North East	19(3.3)
Oti	2(0.4)

There was a significant difference in median age for acute and chronic patients (32 (24, 42) vs. 35 (28, 45) years, ($P < 0.05$). The hospitalization duration was also significant between acute (6(4,9)) and chronic (7(4,11)) HB patients. It implied that the chronic HB patients spent more days at the hospital than the acute patients. The variations in age distribution between the acute and chronic patients were statistically significant (*P<0.05*). The majority of the chronic HB patients were males (89.3%), however, females constituted the highest acute HB patients. More CHB patients (25.2%) died compared to the AHB, though, majority of the AHB (83.1%) patients were discharged from the hospital. A higher number of acute HB patients had primary, JHS and no education but less number for SHS and tertiary education compared to the CHB patients ($P < 0.05$). There were more chronic HB patients as students, traders, businessmen, professionals, and others but less as children, fishermen/farmers, and housewives compared to the acute. Most acute HB patients lived in the Northern region (84.4%), meanwhile, both acute and chronic HB patients hardly came from Oti region. The demographic characteristics of the two groups are summarized in Table 2.

Table 2: Demographic features on disease diagnosis

Variables	Hepatitis B Diagnosis		*P*-value
	Acute (%)	Chronic (%)	
Age(years)			0.005*
< 5	12(3.4)	1(0.5)	
5 to < 15	22(6.2)	3(1.4)	
15 to < 50	267(75.2)	175(81.8)	
50 and above	54(15.2)	35(16.4)	
Gender			0.005*
Female	70(19.7)	23(10.7)	

Male	285(80.3)	191(89.3)	
Hospitality duration	6(4,9)	7(4,11)	0.003*
Disease Outcome			0.016*
Dead	60(16.9)	54(25.2)	
Discharge	295(83.1)	160(74.8)	
Educational level			0.000*
None	256(72.1)	132(61.7)	
Primary	24(6.8)	14(6.5)	
JHS	12(3.4)	5(2.3)	
SHS	12(3.4)	32(15.0)	
tertiary	51(14.4)	31(14.5)	
Occupation			0.000*
Child	30(8.5)	4(1.9)	
Student	41(11.5)	26(12.1)	
Trader/stop attendant	43(12.1)	27(12.6)	
Fishermen/Farmer	138(38.9)	66(30.8)	
Housewife	16(4.5)	3(1.4)	
Businessman	4(1.1)	7(3.3)	
Professional	44(12.4)	28(13.1)	
Others	39(11.0)	53(24.8)	
Residence(region)			0.603
Northern	301(84.8)	169(79.0)	
Savanna	16(4.5)	15(7.0)	
Upper East	24(6.8)	17(7.9)	
Upper West	3(0.8)	3(1.4)	
North East	10(2.8)	9(4.2)	
Oti	1(0.3)	1(0.5)	

*Indicates significant association ($p<0.05$); JHS, junior high school; SHS, Senior high school

Fever, nausea, polydipsia, palpitation, anicteric, anorexia and itching were less frequent, while, abdominal pain, jaundice and enlarged liver were more frequent in chronic HB than in acute HB patients. No significant differences were observed in the other clinical features between AHB and CHB patients ($P > 0.05$). The AST, viral load, bilirubin, PT, PTT, and HBeAg levels were significantly higher in chronic HB than in acute HB patients. Serum albumin, abdominal USG, and globin were lower but LFT and HBsAg were higher in AHB than in CHB patients ($P < 0.05$). ALT, haemoglobin, RFT and total cholesterol levels were similar between AHB and CHB patients ($P > 0.05$). The prevalence of fever, nausea, polydipsia, palpitation, anicteric, anorexia, and itching correlated negatively with disease diagnosis (all r_s= negative, $P < 0.05$) but abdominal pain, jaundice and enlarged liver correlated positively (all r_s= positive, $P < 0.05$). AST, viral load, HBeAg, PT, PTT, bilirubin, albumin, abdominal USG, and globulin also correlated positively (all r_s= positive, $P < 0.05$) with disease diagnosis whereas HBsAg and LFT correlated negatively (all r_s= negative, $P < 0.05$) with disease diagnosis. There was no significant difference in the other

laboratory or clinical characteristics between acute and chronic HB patients ($P > 0.05$). Clinical and laboratory characteristics of HB diagnosis are detailed in Table 3.

Table 3: Comparison of clinical and laboratory characteristics and disease diagnosis

Disease manifestations	Disease Diagnosis		*p*	r_s value
	Acute (%)	Chronic (%)		
Abdominal Pain	292(82.3)	206(96.3)	0.000*	0.205*
Jaundice	275(77.5)	198(90.2)	0.000*	0.161*
Fever	76(21.4)	23(10.7)	0.001*	-0.136*
Nausea	50(14.1)	12(5.6)	0.002*	-0.132*
Constipation	30(8.5)	13(6.1)	0.299	NS
Vericeal bleed	34(9.6)	32(15.0)	0.052	NS
Icterus	32(9.0)	28(13.1)	0.126	NS
Enlarge Liver	38(10.7)	44(20.6)	0.001*	0.136*
Polyuria	29(8.2)	12(5.6)	0.252	NS
Fatigue	18(5.1)	15(7.0)	0.338	NS
Polydipsia	13(3.7)	2(0.9)	0.049*	-0.082*
Palpitation	19(5.4)	4(1.9)	0.041*	-0.086*
Anicteric	13(3.7)	2(0.9)	0.049*	-0.082*
Anorexia	19(5.4)	2(0.9)	0.007*	-0.114*
Dark stool	24(6.8)	7(3.3)	0.076	NS
Portal Hypertension	14(3.9)	4(1.9)	0.171	NS
Itching	19(5.4)	2(0.9)	0.007*	-0.114*
High AST	108(30.4)	116(54.2)	0.000*	0.236*
High ALT	202(56.9)	128(59.8)	0.495	NS
Viral Load	8(2.3)	28(13.1)	0.000*	0.216*
HBeAg	3(0.8)	97(45.3)	0.000*	0.566*
HBsAg	65(18.3)	13(6.1)	0.000*	-0.172*
PT	285(80.3)	199(93.0)	0.000*	0.173*
PTT	285(80.3)	199(93.3)	0.000*	0.173*
High Bilirubin	269(75.8)	194(90.7)	0.000*	0.185*
Low albumin	264(74.4)	193(90.2)	0.000*	0.193*
Low haemoglobin	90(25.4)	62(29.0)	0.344	NS
Abdominal USG	41(11.5)	56(26.2)	0.000*	0.188*
Low globulin	74(20.8)	77(36.0)	0.000*	0.166*
RFT	38(10.7)	18(8.4)	0.374	NS
Total Cholesterol	25(7.0)	17(7.9)	0.690	NS
LFT	10(2.8)	0(0)	0.016*	-0.104*

*Indicates significant association ($p<0.05$); NS, not significant; HB, hepatitis; r_s, correlation coefficient; RFT, renal function test; LFT, liver function test; HBsAg, Hepatitis B surface antigen; HBeAg, hepatitis B e-antigen; AST, aspartate aminotransferase; ALT, alanine aminotransferase; PT, prothrombin time; PTT, partial thromboplastin time.

Influencing factors of acute and chronic HB

Logistic regression was conducted to ascertain the influential factors associated with the diagnosis of HB. The findings revealed that with an additional one year increase in age, patients (OR= 1.017, CI= 1.001, 1.032; $P < 0.05$) were more likely to be diagnosed with chronic HB. When compared

to the female patients, the males (OR= 2.043, CI= 1.114, 3.747; $P < 0.05$) were twice more likely to be diagnosed with chronic HB. Comparison made to patients who were children revealed that, traders (OR= 4.412, CI= 1.102, 17.661; $P < 0.05$) and others (OR= 9.787, CI= 2.530, 37.858; $P < 0.05$) were four and nearly ten times likely to have chronic HB respectively. Primary (OR= 2.834, CI= 1.195, 6.724; $P < 0.05$) and SHS (OR= 8.773, CI= 3.337, 23.063; $P < 0.05$) level of education were respectively nearly three and nine times more likely to be diagnosed with chronic HB when compared with patients with no education. The study also established that if the hospitalization duration was increased by a day, patients (OR= 1.040, CI= 1.010, 1.072; $P < 0.05$) were more likely to be diagnosed with CHB than the AHB. It was found that age, gender (male), occupation (traders & others), educational level (primary & SHS) and hospitalization duration were influential factors of HB diagnosis (all $P < 0.05$).

Discussion

Hepatitis B disease is a major public health problem that may degenerate into chronic liver disease, cirrhosis, and hepatocellular carcinoma (Deny et al, 2010). Largely, exposure to HBV can cause a broad spectrum of infections. About 90 to 95% of HBV infection in adults, progresses to acute infection after that viral clearance, whiles 5 to 10% advances into chronic infection (He et al 2006; Ganem et al 2004; Rehermann et al, 2005). A study that is conducted with a sample representation of adults and children of both sexes shows a significantly higher proportion of old age rather than younger individuals develop the clinical disease with a relationship stronger in females. Children under 5 years representing 9.5%, apparently, develop clinical hepatitis after acute infection with HBV, as compare to 33.3% for adults who are greater or equal to 30 years (McMahon et al, 1985). In this study, it provides similar findings that the age distribution is significant and more of the acute HB patients are females as well as children suffering less with respect to chronic HB. This study realizes most of the disease manifestations associated with HB diagnosis. It is also found that fever, nausea, polydipsia, palpitation, anicteric, anorexia, and itching are less frequent while abdominal pain, jaundice and enlarged liver are more frequent in chronic HB than in acute HB patients. A study in agreement with our finding is conducted on acute HB for pregnant and non-pregnant patients and fever is found to be associated with HB whereas the presence of fatigue is similar between the two groups (Han et al, 2014). On the contrary, (Nazarnezhad et al, 2018) establishes no significant association for fever and HB. Our study also establishes AST, viral load, bilirubin, PT, PTT, and HBeAg levels as significantly higher in chronic HB than in acute HB patients. Serum albumin, abdominal USG, and globin are lower but LFT and

HBsAg are higher in acute HB than in chronic HB patients. Contrary to this study by (Hugo et al. 2018) no HBsAg is detected, indicating no acute or chronic infection. A study that is conducted by (Sali et al, 2013) agrees with our investigation that AST is higher in CHB, but in the case of ALT higher in CHB, disagrees with our study which reveals that ALT, haemoglobin, RFT and total cholesterol levels are similar between AHB and CHB patients. Another study is conducted by (Han et al, 2014) seeks to have varied findings with our study in respect to HBsAg and AST levels in non-pregnant patients with the exception of serum bilirubin levels which indicated similar results to our study. In line with our study, (Nazarnezhad et al, 2018) reveals that AST and PT are significant, however, not significant with ALT and total cholesterol in CHB. Again, our findings disagree with (Nazarnezhad et al, 2018) who establishes that haemoglobin levels are significant whereas PTT levels are not significant in CHB. Increased serum ALT levels or symptoms reflect the T-cell-mediated HBV-specific immune response (Ratnam et al, 2008). The insignificant clinical symptoms and relatively low levels of laboratory parameters in AHB or CHB patients may indicate that specific immunity in patients differs. However, according to current acute hepatitis B investigative guidelines, patients with HBV DNA-positive or HBsAg-positive are considered confirm chronic carriers and may be counselled accordingly (CDCP, 2005).

Our study also indicated that the prevalence of fever, nausea, polydipsia, palpitation, anicteric, anorexia, and itching correlated negatively with disease diagnosis but abdominal pain, jaundice and enlarge-liver correlated positively. Nazarnezhad et al. revealed a similar finding to our study by establishing a significant association of Anorexia, nausea, enlarged liver and jaundice with HB patients. Again, AST, viral load, HBeAg, PT, PTT, bilirubin, albumin, abdominal USG, and globulin correlate positively with disease diagnosis whereas HBsAg and LFT correlate negatively with disease diagnosis. A study that is conducted by (Keshvari et al, 2015) shows a similar finding to our study that HBV DNA and HBsAg correlate significantly with CHB patients as well as (Li et al, 2018) with a significant correlation of ALT in CHB patients. However, (Keshvari et al, 2015) and (Li et al, 2018) in another breath reveal a contradictory finding to this study that bilirubin and AST levels do not significantly correlate with CHB patients.

Binary Logistic regression in this study reveals that age, gender, occupation, educational level, and hospitalization duration are the influencing factors of HB diagnosis. Some studies (Alavian et al, 2012; Gheorghe et al, 2013; Khan et al, 2011) reveal a similar finding to this study that age is a factor of HB prevalence even though a study by (Yang et al, 2017) finds age as not a significant factor. Considering gender as a factor, previous studies (Behal et al 2008; Deng et al, 2013; Khan et al, 2011;

Ochola et al, 2013; Ozer et al, 2011) show similar findings that the prevalence is higher in males than in females, while other studies (Alavian et al, 2012; Yang et al, 2017) reveal contradictory results to this study. Even though some studies (Janahi et al, 2014; Khosravani et al, 2012; Yang et al, 2017) establish dissimilar findings with this study that educational level is not an independent influencing factor of HB, this study indicates educational level as a significant factor with very interesting revelations. There is a decreasing HB prevalence with increasing education level. In other words, patients with a higher educational level have lower hepatitis B prevalence. One possible explanation is that among the higher-educated population there is better awareness of infectious disease prevention and a higher acceptance of vaccination since at least a college education is an important predictor of vaccine completion (Hur et al, 2012). The majority (2/3) of the patients have no level of education, which means that methods of raising awareness must be simplified to the very understanding of the general public, especially for people with no education and lower levels of education, as they are more prone to the disease. In line with this study, (Yang et al, 2017) reveals that occupation is a significant factor of HB. Again, there must be public health concerns over the high incidence of HB in the farming/fishing community since the majority of the patients are farmers/fishermen. The discrepancies in these studies may be accounted for by genetic differences, sociodemographic, variations in study design, relatively low sample size, environmental factors and lack of standardization of patients' selection. From all indications, this study is the first of its kind in the study area that has reviewed influencing factors and disease manifestations on AHB and CHB patients for a control strategy. However, this study has limitations. Firstly, data collection was done in retrospect and there might be a certainty of recall bias. Secondly, some patients are excluded from this study due to insufficient data. Finally, since data is collected in only one Teaching Hospital, it might not be a fair representation of the entire population.

Conclusions

This study revealed that males as well as adults constitute a higher percentage of patients with CHB and also spent more days on admission. It was established that AHB patients were mostly uneducated and very dominant in the farming/fishing community. Even though a significant number of disease manifestations were associated with CHB patients, laboratory features were predominantly associated with CHB patients while also a greater number of clinical features were significantly associated with AHB patients. Age, gender, occupation, educational level, and hospitalization duration were established as the influencing factors of HB in the study. It is satisfying to note that the findings of this study can be used to

create clinical management and awareness programs for hospitals and the public respectively. Hepatitis B education targeted at the uneducated population may be considered as a potential strategy for preventing the menace. A further study may look at clinical and basic studies in order to validate the findings and also explain the fundamental mechanisms.

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