Risk Factors for Hepatitis B Virus Transmission in Oman

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Abstract

Objectives: Hepatitis B virus (HBV) is a major public health problem worldwide. The prevalence of HBV is dependent on the modes of transmission. Chronic hepatitis B infection (CHB) can progress to liver cirrhosis and hepatocellular carcinoma (HCC). Oman is regarded as an intermediate endemicity region and has had a neonatal vaccine against HBV since 1990; however, little research has been conducted regarding risk factors for HBV transmission. This study aimed to identify the prevalence of major risk factors for acquiring HBV in Oman.

Methods: This is a retrospective chart review of all adult Omani patients diagnosed with CHB at two tertiary hospitals in Oman, Sultan Qaboos University Hospital and Armed Forces Hospital between Feb 2009 and July 2013. The prevalence of major risk factors was identified by interviewing CHB patients using a standard questionnaire during their follow-up visits to the hepatology clinic at both hospitals. The risk factor frequency was stratified by age, gender, and educational level.

Results: A total of 274 patients were interviewed. Males were 52.2% of the participants. The median age for men was 35.9 years and for women 35.1 years with 75.5% of them in the age range of 20–39 years. The antenatal screening was the most common means of identifying HBV infection in females and pre-blood donation screening was the most common in males. Intra-familial contact with HBV infected persons and behavioral risks such as body piercing

(females) and barber shaving (males) were more common compared to nosocomial risk factors. Knowledge about HBV infection was scarce among our participants. More than half of the participants had a positive family history of HBV infection. There was a significant association between HBV infection and age groups, and educational levels ($P < 0.05$ and $P < 0.001$ respectively). Among those who were infected due to intra-familial contact or behavioral risk, there was a significant difference between the two genders ($P < 0.02$) and between the three age groups (<23, 24-28, >28) of HBV positive mothers (33.3% 14.3%, 6.6% respectively, $P < 0.05$). There was also a statistically significant difference among different educational levels ($P < 0.05$).

Conclusions: Direct contact of infected individuals within a family and exposure to high-risk behaviors such as piercing and barber shaving are the main reported risk factors for HBV infection in Omani patients. Reducing the vertical and horizontal transmission of HBV in Oman could be improved by the implementation of routine antenatal screening of pregnant women and a greater focus on contact screening respectively.

Keywords: *Hepatitis B, Transmission, risk factors, Oman*

Introduction

Chronic hepatitis B infection (CHB) is a major global health problem worldwide with an estimated prevalence of 3.9% corresponding to approximately 292 million infected people.[1] HBV can cause acute and chronic liver disease including cirrhosis and hepatocellular carcinoma (HCC). Worldwide, CHB is responsible for 60–80% of the cases of HCC.[2] In 2015, an estimated 887,000 deaths worldwide occurred due to HBV infection.[3] There are no clear data about the true prevalence of CHB in Oman however it is estimated to be an intermediate prevalence (2–7%).[4,5]

HBV is mainly transmitted via blood and body fluids. The risk of transmitting the virus depends mainly on the viral load.[6] HBV transmission risk factors show substantial variation globally. Vertical transmission is the most common mode of transmission in high endemicity regions like South Asia, which is responsible for most cases of CHB. Intermediate endemicity of hepatitis B in areas such as the Middle East is attributed to early horizontal transmission of the virus in children of preschool age.[7] Other common modes of transmission (late horizontal transmission) include unsafe medical settings, sexual contact (heterosexual or homosexual),

and intravenous drug use (IDU).[8] Less common risk factors that are thought to contribute to the transmission of HBV include shaving with a barber, tattooing, piercing, and acupuncture. The significance of these practices in spreading the disease has been minimally investigated. Studies from the Middle East showed barbers had low to moderate awareness that hepatitis can be transmitted by contaminated razors, 46% of shaves were done with reused razors, HBV DNA was detected in 6.6% of used razor blades and cuts from barbershops are associated with HBV transmission with an odds ratio of 4.74.[9-12] As for tattooing, in a cross-sectional study in Iran, tattooing was found to be an independent risk factor for being chronically infected with HBV.[13] A recent study from Oman by Alnaamani et al, reported a positive family history of HBV, traditional cautery (*wasm*), body piercing(s), surgery(ies), and blood transfusion(s) in 70%, 65%, 40%, 18.2% and 4.5% of patients respectively.[5]

Certain risk factors for HBV transmission are identified which include hepatitis B surface antigen (HBsAg) and e-antigen (HBeAg) positivity and high maternal HBV viral load.

Research to determine the major risk factors for transmitting HBV in Oman has been lacking. This study was conducted to determine the prevalence of major risk factors for acquiring HBV among Omani patients positive for HBsAg. As there has not been a control group in this study, it is not possible to assess the causative role of risk factors for HBV acquisition in Oman. However, the results of this study will provide a further understanding of the epidemiology of HBV in Oman and it will aid in identifying the people who are at higher risk of acquiring this infection.

Methods

Patients:

All patients were recruited from adult hepatology clinics at Sultan Qaboos University Hospital and Armed Force Hospital, Oman during the period from February 2013 till July 2013. The ethical approval was taken from the ethics committees in both hospitals. The patients were interviewed by a trained interviewer either through a face to face interview during their clinic visits or through a telephone interview. The study was explained to the patients and consent was obtained before starting the interview. All Omani patients with positive HBsAg aged 13 years and above were included. Non-Omani patients and patients with incomplete questionnaires were excluded from the study.

The questionnaire:

Data was collected using a two-page questionnaire recording patients' demographic characteristics such as age, gender, marital status, educational level, and occupation. Participants were also questioned about their immunization history and their frequency of exposure to identified and potential risk factors for HBV transmission before their date of diagnosis. Those risk factors included a history of hospitalization, major surgeries, organ transplantation, blood transfusion, endoscopy, hemodialysis, chemotherapy, dental visits, and contact with infected people.

The questionnaire was derived from known and suggested risk factors in international literature. Each interview took five to 15 minutes and patients were given the chance to ask any questions before and after finishing the questionnaire.

Demographic variables

Participants were grouped into three different age groups depending on the year of introduction of the HBV immunization program in Oman. The three age groups were; 13 to 22 for patients born after the introduction of HBV vaccine to Expanded Program of Immunization in August 1990, 23-28 for patients born before August 1990 but who presumably had completed the catch-up school vaccine campaigns completed in 2004-2005, and finally 29 and above for patients born before the introduction of HBV vaccination.

Risk factors for the transmission of HBV were grouped as nosocomial, family exposure, or high-risk behaviors. Nosocomial risk factors included a history of hospitalization, major surgery, organ transplantation, endoscopy, blood transfusion dialysis, and dental treatment. Family-related risk factors included; family history of HBV, current living with HBV infected individuals (later classified as sexual or non-sexual contact), mothers' history of HBV, and finally, family history of liver disease. High-risk behaviors included piercings, regular shaving with a barber, wasm (a traditional method of healing by cauterization), traditional phlebotomy, acupuncture, circumcision, multiple sexual partners.

Participants were asked for the place where piercing or circumcision was done, which was then classified as clinical and non-clinical settings.

Statistical analysis:

The sample size required was determined by the number of patients that could be interviewed during the data collection period. This was expected to be 300 patients. In a previous study of

CHB carriers in Iran that looked at 560 patients, they found that endoscopy, major surgery, and tattooing were independent risk factors for CHB with percentages of 54.8%, 44.5%, and 8.5% respectively.[13] If the situation was assumed to be similar in Oman, a sample size was 300 participants would enable us to estimate the proportion tattooed with 95% confidence intervals of approximately ±5%, and the proportion with endoscopy or surgery with 95% CI of approximately ±6%.

Epi info version 7 was used to calculate the frequency of HBV transmission risk factors in the total studied population. The risk factor frequency was stratified by age groups (13-<23, 23-28, <28), gender (male and female), and educational level (pre-secondary, secondary and post-secondary). A chi-square test was performed to examine the association between risk factor frequency and gender, age, or educational level and reported when significant. A ***p*-value** of < 0.05 was considered significant.

Results

Out of 365 HBV positive patients eligible to participate in this study, only 274 were included in the final analysis. A total of 92 patients were excluded due to inability to contact and incomplete questionnaire. The demographic features are summarized in (**Table 1).** The number of male patients was 143 which represents 52.2% of the entire cohort. The median age for men was 35.9 years and for women 35.1 years with 75.5% of them in the age range of 20 - 39 (**Figure 1).** The majority of the participants came from Al-Batinah (32.1%), Al-Dakhiliya (25.1%), Muscat (19.0%), and Al-Sharqiyah (16.4%) regions. The level of education of most of the participants (78%) was secondary school and above. A minority of participants (3.7%) worked in high-risk jobs which included; 3 nurses, 2 policemen, 1 doctor, 1 medical student, 1 medical assistant, and 1 medical orderly.

Table 1: Demographic characteristics of the participants (n= 274).

Variable	**N**	**%**
Age (yrs.) median (range)	35.5 (19-86)	
Gender		
Male	143	52.2%
Female	131	47.8%

Marital status		
Married	244	89.1%
Not married	30	10.9%
Governorates		
Al-Batinah	88	32.1%
Al-Dakhiliya	71	25.1%
Muscat	52	19.0%
Al-Sharqiya	45	16.4%
Others	18	6.57%
Education Level		
Secondary school and above	213	78%
Occupation		
Non-high-risk occupations	264	96.3%
High risk occupations	10	3.7%

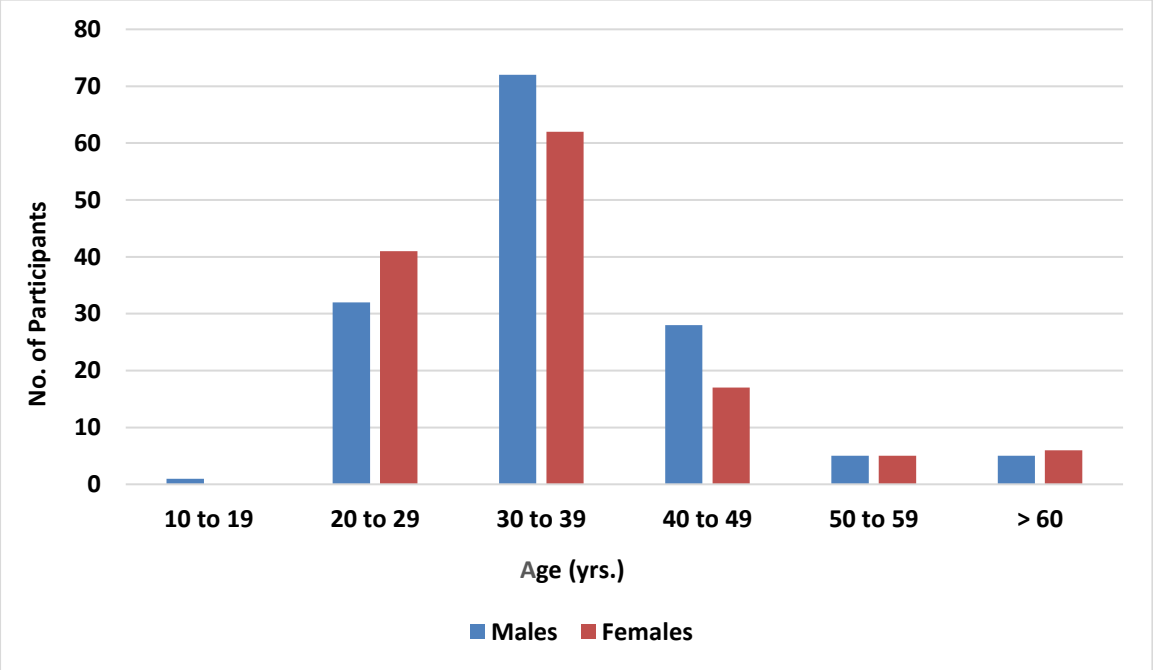

Figure 1. Age distribution of participants (yrs.) (n=274)

Blood donation was found to be the most common means in which HBV was diagnosed in males (45%), while antenatal screening was the most common in females (46%) (**Figure 2a and b**). Blood test for other reasons (e.g. after birth, before or after surgery, multi-transfusion screen, health check-up) was the second most common source of diagnosis in males and females, 35% and 29% respectively. The least common means of diagnosis in both genders was family screening.

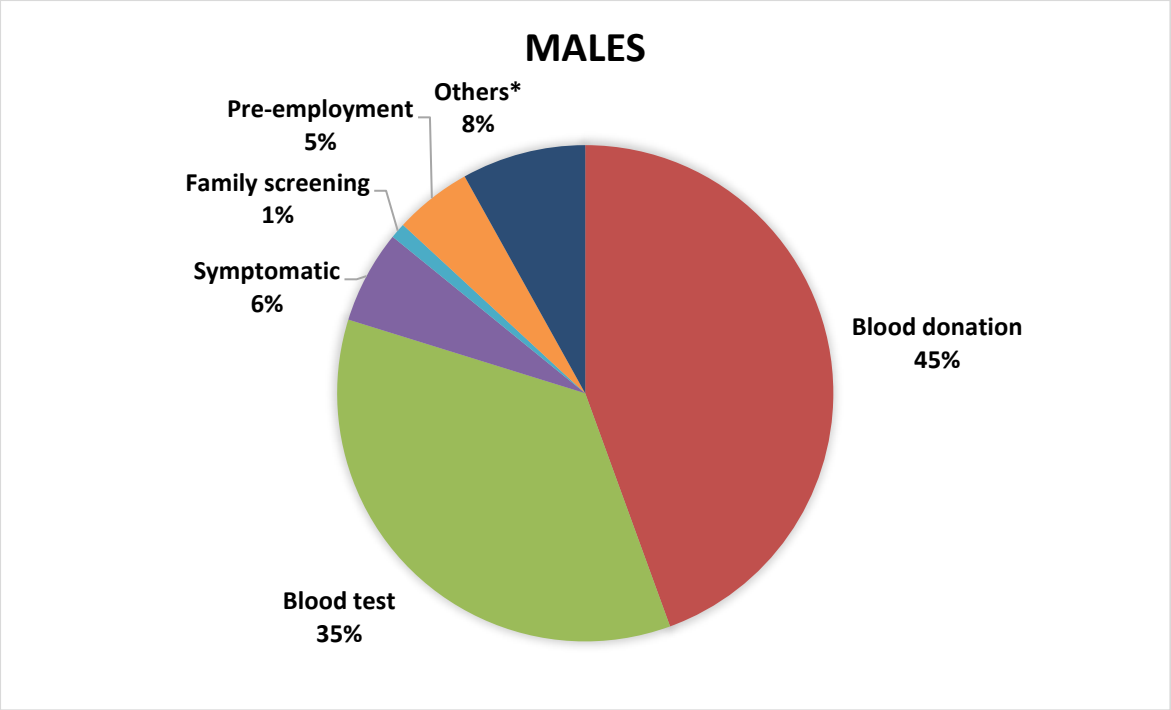

Figure 2a. Means of diagnosing HBV in male patients. (n= 143)

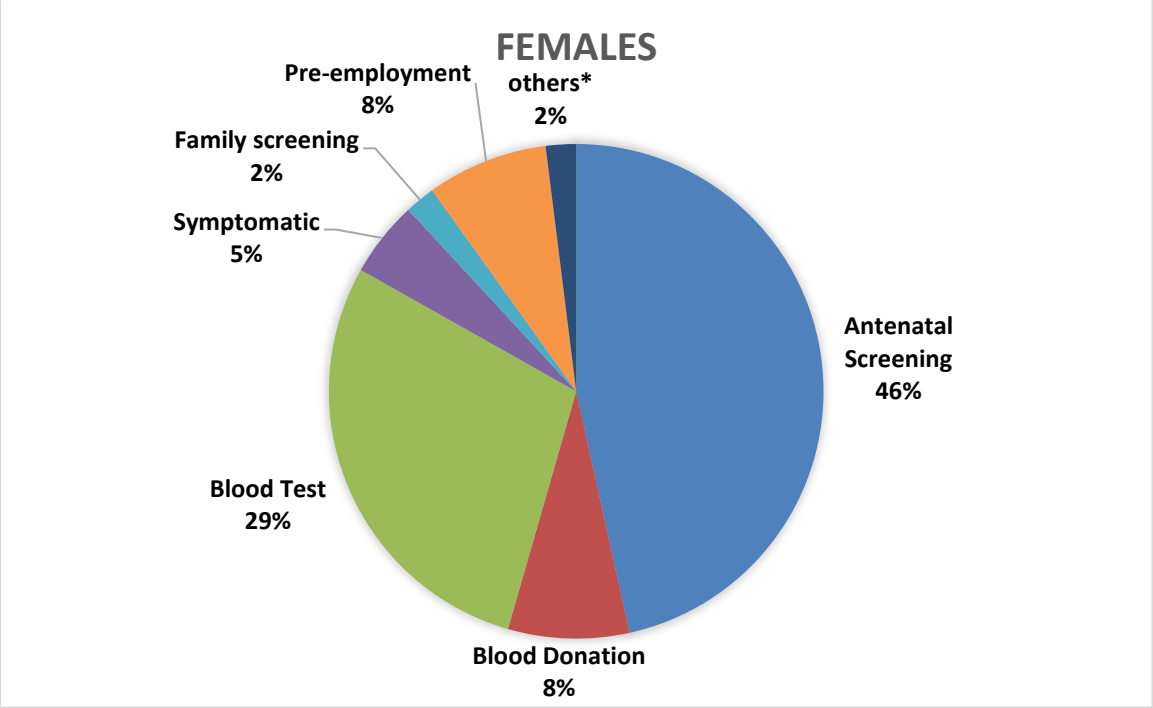

Figure 2b. Means of diagnosing HBV in female patients. (n= 131)

Figure 3 summarizes the prevalence of HBV transmission risk factors grouped as behavioral risk factors, perinatal and household contact, or nosocomial risk factors. High-risk behaviors were very common in this study population with similar distribution in the two age groups. Almost two-thirds of the participants had a history of perinatal and household contact (family-related) transmission risks which were more common in those under the age of 28 years. Around 60% of the interviewees had at least a history of nosocomial risks. Only one participant reported no history of HBV acquisition risk factors. Concerning HBV transmission risk factors, intra-familial contact with HBV infected persons, and behavioral risks such as body piercing (females) and barber shaving (males) were more common than nosocomial risk factors.

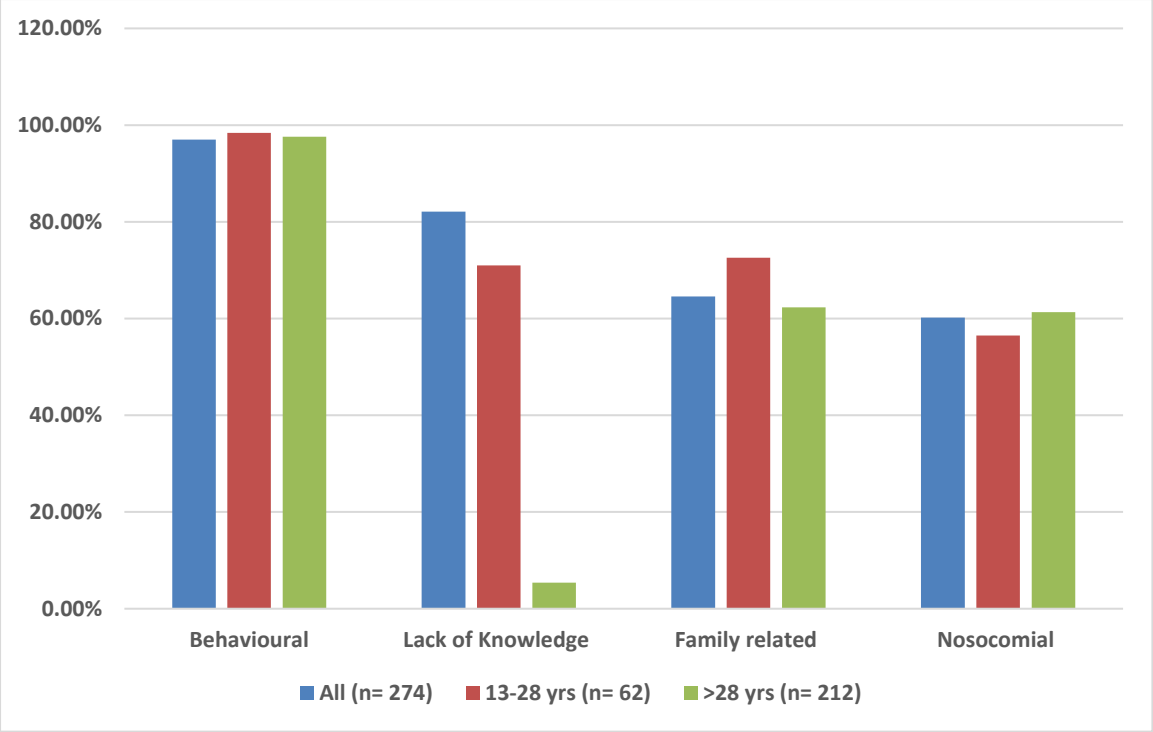

Figure 3. Prevalence of HBV transmission risk factors in this study group (n=274)

The frequency of nosocomial risk in this study population appears to be low (**Table 2)**. The majority of participants had no history of surgery (70.4%), hospitalization (71.9%), blood transfusion (91.2%), and endoscopy (93.4%). Only one patient had a history of dialysis and none of the participants had a history of organ transplantation. With further statistical analysis, a significant difference in the frequency of endoscopy between age groups was noted, but the number of participants in the 13-28 years was smaller than that in the two remaining age groups. The **Chi-square test** did not show any significant difference in the frequency of other nosocomial risk factors between gender, age, and educational level.

Table 2. Frequency of nosocomial risk factors by gender, age, and educational level (n=274)

	Total	**Gender**		**Age**			**Educational level**		
Nosocomial risk factors	(n=274)	Male (n=143)	Female (n=131)	13-23 (n=6)	24-28 (n=56)	>28 (n=212)	Pre-secondary (n=61)	Secondary (n=112)	Post-secondary (n=101)
Surgery	81(29.6%)	37(25.9%)	44(33.6%)	4(66.7%)	16(28.6%)	61(28.8%)	21(34.4%)	36(32.1%)	24(23.8%)
Hospitalization	77(28.1%)	42(29.4%)	35(26.7%)	3(50.0%)	13(23.2%)	61(28.8%)	18(29.5%)	25(22.3%)	34(33.7%)
Blood transfusion	24(8.8%)	13(9.1%)	11(8.4%)	0(0%)	5(9.0%)	19(9.0%)	7(11.5%)	12(10.7%)	5(5.0%)
Endoscopy*	18(6.6%)	11(7.7%)	7(5.3%)	2(33.3%)	2(3.6%)	14(6.6%)	8(13.1%)	6(5.4%)	4(4.0%)
**the frequency of endoscopy shows statistical difference between age groups, x^2= 7.8227, d.f. = 2, P =0.02*									

Assessment of the effect of perinatal, early horizontal, and spousal transmission of HBV among participants (**Table 3)** revealed that more than half of the participants had a positive family history of HBV infection. This was significantly different between the two genders (p =0.016) and educational level (p =0.0019). Significant difference was also found between the three age groups (<23, 24-28, >28) of HBV positive mothers (33.3% 14.3%, 6.6% respectively, p =0.049). Contact with HBV-infected persons appeared to be a statistically significant difference among different educational levels (p =0.009).

Table 4 shows the prevalence of high-risk behaviors in the participants. A minority of participants indicated history of tattoos (0.4%), acupuncture (1.5%), traditional phlebotomy (5.1%), extra-marital sexual contact (8.8%) and circumcision in non-clinical settings (13.5%). The frequency of circumcision in non-clinical settings decreased significantly by the increase in educational levels ($p = 0.04$). Unawareness about HBV infection (82.1%), piercing in non-clinical settings (46.7%), regular shaving with a barber (46.7%), *wasm* (49.6%) were more common in this studied group. There was a significant association between hepatitis B and age groups, and educational levels ($p = 0.03$ and $p < 0.001$ respectively). The relation between having *wasm* by age, and educational level was also significant, $p = 0.025$ and $p = 0.03$, respectively. There was also a significant association between having an extramarital sexual relationship by gender ($p<0.00001$).

Discussion

The HBV vaccine was introduced to the Expanded Program of Immunization in Oman in August 1990 aiming to reduce the prevalence of HBV carriage to below 2% in the general population.[14] All new-borns well enough to be discharged from the hospital (including pre-mature and low weight infants) are indicated for the first HBV vaccine dose within the first 12 hours of life. Active immunization using the three-dose vaccine plus passive immunization by administering hepatitis B immunoglobulins to neonates born to HBsAg mother regardless of her HBeAg status is followed in SQUH and AFH but not in Ministry of Health (MoH) hospitals.[5] To increase the coverage rate of the HBV vaccination strategy, hepatitis B catch-up school campaigns from 2001-2004 were conducted to vaccinate school children who were born before August 1990.[14]

Other strategies were also implemented by the MoH to improve the control of the diseases in Oman.[15] These include the screening of all family contacts of HBsAg positive patient, vaccinating HBsAg negative children below the age of 10 years, and screening all blood and blood products for viral hepatitis.

Certain risk factors for HBV transmission such as the family history of hepatitis B, *wasm*, body piercings, and surgeries were found common among a group of Omani patients.[5] Our current study revealed similar findings which demonstrated the common sources of identifying HBV infected patients.

The male to female ratio was almost equal to one. This finding is consistent with other studies conducted in Oman [5] and Iran.[16,17] On the other hand, men account for most of HBV cases in most parts of the world.[7,8,12,18-21] It may be that Oman has different epidemiology of hepatitis B or this might be a result of referral bias. Almost three-quarters of the participants lie in the 20–39 age group. Generally, this would contribute indirectly to the economic burden associated with job loss, reduced work productivity, and premature death.[22] Specifically, most of the female patients were of child-bearing age which maintains the risk of mother to child transmission of hepatitis B.

Iatrogenic risk factors seemed to be the least frequent among our participants. Almost one-third of participants have a history of surgery, which was the most prevalent nosocomial risk factor. A case-control study from Iran, which has a similar hepatitis B prevalence to Oman, found that a history of surgery is an independent risk factor for CHB carriage.[13] Moreover, the major sources of HBV infection in Bahrain[23] and Yemen[24] were hospital-acquired infections including dental procedures, surgical operations, and blood transfusions. On the contrary, studies conducted in other Arab and African countries showed an insignificant role of surgical interventions in transmitting HBV.[25] Therefore, it is difficult to assess the real impact of surgical interventions in transmitting hepatitis B. Such mode of transmission could be significantly reduced by having high standards for sterilization, disinfection, screening, and training.

Intra-familial transmission of hepatitis B can be through vertical or horizontal mode by either sexual or non-sexual contact. The latter is thought to be the predominant mode of hepatitis B transmission in the Middle East.[7] In the current sample, only 8.8% of participants reported positive mother status for HBV which was significantly associated with the age of participants ($p<0.05$), while more than half of the participants reported familial contact with HBV positive persons (11.3% sexual contact vs. 42.7% non-sexual contact). The majority of the participants who reported sexual contact also have siblings with HBV. This suggests the possibility of the infection occurring earlier in life. HBV is a highly infective virus and HBeAg is most prevalent in children, a fact which is associated with the high infectivity rate.[7]

Multiple studies showed shared use of contaminated materials such as razors, toothbrushes, towels, eating utensils may account for early horizontal transmission of HBV among family members,[7,12,26] while the availability of sanitization tools within the household is reported to be protective against transmission.[27]

Our study revealed a significant association between high educational level and contact with an HBV positive person ($p< 0.05$). This finding differs from the previous reports of Zhang et al., and Merat et al., where lower educational level and lower-income are identified risk factors for HBsAg positivity in both high and intermediate endemicity regions.[17,28] This might be since highly educated persons are more likely to convince their family members to screen for hepatitis B and therefore higher reporting level.

From this study, high-risk behaviors were noted to be common in this group of patients. The majority of females had body piercing in non-clinical settings and a similar proportion of males shaved regularly with barbers. Determining the role of these practices in transmitting HBV is difficult as it is poorly researched within the region. Although body piercing has been identified as a potential risk factor for HBV infection [28,29], a recent study in the Netherlands found that body piercings did not increase the risk of HBV infection for the Dutch population.[30] While this may be true for the Netherlands where HBV endemicity is low and hygiene guidelines have been introduced in piercing shops, in Oman HBV is more endemic and most of our participants had their piercings at home. Moreover, piercings for females are usually done at a young age in Oman where the risk of chronic carriage is higher.[31]

Concerning barber practices, studies from the Middle East showed barbers had low to moderate awareness that hepatitis can be transmitted by contaminated razors, and 46% of shaves were done with reused razors.[9,10] HBV DNA was detected in 6.6% of used razor blades and cuts from barbershops are associated with HBV transmission with an odds ratio of 4.74.[11,12] Despite the effort of the Omani government to ensure the safety of these practices by requiring the use of one-time disposable razors, the availability of sanitization tools in all barbershops with regular inspection, their contribution to HBV transmission cannot be ruled out entirely.

None of the participants in our study reported a history of IDU and only 16.8% reported multiple sexual partners. Such risk factors are the most common modes of HBV transmission in lower endemicity regions in Western societies. In the USA, sexual contact (heterosexual or homosexual) and IDU account for 40.9% and 18.2% of acute hepatitis B respectively.[32] In China, on the other hand, where HBV is of high endemicity, no association between acute hepatitis B and sexual contact or IDU was found in univariate and multivariate regression analyses.[29] The reason for this may be a similar attitude of Chinese and Omani people towards these behaviors. Studies in the Middle East reported that HBV prevalence among IDU ranges between 6% to 44.3%.[9,13]

Antenatal screening seems to be one of the most effective detection strategies for women in our sample and almost half of the female participants were discovered to be HBsAg positive during pregnancy. Despite the evidence of the higher prevalence of HBV infection among Omani pregnant women (7.1%) compared to those in other GCC states (Saudi Arabia 1.6%, UAE 1.5%, and Qatar 1%)[25,33], routine antenatal screening for HBsAg is not available at MoH institutes. With the introduction of neonatal vaccination in 1990, it would take around 20-40 years for the vaccine alone to eliminate vertical transmission of HBV in Oman. The Center for Disease Control (CDC) recommends routine screening of all pregnant women for HBsAg and the administration of active and passive vaccination for infants born to HBsAg positive mothers.[34] These measures are associated with 90-100% effectiveness in preventing the transmission of the virus in neonates born to mothers with HBV infection[35] and should consider in Oman. However, in mothers positive for HBeAg with high viral load, post prophylaxis failure is possible and the introduction of antiviral therapy within the third trimester should be considered.[36]

Despite the evidence of common contact with HBV positive family members among the participants, only 1.5% were diagnosed through contact screening. This suggests that contact screening is not being widely applied. Greater focus on contact screening could aid in the control of HBV infection in Oman by identifying non-immune contacts and vaccinating them. Furthermore, it could act as a secondary prevention measure by identifying those with chronic infection, providing them with the appropriate treatment or follow up and hence, reduce the long-term complications (cirrhosis or HCC) and mortality associated with chronic infection.

The majority of our participants did not know about HBV infection before their diagnosis. Educating individuals about hepatitis B risk factors could help to reduce the risk of spreading the virus. It has been shown that improving awareness regarding risk factors of HBV transmission has led to a decrease in HBV prevalence in Iran.[37]

There are some strengths and weaknesses in this study. One of the strengths is the use of a standard questionnaire containing closed questions throughout the study. The same interviewer filled all the questionnaires during a direct interview with the participants for consistency. This way, any misinterpretations of questions by patients were corrected at the time of the interview thus minimizing any false reporting. Moreover, any potential heterogeneity in reporting that may have arisen from using two interviewing methods (face to face vs. telephone) would be expected to be minimized. Another strength is that both hospitals screen pregnant women for

HBsAg, this would give a more accurate representation of hepatitis B distribution between genders.

The limitations of this study might arise from referral bias and recall error. Referral bias from recruiting patients from tertiary referral hospitals, SQUH, and AFH, could play a role in this study. Patients under the age of 13 years are not seen at the outpatient clinics where patients were recruited for this study. This would limit our investigations regarding the vertical transmission of HBV and would make the findings of this study only applicable to adults in Oman. Also, as both hospitals are located in Muscat Governorate, patients from regions outside Muscat might be underrepresented. This was noted for Dhofari patients. Only 0.7% of our participants came from Dhofar Governorate, while CDSC reports show that Dhofar governorate accounted for almost a quarter of the cumulative incidence of AHB from 1991 to 2010 (Sultanate of Oman Ministry of Health, 2012). Risk factors for HBV transmission might differ in Dhofari patients compared to the general population.

In any study in which data is collected during an interview with the patients, recall error is expected to occur especially in patients with chronic infection, patients diagnosed with the disease a long time ago, and older patients who have a long history. Patients may report that an exposure (risk factor) preceded the outcome (hepatitis B) even if it occurred after, hence, overestimating the role of these risk factors in this group of patients. Using the date of diagnosis as the reference date helped to minimize this recall error. In addition, risk factors such as sexual activity or intravenous drug use are difficult to investigate and maybe underestimated due to the sensitivity of these issues culturally and religiously in Oman.

Conclusion

This study indicated that risk factors for HBV infection in Oman include direct contact of infected individuals within a family and exposure to high-risk behaviors such as piercing and barber shaving. While further analytical epidemiological studies are needed to assess the proportion of hepatitis B attributable to different risk factors, implementing antenatal screening for pregnant women would reduce the vertical transmission of HBV, and improving contact screening would reduce horizontal transmission of the virus and reduce morbidity and mortality associated with the virus. Besides, future work is required to confirm the association with behavioral risk factors and whether this association is causal, particularly piercing and shaving at barbershops. If confirmed, relatively simple and effective interventions could be developed to reduce the risk of horizontal transmission related to these activities.

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Table 3: Frequency of family-related risk factors by gender, age, and educational level (n=274)

	Total	**Gender**		**Age**			**Educational level**		
Risk factors	(n=274)	Male(n=143)	Female(n=131)	13-23 (n=6)	24-28 (n=56)	>28 (n=212)	Pre-secondary (n=61)	Secondary (n=112)	Post-secondary (n=101)
Maternal history of HBV				*					
yes	24(8.8%)	8(5.6%)	16(12.2%)	2(33.3%)	8(14.3%)	14(6.6%)	2(3.3%)	13(11.6%)	9(8.9%)
No	100(36.5%)	52(36.4%)	48(36.6%)	3(50.0%)	18(32.1%)	79(37.3%)	22(36.1%)	39(34.8%)	39(38.6%)
Unknown	150(54.7%)	83(58.0%)	67(51.2%)	1(16.7%)	30(53.6%)	119(56.1%)	37(60.7%)	60(53.6%)	53(52.5%)
Family history of HBV		**					**		
Yes	150(54.7%)	67(46.8%)	83(63.4%)	4(66.6%)	36(64.3%)	101(51.9%)	19(31.1%)	65(58.1%)	66(65.3%)
No	61(22.3%)	35(24.5%)	26(19.8%)	1(16.7%)	8(14.3%)	52(24.5%)	21(34.4%)	24(21.4%)	16(15.8%)
Unknown	63(23.0%)	41(28.7%)	22(16.8%)	1(16.7%)	12(21.4%)	50(23.6%)	21(34.4%)	23(20.5%)	19(18.8%)
Contact with HBV infected person		***					***		
Sexual contact	31(11.3%)	11(7.7%)	20(15.3%)	1(16.7%)	8(14.3%)	22(10.4%)	4(6.6%)	16(14.3%)	11(10.9%)
Non-sexual contact	117(42.7%)	54(37.8%)	63(48.1%)	2(33.3%)	27(48.2%)	88(41.5%)	16(26.2%)	51(45.5%)	50(49.5%)
No contact	95(34.7%)	58(40.6%)	37(28.2%)	2(33.3%)	12(21.4%)	81(38.2%)	28(45.9%)	35(31.3%)	32(31.7%)
Unknown	31(14.0%)	20(16.1%)	11(8.4%)	1(16.7%)	9(16.1%)	21(9.9%)	13(21.3%)	10(8.9%)	8(7.9%)
Family history of liver disease									
Yes	27(9.9%)	13(9.1%)	14(10.7%)	2(33.3%)	8(14.3%)	17(8.0%)	4(6.6%)	10(8.9%)	13(12.9%)
No	199(72.6%)	102(71.3%)	97(74.0%)	3(50.0%)	36(64.3%)	160(75.5%)	41(67.2%)	85(75.9%)	73(72.3%)
Unknown	48(17.5%)	28(19.6%)	20(15.3%)	1(16.7%)	12(21.4%)	35(16.5%)	16(26.2%)	17(15.2%)	15(14.9%)

**** significant difference in mother's history of HBV infection by age, x^2= 9.5164, d.f. = 4, p = 0.049)***

***** significant difference in family history of hepatitis B by gender, x^2= 9.0944, d.f. = 3, p=0.016 and educational level x^2= 20.9362, d.f. = 6, p =0.0019***

****** living with HBV infected persons significantly differed between the three educational level groups (x^2= 19.1856, d.f. = 6, p =0.009)***

HBV: Hepatitis B Virus

Table 4. Frequency of high-risk behaviors by gender, age, and educational level (n=274)

	Total	**Gender**		**Age**			**Educational level**		
High-risk behaviors	(n=274)	Male (n=143)	Female (n=131)	<23 (n=6)	23-28 (n=56)	>28 (n=212)	Pre-secondary (n=61)	Secondary (n=112)	Post-secondary (n=101)
Lack of knowledge of HBV infection	225(82.1%)	119(83.2%)	106(80.9%)	* 4(66.7%)	40(71.4%)	181(85.4%)	* 60(98.4%)	90(84.8%)	70(69.3%)
Piercing in non-clinical settings	128(46.7%)	15(10.5%)	113(86.3%)	3(50.0%)	21(37.5%)	104(49.1%)	33(54.1%)	48(42.9%)	47(46.5%)
Regular shaving with a barber	128(46.7%)	128(88.8%)	0	2(33.3%)	22(39.3%)	104(49.1%)	25(40.9%)	54(48.2%)	49(48.5%)
Traditional Cautery (*Wasm#)***	132(49.6%)	75(52.4%)	61(46.6%)	1(16.7%)	21(37.5%)	114(53.8%)	39(63.9%)	55(49.1%)	42(41.6%)
Traditional phlebotomy	14(5.1%)	6(4.2%)	8(6.1%)	1(16.7%)	3(5.4%)	10(4.7%)	5(8.2%)	5(4.5%)	4(4.0%)
Acupuncture	4(1.5%)	1(0.7%)	3(1.7%)	0(0%)	0(0%)	4(1.9%)	2(3.3%)	0(0%)	2(1.9%)
Circumcision in non-clinical settings	37(13.5%)	37(25.9%)	0	0(0.0%)	2 (3.6%)	35(16.5%)	*** 12(19.7%)	16(14.3%)	9(8.9%)
Extramarital sexual contact	24(8.8%)	**** 24(16.8%)	0(0%)	1(16.7%)	2(3.6%)	21(9.9%)	6(9.8%)	11(9.8%)	7(6.9%)
IDU	0	0	0	0	0	0	0	0	0

 # an alternative medical practice used to treat jaundice by applying a hot metal implement to the skin.

***Significant difference in hepatitis B awareness by age and educational level (x^2= 6.8664, d.f. = 2, p =0.03) and (x^2= 22.8042, d.f. = 2, p <0.001) respectively.**

**** Significant difference in wasm by age (x^2= 10.5833, d.f. = 4, p=0.025) and educational level (x^2= 10.5833, d.f. = 4, p=0.025), (x^2= 10.5394, d.f. = 4, p =0.03).**

*****Significant difference in circumcision between the three educational groups (x^2= 13.0917, d.f. = 6, p =0.04**

******Significant difference in extramarital sexual contact by gender ((Fisher's exact test, p<0.001).**

HBV: Hepatitis B virus

IDU: Intravenous Drug Abuse