Risk Factors for Hepatitis B Virus Transmission among Adolescents in Secondary Schools in Onitsha, South-Eastern Nigeria

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ABSTRACT

Background: Hepatitis B virus (HBV) infection is a highly contagious disease of public health importance which is hyperendemic in Nigeria. Horizontal transmission is a major route of spread and adolescents are susceptible because of their high-risk behaviours. **Objectives:** The risk factors for hepatitis B virus transmission among apparently healthy adolescents in secondary school in Onitsha were determined. **Materials and Methods:** This was a cross-sectional descriptive study among adolescents in secondary schools in Onitsha using a multi-staged sampling technique. Enzyme-linked immunosorbent assay (ELISA) was used for qualitative detection of Hepatitis B surface antigen (HBsAg) in the serum samples. Risk factors for transmission of HBV were obtained through semi-structured questionnaires. Simple descriptive statistics, chi-square and odds ratio were determined using the statistical package for the social sciences (SPSS 20). **Results:**In the study group the following variables were significantly associated with the risk of HBV transmission: blood transfusion ($p<0.001$), sexual activity ($p<0.001$), sharing of personal items ($p<0.001$), use of illicit drugs ($p=0.003$), contact with a person with jaundice ($p=0.012$), tattoo/scarification ($p=0.005$) and ear piercing ($p=0.045$). **Conclusion**: The observed risk factors enhance horizontal transmission of HBV among these adolescents and contribute to the existing high prevalence of HBV infection in Nigeria. Targeted health education through school health programs is crucial to enable the study area meet up with the World Health Organization's target of 90% reduction in new cases of HBV infection by 2030.

Keywords: Risk factors, Hepatitis B Virus transmission, Adolescents, Onitsha, Nigeria.

INTRODUCTION

The Hepatitis B virus is a deoxyribonucleic acid (DNA) virus that causes potentially life-threatening liver disease. It is ten times more contagious than Human Immunodeficiency Virus (HIV) and is considered a public health problem globally.[1,2]. Hepatitis B virus can be transmitted vertically from mother to child during pregnancy and the perinatal period. It

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is also transmitted horizontally through several means like exposure to infected blood and body fluids (saliva, menstrual, vaginal and seminal fluids), blood transfusion, unprotected and indiscriminate sexual intercourse, unsafe injections or contaminated sharp instruments.[3] Parenteral/percutaneous transmission can occur during surgery, after needle-stick injuries, intravenous drug use, and following procedures such as ear piercing, tattooing, acupuncture, circumcision and scarification.[4,5] Contaminated injections were estimated to have caused about 21 million HBV infections worldwide in 2000, accounting for 32% of all new infections.[6] However, in recent years, global safe injection campaigns have reduced the absolute numbers of HBV infections transmitted through injections particularly where there is adherence to stipulated measures.[7]

A major challenge of Hepatitis B virus infection is its tendency to progress to chronicity with the risk of complications like hepatic cirrhosis, liver failure, hepatocellular carcinoma and death.[5] Majority of children with Chronic Hepatitis B (CHB) infection are asymptomatic; however, they may develop progressive disease and are at increased risk of advanced liver disease or liver cancer before their third decade.[8] The World health organization reports that about 240 million people worldwide have chronic hepatitis B virus infection which is likely to cause 20 million deaths between 2015 and 2030 if appropriate measures are not taken promptly.[9] Like many sub-Saharan African countries, Nigeria is hyper-endemic for Hepatitis B and has one of the highest rates of cancers attributable to HBV.[10–12]

As a key strategy for the global elimination of HBV infection, the World Health Organization (WHO) introduced universal Hepatitis B immunisation at birth and in infancy by 1992.[13] Subsequently, it set a target of 90% reduction in new cases of HBV infection by 2030.[9] The former has been highly effective in reducing HBV transmission in the first five years of life, however, progress in the scale-up of HBV testing and treatment globally is reported to be slow in older children and adults.[4,14] The persisting high prevalence of HBV in Nigeria and some other developing countries remains a matter of grave concern. In a recent national survey in Nigeria, children accounted for 12.8% of infected individuals suggesting continued transmission in this age group as a result of low or inadequate vaccine coverage as well as the prevalence of factors that enhance horizontal transmission.[15] This study thus explores risk factors for Hepatitis B virus transmission in students of secondary schools in Onitsha metropolis who are predominantly adolescents and prone to engaging in diverse high-risk behaviors that may promote the transmission of HBV.

MATERIALS AND METHODS

This was a descriptive cross sectional study conducted in Secondary schools in Onitsha, Southeast Nigeria. Onitsha is a major commercial centre in Nigeria and sub-Saharan Africa with a population of about 1.5 million people.[16,17] At the time of the study, there were 66 approved secondary schools in the area with an estimated population of about 22,000 students- 13,604 students in public schools and 8,500 in private schools. The schools were further divided into male only, female only, and co-educational (mixed) schools. By simple proportion of their population, 8 schools were selected with a ratio of 1:1:2 respectively representing both private and public schools. A multi-staged sampling technique was used to recruit subjects from the selected schools for the study. Using the Cochrane's formula: $n = z^2pq/E^2$ [18] a minimum sample size of 743 was obtained.

Ethical approval for the study (NAUTH/CS/66/Vol.4/004) was obtained from the Ethics and Research Committee of Nnamdi Azikiwe University Teaching Hospital, (NAUTH) Nnewi. Permission was also gotten from the Post Primary Schools Service Commission, Onitsha as well as the Principals and Class teachers of the selected schools/classes. Informed consent was obtained from parents/guardians of students under the age of 18 years and assent from all subjects. Participation

was entirely voluntary and subjects were assured they could withdraw if they wished to. Pre–tested semi-structured questionnaires were used to get information about the possible risk factors of Hepatitis B transmission. The participants were screened for HBsAg using ELISA.

Statistical analysis of the data was computed using the statistical package for social sciences (SPSS) version 20. Simple descriptive statistics such as means, standard deviations, and proportions were used to describe the data. The chi-square test was used to explore the association between HBsAg status and the assessed categorical variables/risk factors. The Odds Ratio (OR) and the corresponding 95% confidence interval (95% CI) were used to summarise the strength of the association between specific exposure and outcome variables and thus remove confounding factors. The level of statistical significance was set at $p < 0.05$.

RESULTS

A total of 750 secondary school students were enrolled in the study of which 305 were males and 446 females with a male: female ratio of 1:1.5. The risk factors for HBV transmission identified in the study population were blood transfusion, circumcision, ear piercing, scarification/tattoo, previous surgery, injection use, previous accident with bleeding, sharing of intimates/sharps, contact with someone with jaundice and sexual activity. The details of their association with HBsAg status and statistical significance are outlined below.

Table 1 shows that a history of previous blood transfusion was significantly associated with HBsAg seropositivity. Less than 20% of the respondents were certain that the blood transfused was screened for Hepatitis B, many others did not enquire about this.

Table 2 reflects that ear piercing (x2 =4.032, p =0.045), scarification (x2=7.826, p=0.005) and use of illicit drugs (x2=8.880, p=0.003) were significantly associated with sero-prevalence of HBsAg unlike circumcision. It is noteworthy that 25% of those who admitted previous use of illicit drugs were seropositive to HBsAg.

History of contact with a person with jaundice (x2 = 8.784, p= 0.012), the practice of sharing of intimates (x2 = 21.125, P < 0.001) and sexual activity (x2= 21.996, P < 0.001) were significantly associated

Table 1: Association Between Hbsag Status And Blood Transfusion

Variable	HBsAg Status				
Previous transfusion	**Value**	**Positive (%)**	**Negative (%)**	**Total**	**X^2**
Yes	17(29.8)	73(10.5)	90(12.0)	18.794	<0.001
No	36(63.2)	574(82.8)	610(81.3)		
I don't know	4(7.0)	46(6.6)	50(6.7)		
Frequency of transfusions					
Once	11(64.7)	48(65.8)	59(65.6)	2.785	0.426
Twice	5(29.4)	18(24.7)	23(25.6)		
Thrice	0(0.0)	6(8.2)	6(6.7)		
—	–	–	–		
Donor of transfused blood					
Parents	12(70.6)	48(65.8)	60(66.7)	0.760	0.684
Blood bank	3(17.6)	10(13.7)	13(14.4)		
Other relations	2(11.8)	15(20.5)	17(18.9)		
HBV Screening of the blood					
Yes	4(23.5)	13(17.8)	17(18.9)	1.351	0.509
No	1(5.9)	12(16.4)	13(14.4)		
I don't know	12(70.6)	48(65.8)	60(66.7)		

Table 2: Association Between Hbsag Status And Use Of Sharps

Variable	HBsAg Status Positive (%)	Negative (%)	Total	X^2	P-value
Male circumcision					
Yes	30(100)	267(97.1)	297(97.4)	0.896	0.344
No	0(0.0)	8(2.9)	8(2.6)		
Female circumcision					
Yes	3(11.5)	69(16.6)	72(16.3)	0.457	0.490
No	23(88.5)	347(83.4)	370(83.7)		
Place of circumcision					
Hospital	19(57.6)	237(78.5)	256(69.4)	6.498	0.090
Traditional healer	6(18.2)	45(13.4)	51(13.8)		
Maternity home	7(21.2)	30(8.9)	37(10.0)		
I don't know	1(3.0)	24(7.1)	25(6.8)		
Ear piercing					
Yes	25(43.9)	399(57.6)	424(56.5)	4.032	0.045*
No	32(56.1)	294(42.4)	326(43.5)		
Mode of Ear piercing					
New needle	16(64.0)	301(75.4)	317(74.8)	1.655	0.437
Old needle	7(28.0)	78(19.5)	85(20.0)		
I Don't Know	2(8.0)	20(5.0)	22(5.2)		
Past Injections					
Yes	57(100)	652(94.1)	709(94.5)	3.567	0.168
No	0(0.0)	36(5.2)	36(4.8)		
I don't know	0(0.0)	5(0.7)	5(0.7)		
Place of administration of injections					
Self	4(7.0)	92(14.1)	96(13.5)	8.694	0.122
Patent Med. Store	21(36.8)	143(21.9)	164(23.1)		

with HBsAg positivity. These are shown in Tables 3.

Table 3: Association Between Hbsag And Contacts

Variable	HBsAg Status			X^2	P-value
	Positive (%)	Negative (%)	Total		
Sexual activity					
Yes	17(29.8)	66(9.5)	83(11.1)	21.996	<0.001*
No	40(70.2)	626(90.5)	666(88.9)		
Condom use					
Yes	7(41.2)	30(45.5)	37(44.6)	0.100	0.752
No	10(58.8)	36(54.5)	46(55.4)		
Number of sex partners					
1 partner	12(70.6)	46(89.7)	58(69.9)	2.929	0.403
2 partners	4(23.5)	8(12.1)	12(14.5)		
3 partners	1(5.9)	6(9.1)	7(8.4)		
4 or more	0(0.0)	6(9.1)	6(7.2)		
Contact with jaundiced person					
Yes	11(19.3)	54(7.8)	65(8.7)	8.78	0.012*
No	45(78.9)	625(90.3)	670(89.5)		
I don't know	1(1.8)	13(1.9)	14(1.9)		
Contact person					
Parent	5(45.5)	10(18.5)	15(23.1)	4.380	0.223
Sibling	3(27.3)	14(25.9)	17(26.2)		
Friends	3(27.3)	29(53.7)	32(49.2)		
Others	0(0.0)	1(1.9)	1(1.5)		
Sharing of intimates					
Yes	40(71.4)	276(39.8)	316(42.2)	21.215	0.001*
No	16(28.6)	417(60.2)	433(57.8)		

Table 4. Adjusted Odds Ratio For Risk Factors Of Hbsag Transmission Of The Respondents

Variables			
Previous transfusion	Odds ratio	98%Confidence Interval	P-value
Yes	2.489	1.2295.040	0.011*
No	1.000		
Sexual activity			
Yes	3.353	1.6866.666	0.001*
No	1.000		
Tattoo/scarification			
Yes	1.876	0.9773.601	0.059
No	1.000		
Use of illicit drugs			
Yes	1.876	1.81022.214	0.004*
No	1.000		
Hx of contact with jaundiced person			
Yes	2.207	0.9725.013	0.059
No	1.000		
Sharing of intimates			
Yes	4.542	2.3648.728	<0.001*
No	1.000		

DISCUSSION

This study identified the significant risk factors of HBV transmission among secondary school students in Onitsha Southeast Nigeria as blood transfusion, sexual activity, sharing of personal items (clipper, razor blades, towels, tooth-brush), use of illicit drugs, previous history of surgery, contact with a person with jaundice, tattoo/scarification and ear piercing.

Transfusion of blood/blood products is an established route of HBV transmission,[5,19] so it is worrisome that caregivers of about 70% of those that had been transfused did not ascertain that the blood transfused was screened for HBV. Unfortunately, national systematic reviews in the past[15,20] reported a high prevalence of HBV among blood donors which raised concerns about the safety of blood and blood products and the high prevalence of occult hepatitis B virus in Nigeria. Conversely, due to improvements in the screening of blood and blood products for HBV markers and the exclusion of donors who engage in high-risk activities the role of blood transfusion in the spread of HBV across age groups including sickle cell disease patients is reducing.[21–24]. Interestingly, 25% of the respondents that tested positive for HBsAg acknowledged the blood was tested for HBV. The reason is not very clear but there was no record of their HBV status prior to transfusion. It is also possible that the sensitivity of the screening methods used could be culpable because the transmission of HBV is still possible when blood donors are asymptomatic carriers with HBsAg negative unless the HBV nucleic acid test is done.[25–27]

Sexual activity was a major risk factor to HBV transmission in the study population with about 30% of respondents admitting to having had sexual intercourse in the past and 55.4% of these engaged in unprotected sexual intercourse which increases the risk of contracting HBV.[5,28,29] A similar study in Benin[30] reported that 61% were sexually active and about 55% of these engaged in unprotected sex which is slightly higher than our findings. Corroboratively, Ndako *et al*(31) in North Central Nigeria, Komas *et al* in Central African Republic[32], and Sira et al in the United Kingdom[28] also identified unprotected sexual intercourse, multiple sexual partners, and previous history of sexually transmitted diseases as

significant risk factors to the transmission of HBV among adolescents and young adults. Though Nwokediuko[33] and Komas *et al*[34] in Enugu and Bangui respectively demonstrated that multiple sexual partners were associated with HBV in the univariate analysis, the influence of such variables as single/multiple sexual partners and duration of exposure was not significant in this study. The reason for this may not be unrelated to the finding that majority of the students who were sexually exposed in this study had only one partner.

In this study, although about 23% of the respondents had at one time or other patronised chemist/patent medicine shops often manned by unqualified medical personnel for injections, majority of the students were sure that new needles were used every time they received injections. This can be attributed to the injection safety practices and widespread campaign to curb the spread of HIV which is transmitted in almost the same way as HBV. Nonetheless, Ugwuja[35] reported differently in Abakaliki where unsafe injections constituted a major risk factor among adolescents, and suggested that patent medicine store and chemist operators who did not adhere to universal precautions on injection safety were chief culprits in this regard. Similarly, in Enugu, Nwokediuko[33] reported that nearly half of the patients with various forms of HBV-related liver disease gave a history of having received injections from medical quacks through unsterile needles. This is disturbing considering sociocultural preferences in this environment as in many other developing countries, which favour the overuse of injections. To stem this tide, it is necessary to re-orientate the populace, increase the awareness/practice of infection control measures, and encourage the use of disposable medical equipment and surgical consumables by health practitioners.

The use of illicit/hard drugs was a significant risk factor for the transmission of HBV in this study like some other studies.[28,29,36] This may be because illicit drug use is often practiced in secrecy and the participants are more likely to share needles, as they are often unaware of or ignore the risks associated with this practice when their sense of judgment is clouded by the effect of the abused substance.

Traditional practices like scarification and tribal marks, tattooing, ear piercing, male circumcision, and female genital mutilation can expose individuals to HBV infections as these procedures make use of sharp instruments which can be contaminated by blood and if improperly sterilised might serve as a medium of transmission of HBV when re-used. Most of these played significant roles in the transmission of HBV similar to the findings of Aderigbe in Ilorin[37], Ugwuja in Abakaliki[35], Nwokediuko and Eke in Enugu[24,33], Damien in Benin Republic[30], Ramya in India.[38] However, Omeje[22] reported differently. The difference hinges on the knowledge and practice of service workers with regard to universally accepted precautions for infection control and sterilisation.

Contrary to the findings of Olayinka *et al* in a Nigerian national survey, circumcision did not play a significant role in the transmission of HBV in the study population. This may be because in the study area, for cultural and religious reasons, circumcision of males is often done shortly after delivery and mostly in health facilities where adherence to standard practices which reduce the transmission of infections is guaranteed.[39] It is however worrisome that in spite of the widespread campaign against female genital mutilation, about 16% of the girls had been circumcised. Three of these tested seropositive to HBsAg. The practice of female genital mutilation is often carried out by non-medically qualified individuals sometimes using scientifically unsterilized devices which predispose the girls to infectious diseases like HIV and HBV as well as other complications of the procedure.

Just as reported by Eke et al[24] in Nnewi and Ugwuja in Abakaliki,[35] a history of contact with a jaundiced person was identified as a risk factor for HBsAg-seropositive status in the respondents with about 33% of these contacts being members of their family (parents and siblings) and 32% were friends.

This tends to occur more commonly in overcrowded settings whether in the home or school where sharing of personal items (clippers, razor blades, towels, toothbrushes) is common, especially in the lower socioeconomic class. Complimenting reports from several studies [33,40] also strengthen the proposition that Hepatitis B Virus infection exhibits familial clustering characteristics.

CONCLUSION

The observed risk factors that enhance horizontal transmission of HBV among these adolescents contribute to the persisting high prevalence of HBV in Nigeria. The implication is that carriers of the virus can serve as reservoirs for subsequent transmission to others. It is thus important to establish an effective program focused on enlightening the public on the nature of the HBV disease, its complications, routes of infection and possible risk factors for its transmission. This should be strategically planned to attract the interest of adolescents**.**

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