**PREVALENCE OF HEPATITIS B AMONG HIV POSITIVE PATIENTS RECEIVING HAART AT FEDERAL MEDICAL CENTRE MAKURDI, BENUE STATE: A COHORT STUDY**

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| **ABSTRACT****INTRODUCTION:** Human immunodeficiency virus (HIV) and hepatitis B virus (HBV) infections have overlapping transmission and contribute significantly to the morbidity and mortality of HIV infected patients.**METHODS:** A total of 250 study participants were involved in a cohort study design using a consecutive sampling technique. A pre-tested structured self-administered questionnaire was used to collect data on socio-demographic, risk factors. While the prevalence of HBV co-infection was tested using Serum samples from individuals using VITROS HBsAg Reagent Pack (Ref 680 1322). Chi square was used to test association between socio-demographic and HBV/HIV co-infection while binary regression analysis was used to test for independent predictors of HBV co=infection. All test were carried out at 9% C.I using SPSS version 26.0.**RESULTS:** HBV/HIVco-infection rate was 14%, with a mean age of 44 years and a male to female sex ratio of 1:3. The findings further shows that prevalence was higher in respondents with low education level (17.9%), multiple sexual partners (31.0%), sharing of sharps/blades (25.9%), and alcohol use (31.0%) and were significant independent predictors of HBV/HIV co-infection. Low education level (COR=2.419), MSP (COR=3.600), Sharing of sharps/blades (COR=2.674), alcohol use (COR=3.271). Sex, age, religion, marital status, employment status, smoking and BMI were not significantly associated with HBV co-infection.**CONCLUSION:** Thehigh frequency of HBV/HIV coinfection (14%) demonstrates the disease's endemicity and is, thus, a crucial indicator that needs to be taken into account. There is a need for enhanced public health awareness to address risk behaviors and promote health through widespread testing and immunizations.**Keywords:** HBV, HIV, Co-infection, prevalence |

**INTRODUCTION**

Viral hepatitis B infection is a major worldwide health concern which has claimed the lives of many individuals, young and old inclusive. The hepatitis B virus (HBV) is the cause of this potentially fatal liver infection and it is a deadly virus which belongs to the class of viruses called Hepadnaviridae and was first recorded by Lurman during an epidemic in 1885. (1) The modes of transmission of this virus have generally been classified into two - horizontal and vertical transmission. The spread of hepatitis B through sexual intercourse or contact with mucosal surfaces is known as horizontal transmission. Unprotected intercourse (vaginal, oral, or anal) is considered sexual contact, whereas any contact with an infected patient's blood, semen, saliva, or vaginal secretions is considered mucosal contact. In regions with low to moderate prevalence, unprotected sex and injectable drug use are the main ways that the disease is spread.(2) In vertical transmission, the virus can spread vertically from mother to newborn during the perinatal period.(3) In regions with high prevalence, it is the most common form of transmission.

HIV, Human Immunodeficiency Virus, is another serious global health concern and is one of the leading causes of immunocompromised states in these climes. 9% of the individuals living with HIV worldwide reside in Nigeria. (4) Since no cure has yet been found for this virus, infected individuals live their lives susceptible to infections and other disease conditions because the body's immune system has become deficient. Thankfully, with the advent of the Highly Active Anti Retro viral Therapy (HAART), people living with HIV can go on to live healthier lives, thus, reducing mortality rates.

Co infection of HIV/AIDS patients with Hepatitis B virus is quite common. According to the Hepatitis B foundation, Hepatitis B co-infection affects about 10% of people with HIV worldwide; rates vary by geography, ranging from 5 to 14% in the US and Europe.(5) According to a study, HBV co-infection rates among HIV patients ranged from 3.7% to 59.8%; in Nigeria, the rates were 11.9%.(6) Hepatitis B virus (HBV) co-infection is more common in HIV patients for a number of reasons - Shared Transmission Routes: Sexual contact, sharing needles, and coming into contact with contaminated blood are some of the ways that HIV and HBV are spread. Also, HIV impairs immunity, which reduces a person's ability to manage an HBV infection. HIV-positive people are therefore more likely to have a persistent HBV infection.(7) Furthermore, individuals infected with HIV frequently exhibit a reduced response to HBV immunisation, hence heightening their vulnerability to infection.(8)This study seeks to assess Hepatitis B prevalence among HAART-treated HIV-positive patients at FMC Makurdi, Benue State.

**MATERIALS AND METHODS**

**Study Area**

The study was conducted at the out-patient department, APIN, Federal medical Centre Makurdi (FMC). Makurdi is the state capital of Benue state Nigeria. FMC, Makurdi is one of the leading tertiary hospitals in the state that provides healthcare to over 5000 PLWHIV in North central, Nigeria. Makurdi is a cosmopolitan city with rich cultural significance and a background of HIV infection, with a robust treatment centres making it an important site for this study.

**Study design:** A hospital-based cohort study involving HIV positive adults within the age group of 18 to 80 years. Study participants were recruited at the APIN Antiretroviral therapy clinic, FMC, Makurdi. Recruitment of participants took a span of 3 months from September to November 2023.

**Study population**: Participants were recruited from HIV-infected patients who came to the center for drug refill or routine check-up.

**Inclusion and Exclusion Criteria**:Participants included those whose HIV/AIDS status have been confirmed (Western blot), whether symptomatic or asymptomatic and were receiving ART (≥ 2 years). Excluded from the study were patients that have any other medical conditions that may interfere with the result such as Chronic liver disease.

**Sampling Technique**

A simple random consecutive sampling technique was used to enroll HIV patients on HAART from the out patients department in the study site.

**Administration of Questionnaires**

socio-demographic characteristics, medical history and some anthropometry measurements(height and weight) were collected using a structured self-administered questionnaire, the type of drug regimen and the duration of treatment was also considered.

**Blood Specimen Collection**

About 2 mls of venous blood sample was collected from each participant into a labelled dry tube using a vacutainer needle. Samples were allowed to clot and then centrifuge at 3000rpm for 10 seconds to obtain serum which was preserved at standard temperature and later used for screening. HBV co-infection was tested using Serum samples from individuals using VITROS HBsAg Reagent Pack (Ref 680 1322).

 **Statistical Analysis**

Chi-square analysis was used to test significant association between the sociodemographic characteristics, risk factors with HBV co-infection. Binary logistics regression was used to test the independents predictors of HBV co-infection, using Statistical Package for Social Sciences (SPSS) version 26.0. All test were carried out at 95% confidence level. Results was presented using tables.

**Ethical clearance:**

The study was approved by the Health Research Ethical Committee (HREC) of Federal Medical Center, Makurdi Benue State with Ref. No: **FMH/FMC/HREC/108/VL.1**. Study participation was preceded by written informed consent of each participant; after a thorough explanation and clarification of study aims. Participation in the study was voluntary; with confidentiality and anonymity of study participants assured.

**RESULTS**

**Table 1:** Socio-demographic characteristics of respondents shows that the sample of 250 respondents consisted of 25.6% males and 74.4% females, yielding a sex ratio of 1:38. The majority of respondents were between 41 and 60 years old (52.8%), with 38.0% aged 21-40, 8.4% aged 61-80, and 0.8% aged ≤20 years, the mean age was 54 years. Most participants were married (55.6%), followed by widowed (27.6%), single (12.4%), and divorced (4.4%). Over half of the respondents had a tertiary level of education (51.6%), while 35.2% had a secondary education, 10.8% had a primary education, and 21.2% had no formal education8. The employment status showed that 32.0% were employed, and 68.0% were unemployed

**Table 1:** Socio-demographic characteristics of respondents (n=250)

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | Response | Frequency | Percentage (%) |
| Sex | Male | 64 | 25.6 |
|  | Female | 186 | 74.4 |
|  | **Sex ratio (M: F)** |  | **1:3** |
|  |  |  |  |
| Age (years) | ≤20 | 2 | 0.8 |
|  | 21-40 | 95 | 38.0 |
|  | 41-60 | 132 | 52.8 |
|  | 61-80 | 21 | 8.4 |
|  | **Mean age** |  | 44.9±11.7 |
|  |  | 247 | 98.8 |
| Religion | Christianity | 3 | 1.2 |
|  | Islam |  |  |
|  |  |  |  |
|  |  |  |  |
| Marital Status | Single | 31 | 12.4 |
|  | Married | 139 | 55.6 |
|  | Widowed | 69 | 27.6 |
|  | Divorced | 11 | 4.4 |
|  |  |  |  |
| Level of education | NFE | 53 | 21.2 |
|  | Primary | 27 | 10.8 |
|  | Secondary | 88 | 35.2 |
|  | Tertiary | 129 | 51.6 |
|  |  |  |  |
| Employment | Employed | 80 | 32.0 |
|  | Unemployed | 170 | 68..0 |

NFE=No Formal Education

Table 2 presents the behavioral characteristics of the 250 respondents. 34.8% reported having multiple sexual partners (MSP), while 65.2% did not. A significant proportion (46.4%) admitted to sharing sharps, compared to 53.6% who did not. Alcohol use was reported by 38.0% of the respondents, while 62.0% did not consume alcohol. Only a small percentage (6.8%) were smokers, with the vast majority (93.2%) being non-smokers. Regarding Body Mass Index (BMI), 52.4% were within the normal range, 24.0% were overweight, 10.4% were moderately obese, 6.0% were severely obese, 1.6% were morbidly obese, and 5.6% were underweight.

**Table 2:** Behavioural characteristics of respondents (n=250)

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | Response | Frequency | Percentage (%) |
| MSP’s | Yes | 87  | 34.8 |
|  | No | 163 | 65.2 |
|  |  |  |  |
| Sharing of sharps | Yes | 116 | 46.4 |
|  | No | 134 | 53.6 |
|  |  |  |  |
| Alcohol use | Yes | 95 | 38.0 |
|  | No | 155 | 62.0 |
|  |  |  |  |
| Smoking | Yes | 17 | 6.8 |
|  | No | 233 | 93.2 |
|  |  |  |  |
| BMI (kg/m2) | Underweight | 14 | 5.6 |
|  | Normal | 131 | 52.4 |
|  | Overweight | 60 | 24.0 |
|  | Moderately obese | 26 | 10.4 |
|  | Severely obese | 15 | 6.0 |
|  | Morbidly obese | 4 | 1.6 |

MSP=Multiple sexual partners; BMI=Body Mass Index

From table 3, the study of 250 participants showed an overall hepatitis B virus (HBV) co-infection prevalence of 14.0% among HIV patients on HAART. Statistical analysis revealed a significant association between the level of education and HBV co-infection (p=0.002), with the highest rate of co-infection (17.9%) observed in participants with a secondary education. No significant associations were found between HBV co-infection and sex (p=0.394), age (p=0.950), religion (p=0.482), marital status (p=0.135), or employment status (p=0.755)

**Table 3:** Prevalence of HBV co-infection among HIV patients on HAART based on sociodemographic characteristics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | HBV Co-infection (%) |  |  |
| Variables | Response | Freq. | Negative | Positive | **χ2** | p-value |
| Sex | Male | 64 | 53(82.8) | 11(17.2) | 0.726 | 0.394 |
|  | Female | 186 | 162(87.1) | 24(12.9) |  |  |
|  | **TOTAL** | **250** | **215(86.0)** | **35(14.0)** |  |  |
|  |  |  |  |  |  |  |
| Age (years) | ≤20 | 2 | 2(100.0) | - | 0.352 | 0.950 |
|  | 21-40 | 95 | 82(86.3) | 13(13.7) |  |  |
|  | 41-60 | 132 | 113(85.6) | 19(14.4) |  |  |
|  | 61-80 | 21 | 18(85.7) | 3(14.3) |  |  |
|  | **TOTAL** | **250** | **215(86.0)** | **35(14.0)** |  |  |
|  |  |  |  |  |  |  |
| Religion | Christianity | 247 | 212(85.8) | 35(14.2) | 0.494 | 0.482 |
|  | Islam | 3 | 3(100.0) | - |  |  |
|  | **TOTAL** | **250** | **215(86.0)** | **35(14.0)** |  |  |
|  |  |  |  |  |  |  |
| Marital Status | Single | 31 | 23(74.2) | 8(25.8) | 2.560 | 0.135 |
|  | Married | 139 | 121(87.1) | 18(12.9) |  |  |
|  | Widowed | 69 | 60(87.0) | 9(13.0) |  |  |
|  | Divorced | 11 | 11(100.0) | - |  |  |
|  | **TOTAL** | **250** | **215(86.0)** | **35(14.0)** |  |  |
|  |  |  |  |  |  |  |
| Level of education | NFE | 53 | 47(88.7) | 6(11.3) | 11.0097 | 0.002 |
|  | Primary | 31 | 28(90.3) | 3(9.7) |  |  |
|  | Secondary | 71 | 62(87.3) | 17(17.9) |  |  |
|  | Tertiary | 95 | 78(82.1) | 6(11.3) |  |  |
|  | **TOTAL** | **250** | **215(86.0)** | **35(14.0)** |  |  |
|  |  |  |  |  |  |  |
| Employment | Employed | 80 | 68(85.0) | 12(15.0) | 0.098 | 0.755 |
|  | Unemployed | 170 | 147(86.5) | 23(13.5) |  |  |
|  | **TOTAL** | **250** | **215(86.0)** | **35(14.0)** |  |  |

Result is significant where (p<0.05); NFE=No Formal Education

Based on MSP's (Multiple Sexual Partners): Participants who reported having multiple sexual partners had a co-infection rate of 31.0%, significantly higher than the 4.9% among those without multiple partners (p=0.001). Based on Sharing of Sharps: A similar trend was observed with sharp sharing, where 25.9% of individuals who shared needles or other sharp instruments were co-infected, compared to just 3.7% among those who did not share sharps (p=0.001). Based on Alcohol Use: Alcohol consumption was another significant risk factor, with a co-infection rate of 31.0% among users versus 4.9% among non-users (p=0.001). Based on Smoking: No significant association was found between smoking and HBV co-infection, with rates of 17.6% in smokers and 13.7% in non-smokers (p=0.654). Based on Body Mass Index (BMI): The analysis showed no significant correlation between BMI categories and HBV co-infection rates, with percentages ranging from 35.7% in underweight individuals to 6.7% in severely obese individuals, but the p-value was not statistically significant (p=0.223).

**Table 4:** Prevalence of HBV co-infection of respondents with respect to risk factors

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  | HBV Co-infection (%) |  |  |
| Variables | Response | Freq. | Negative | Positive | **χ2** | p-value |
| MSP’s | Yes | 87 | 60(69.0) | 27(31.0) | 32.159 | 0.001 |
|  | No | 163 | 155(95.1) | 8(4.9) |  |  |
|  | **TOTAL** | **250** | **215(86.0)** | **35(14.0)** |  |  |
|  |  |  |  |  |  |  |
| Sharing of sharps | Yes | 116 | 86(74,1) | 30(25.9) | 25.292 | 0.001 |
|  | No | 134 | 129(96.3) | 5(3.7) |  |  |
|  | **TOTAL** | **250** | **215(86.0)** | **35(14.0)** |  |  |
|  |  |  |  |  |  |  |
| Alcohol use | Yes | 87 | 60(69.0) | 27(31.0) | 32.159 | 0.001 |
|  | No | 163 | 155(95.1) | 8(4.9) |  |  |
|  | **TOTAL** | **250** | **215(86.0)** | **35(14.0)** |  |  |
|  |  |  |  |  |  |  |
| Smoking | Yes | 17 | 14(82.4) | 3(17.6) | 0.202 | 0.654 |
|  | No | 233 | 201(86.3) | 32(13.7) |  |  |
|  | **TOTAL** | **250** | **215(86.0)** | **35(14.0)** |  |  |
|  |  |  |  |  |  |  |
| BMI | Underweight | 14 | 9(64.3) | 5(35.7) | 6.964 | 0.223 |
|  | Normal | 131 | 113(86.3) | 18(13.7) |  |  |
|  | Overweight | 60 | 53(88.3) | 7(11.7) |  |  |
|  | Moderately obese | 26 | 23(88.5) | 3(11.5) |  |  |
|  | Severely obese | 15 | 14(93.3) | 1(6.7) |  |  |
|  | Morbidly obese | 4 | 3(75.0) | 1(25.0) |  |  |
|  | **TOTAL** | **250** | **215(86.0)** | **35(14.0)** |  |  |

Result is significant where (p<0.05);

The data from Table 5 identifies independent predictors of hepatitis B virus (HBV) co-infection among HIV patients on HAART. With respect to Level of Education (LOE), Compared to individuals with tertiary education (reference group), those with secondary education had a higher odds ratio of HBV co-infection, but it was not statistically significant (COR = 2.419, p=0.049). The odds ratios for no formal education (NFE) and primary education were not statistically significant. Having multiple sexual partners was a significant predictor of HBV co-infection (COR = 3.600, p=0.001).Sharing sharp instruments was also a significant predictor of HBV co-infection (COR = 2.674, p=0.002).Alcohol use was significantly associated with HBV co-infection (COR = 3.271, p=0.001).

**Table 5:** Independent predictors of HBV co-infection among HIV patients on HAART

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  | 95% C.I |
| Predictors | Response | COR | p-value | Lower | Upper |
| LOE | NFE | 0.654 | 0.529 | 0.175 | 2.451 |
|  | Primary | 1.271 | 0.626 | 0.475 | 3.580 |
|  | Secondary | 2.419 | 0.049 | 0.484 | 4.338 |
|  | Tertiary (Ref) | 1.000 |  |  |  |
|  |  |  |  |  |  |
| MSP’s | Yes | 3.600 | 0.001 | 2.074 | 6.251 |
|  | No |  |  |  |  |
|  |  |  |  |  |  |
| Sharing of sharps | Yes | 2.674 | 0.002 | 1.551 | 4.611 |
|  | No (Ref) | 1.000 |  |  |  |
|  |  |  |  |  |  |
| Alcohol use | Yes | 3.271 | 0.001 | 1.892 | 5.655 |
|  | No(Ref) | 1.000 |  |  |  |

Dependent variable: HBV co-infection; MSP=Multiple Sexual Partners: NFE=No formal education

**DISCUSSION**

The findings of this study has revealed a HBV co-infection rate of 14%, with a mean age of 44 years and a male to female sex ratio of 1:3. The findings further shows that low education level, multiple sexual partners, sharing of sharps, and alcohol use are significant independent predictors of HBV co-infection among HIV patients on HAART. Sex, age, religion, marital status, employment, smoking and BMI were not significantly associated with HBV co-infection.

The 44 years mean age found in this study is in agreement with recent national statistics that indicate that the burden of HIV infection in Nigeria is highest in individuals aged 15- 49 years (about 75% of all PLWHA). (9) More women (randomly selected) were found to have participated in this study, which may suggest that more women attended the ART clinic during the study period. Generally speaking, the sex preponderance is consistent with national figures showing that more than half of PLWHA in Nigeria are women, whether in rural or urban regions. (9)

The co-infection rate of 14% in this study is substantially high and can be attributed to several interrelated factors, such as the Shared transmission route that exist in both virus, primarily through Unprotected sexual practices, Sharing needles and other sharps as well as low education and awareness, which often correlates with poor health-seeking behaviors and limited knowledge about preventive measures could have influence the observed rate. The reported prevalence of HBV co-infection among HIV patients in this study aligns with global estimates, which suggest that approximately 5% to 10% of HIV-infected individuals are also infected with HBV.(5) However, studies have shown varying prevalence rates of HBV co-infection among HIV patients globally, America is known as the continent with the least HBV prevalence but the HIV-HBV co-infection is frequent. (10) A study from Atlanta reported as high as 59.8% (11) while a study in New York city has reported 4.47%. (12) 10.46% and 40.9% has been reported in Canada and Brazil respectively. (13,14) In Asia, HBV co-infection is reported to be endemic.(15) Although the number of studies is limited, a relatively high prevalence of co-infection has been reported in Iran to be 28.6%. (16) The rates of 14.5 and 11.25 % have also been reported in Iran. (17,18) 29.34%, 11.9%, and 8.35% were reported in China, Japan and India respectively. (19-21) Previous studies have indicated that sub-Saharan Africa is highly endemic for HBV and HIV co-infections. (22) surprisingly they compared lower than this present study, a study revealed that 12.17% among women in Burkinafaso, (23) a very low rate of 1.13% was seen in Mali, (24) studies in Abidjan showed 9.0% rate.(25) Higher rates relative to this present study shows 21%, 20% in Cameron and South Africa respectively. (26,27) In Nigeria, earlier report have shown relatively lower co-infection rates compared to this present study, a rate of 10% was reported for all HIV infected patients in Nigeria. (28) Similarly, 11% was reported in Yola Adamawa state (29) Other Nigerian studies align themselves with the aforementioned, 12.5% was reported in Kano, North West Nigeria,(30) 11.9% in Ibadan,(5) 11.5% in Abuja,(31) and 11.8% in Jos.(32) The current study's relatively higher prevalence of co-infection supports the growing concern about HBV/HIV coinfection due to increased immune suppression, higher levels of HBV replication, lower rates of spontaneous resolution of the HBV infection, a higher risk of reactivation of prior infections, and increased tenofovir-induced toxicity from antiretroviral medications in HBV co-infected individuals. This suggests that people who are co-infected with HBV and HIV have a higher chance of developing liver cirrhosis. (33,34)

Findings from this study also showed that more coinfection was observed in men (17.2%) than women although the difference was not statistically significant, this is however in contrast to studies by Okechukwu *et al* in Owerri who found that the prevalence was higher in women (65.6%) than in men (34.4%).(35) In Abuja, Nigeria, another study by Adewole et al. (31) revealed a greater prevalence of HIV/HBV co-infection among women. Men in the research area may be more likely than women to participate in risky behaviors that favor transmission, as seen by the difference between male and female coinfection in those studies.

The results also showed that 17.9% of people with secondary level of education had the higher co-infection rate compared to those with tertiary level of education; there was a two-fold increase in chance of having a co-infection with secondary level of education. Low education and awareness, which often correlates with poor health-seeking behaviors and limited knowledge about preventive measures, could have influence the observed rate. (36) A study in Ethiopia also found lower education status to be significantly associated co-infection rate. (37)

The study also found that sharing of sharp objects was an independent predictor of co-infection rate, there was 2.6 fold increase chances of co-infection among individual who share sharp objects. This may be explained by the possibility of infection when sharp objects such as needles and blades infected with the virus are shared with. This is in keeping with a study in Muzambique were they found respondents with history of needle/syringe sharing and history of injection with used needle/syringe was associated with HIV/HBV co-infection and had 5 times chances of co-infection. (38) Other studies have also found that HIV and hepatitis co-infection are associated sharing of infected sharp objects. (39,40) Having multiple sexual partners was significantly associated with co-infection rate and increased the chance by 3.6-fold. This align with a study by Tesfaye *et al*. (41) The study also found that alcohol consumption was an independent predictor of HBV/HIV co-infection, and increased the chances of co-infection by 3.2-fold. This is not surprising because alcohol use is linked to risky sexual behaviors, which can increase the likelihood of acquiring HIV/HBV. Studies have shown that hazardous drinkers are significantly more likely to engage in unprotected sex or have multiple sexual partners which further contributes to the risk of both acquiring and transmission.(42) Additionally, alcohol can impair immune function, making the already HIV individuals more susceptible to other infections like HBV and potentially accelerating the chances of co-infection.(43) This finding is in keeping with a study conducted in Vietnam that found significant association of alcohol consumption with co-infection rate. (44)

The lack of significant association of variables such as Sex, age, religion, marital status, employment, smoking and BMI could be attributed to some limitations in this study, which was limited in some aspect. Several potential biases could have influence the study's findings. The reliance on self-reported questionnaires may have led to social desirability bias, where respondents provide answers they believe are expected rather than their true practices, the sample may not represent all HIV cohort in Makurdi, as it was limited to a specific tertiary hospital since it was not a cross-sectional study limits its ability to establish causal relationships between these variables and co-infection outcomes. The generalizability of this study is also limited by its specificity focusing on Federal medical center Makurdi that is just one of the 3 major tertiary health centers in the study area and could provide a limited insight into Changes over time. Lastly, rather than the other background factors, the inhibition of immune responses against HBV infection in HIV-positive individuals may be the cause of the increased incidence of HBV in these patients. (45)

**CONCLUSION**

This study's rather high frequency of HBV/HIV coinfection (14%) demonstrates the disease's endemicity and is, thus, a crucial indicator that needs to be taken into account prior to starting antiretroviral therapy for HIV-positive individuals. This is because it might influence the patients' selection of HAART regimen. More research and focus on this area are necessary in order to plan more potent preventative or treatment measures.

**RECOMMENDATIONS**

Raising public health awareness is necessary to address risk behaviors and promote health through widespread testing and vaccinations, given the seroprevalence of HBV among HIV patients and the general population.

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