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Prevalence and Vaccination Status of Hepatitis B among HIV-Infected Patients in N'Djamena, Chad

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Abstract

The hepatitis B virus is transmitted in the same ways as HIV. With an estimated prevalence rate of over 8% in the general population, Chad is classified as a country with a high endemicity of hepatitis B virus infection. This study examines the prevalence of HIV/HBV co-infection and hepatitis B vaccination status among individuals who underwent voluntary HIV and hepatitis B screening at three HIV treatment centers in N'Djamena, Chad. Over an eight-month period, 2210 participants were tested, of whom 133 were co-infected with HIV/HBV, representing a prevalence of 6%. The prevalence of HIV/HBV co-infection was higher among females, 9.40%, with a sex ratio (M/F) of 0.60. The prevalence of HIV/HBeAg was 1%, while that of HIV/anti-HBcAb was 2.4%, HIV/anti-HBs antibodies was 100% negative. The average age of patients was 35 years, ranging from 18 to 70 years. The most represented age group was 25 to 35 years (36.8%). None of the co-infected participants had been vaccinated against HBV. HIV/HBV co-infection is considered a significant public health problem in Chad, requiring early diagnosis through awareness and screening campaigns among the general population, thereby enabling better care for patients co-infected with HIV/HBV.

Keywords

Prevalence, Vaccination, Co-Infection, HIV, HBsAg (HBV), N'Djamena, Chad

1. Introduction

HIV remains a major global public health issue, having caused the deaths of some 44.1 million people. Transmission continues in all countries worldwide. It is estimated that approximately 40.8 million people were living with HIV at the end of 2024, 65% of them in the WHO African Region [1]. Several years after its discovery, the Human Immunodeficiency Virus (HIV) remains one of the leading causes of death worldwide, with Sub-Saharan Africa paying the heaviest price [2].

Hepatitis B is a major public health issue [3]. The WHO estimates that 254 million people were living with chronic hepatitis B in 2022, with 1.2 million new infections each year. Approximately 1% of people living with HBV (2.7 million) are also infected with HIV. Conversely, the global prevalence of HBV infection among people infected with HIV is 7.4% [3].

The World Health Organization (WHO) classifies Chad as a region with high HBV endemicity, corresponding to an HBsAg seroprevalence of 8% [4].

Co-infection with Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV) is a major public health concern worldwide, particularly in sub-Saharan Africa [5].

The hepatitis B virus is transmitted in the same ways as HIV/AIDS. The clinical manifestations of HIV-HBV co-infection are indistinguishable from those of chronic hepatitis [6]. HBV vaccination should be offered to HIV-positive patients with no markers or isolated anti-HBc antibodies [6].

In Cameroon, the prevalence of HIV-HBV co-infection was 35.6% [7]. In Bangui, the prevalence of HIV-HBV co-infection was 11.7% [8]. In Senegal, 6.5% of people are co-infected with HIV and HBV [9]. The management of HIV infection must take into account the possibility of HBV infection [8].

HIV infection alters the natural history of HBV and worsens the prognosis for patients with chronic hepatitis B. It is associated with an increased risk of acute hepatitis B becoming chronic, thereby accelerating the progression of lesions such as fibrosis and the risk of developing complications such as cirrhosis and hepatocellular carcinoma [10].

In our context, surveys on HIV/HBV co-infection and vaccination status are not sufficiently conducted among people who have not received antiretroviral treatment. The objective of our study is, therefore, to determine the prevalence and vaccination status among patients co-infected with HIV/HBV in N'Djamena, Chad.

2. Materials and Methods

2.1. Study Framework

The study was conducted in N'Djamena at three [3] HIV and hepatitis treatment centers, including the Psycho-Medical-Social Support Center (APMS), the Chad-China Friendship University Hospital Center (CHU-ATC), and the National Reference Hospital Center (CHU-RN).

Laboratory analyses were carried out at the APMS Laboratory, which is the laboratory for the sectoral program to fight AIDS and hepatitis in Chad; the CHU-ATC Laboratory; and the CHU-RN Laboratory.

2.2. Type and Period of Study

This is a prospective, transversal study lasting 8 months, from March 2025 to October 2025.

2.3. Study Population

The study population consisted of male and female patients over 18 years of age who were seen at the laboratory of the APMS, CHU-ATC, and CHU-RN in N'Djamena for screening for both HIV and hepatitis B. The counseling was carried out by qualified staff from the treatment units.

2.4. Inclusion Criteria

All newcomers for voluntary HIV and hepatitis B screening, patients who have not previously received antiretroviral treatment, and who agree to take part in the study.

2.5. Exclusion Criteria

Children, patients undergoing antiretroviral treatment prior to testing, and patients who are not willing or unable to take part in the study.

2.6. Variables Studied

The variables recorded in the data collection form include sociodemographic data (age, gender, marital status, and occupation); serological markers (HIV, HBsAg, HBeAg, anti-HBc antibodies and ant-HBs antibodies); and HBV vaccination status (yes or no). After collecting and labeling whole blood in an anticoagulant tube or dry tube, it should be centrifuged for 5 minutes in the centrifuge. After centrifugation, 50 microliters of serum or plasma are collected using a pipette, placed in the well of the strip, and left for 15 minutes before reading the result. The diagnosis of HIV infection was made according to the national HIV testing algorithm in Chad, following WHO strategy 2. It consisted of using three tests: Determine HIV 1⁄2, SD Bioline HIV1/2, and STAT-PAK HIV1/2. Quality control was also performed on each positive sample in the laboratory using the ELISA method with the mini-Vidas automated system (bio-Mérieux, France). Five known samples (3 negatives and 2 positives) were used for quality control of the analyses.

For HIV Determine HIV 1/2 Test: Determine HIV 1/2 is an immunochromatographic test for the qualitative detection of HIV-1 and HIV-2 antibodies [11]. The sample is placed on the deposition area, then migrates to the conjugate area where it forms and mixes with the selenium-Ag colloidal conjugate. This mixture continues to migrate on the solid surface to the immobilized recombinant Ag synthesized at the patient window [11]. To ensure assay validity, a procedural control

is incorporated in the device and is labeled "control". If the control bar does not turn red by assay completion, the result is invalid and the sample should be re-tested. The procedure and instructions for use of HBe Ag, anti-HBc antibodies and anti-HBs antibodies cassettes are similar to those for HBs Ag.

Confirmation was performed by ELISA using the mini-Vidas automated system, in accordance with the manufacturer's recommendations (bio-Mérieux, France). The protocol was strictly followed as per the manufacturer's instructions.

Positive samples determined by HIV1/2 are evaluated using a second SD Bioline HIV1/2 immuno-chromatographic test, which allows the type of HIV (HIV-1 and HIV-2) to be specified. Samples that test positive with SD Bioline are then tested using STAT-PAK HIV1/2.

For SD Bioline HIV1/2 Diagnosis: The SD Bioline HIV1/2 test is a confirmatory test for HIV1/2.

To perform this test, it is important to bring the samples to room temperature between 15˚C and 30˚C. The test device is then removed from the aluminum foil pouch and placed on a flat, dry surface. A label with the patient's identity is affixed to the test device. Using a precision micropipette, 20 to 50 microliters of plasma or serum or 20 microliters of whole blood are collected and placed in the "S" sample well, then 4 drops of assay diluent are added to the "S" sample well and the test result is observed for 10 to 20 minutes after the assay diluent is added to the strip. To ensure assay validity, a procedural control is incorporated in the device and is labeled "control". If the control bar does not turn red by assay completion, the result is invalid and the sample should be retested.

For STAT-PAK HIV1/2 Test: The Chembio HIV1/2 STAT-PAK test is also a confirmatory test. After removing the device from the box and its pouch and bringing it to room temperature, place it on a flat surface. The sample loop is held upright and the buffer is brought into contact with the center of the specimen area of the device to deposit 5 microliters of the sample (plasma). The transport buffer vial is then inverted, and 3 drops of the buffer solution are slowly added to the specimen. The test result is then read 15 minutes after the transport buffer solution is added. In some cases, a test line may appear in less than 15 minutes; however, it takes 15 minutes to report a nonreactive test result. To ensure assay validity, a procedural control is incorporated into the device and is labeled "control". If the control bar does not turn red by assay completion, the result is invalid and the sample should be retested.

The test results are then read in a bright area. The protocol was strictly followed as per the manufacturer's instructions.

For HBs Ag Test: The HBs Ag rapid test cassette is a qualitative two-site solid-phase sandwich immunochromatographic assay for the detection of HBs Ag in whole blood, serum, or plasma [12]. The membrane is pre-coated with anti-HBs Ag antibodies in the test line area. During the test, the whole blood, serum, or plasma sample reacts with the anti-HBsAg antibody-coated particles to form a complex. The complex migrates chromatographically by capillary action to the

top of the membrane to react with anti-HBs Ag antibodies present on the membrane, thereby generating a colored line. The presence of this color line in the test zone indicates a positive result, while its absence indicates a negative result. To serve as a procedural control, a color line always appears in the control line zone, indicating that a correct volume of sample has been added and the membrane has been properly saturated by capillary action. To ensure assay validity, a procedural control is incorporated in the device and is labeled "control". If the control bar does not turn red by assay completion, the result is invalid and the sample should be retested.

The procedure and instructions for use of HBe Ag and AC anti-HBc cassettes are similar to those for HBs Ag. Confirmation was performed by ELISA using the mini-Vidas automated system, in accordance with the manufacturer's recommendations (bio-Mérieux, France). The protocol was strictly followed as per the manufacturer's instructions.

2.7. Sampling

A simple randomized sampling technique was used to recruit antiretroviral treatment-naïve subjects. The volunteers were recruited after providing written consent.

2.8. Data Analysis

The data collected on the individual survey forms were recorded in Excel 2013, exported, and analyzed using IBM SPSS 26 software.

3. Results

During the study period, we followed 2210 individuals who came for voluntary HIV and hepatitis B screening at the study sites, patients who had not received antiretroviral treatment, of whom 1770 were HIV-negative 80.1%; 432 were HIV-1 positive representing a HIV-1 infection rate of 19.5%; HIV-2 0.1% and HIV1-2 0.3% (Table 1).

The number of participants was estimated at 2210 patients, of whom 133 were co-infected with HIV/HBV, representing a prevalence of HIV/HBV co-infection of 6% (Figure 1).

The prevalence of HIV/HBeAg was 1% (n = 22), while that of HIV/anti-HBcAb was 2.4% (n = 54), HIV/anti-HBs antibodies was 100% negative (n= 133). The results of this study show that the prevalence of HIV/HBsAg was higher among females (9.40%) than among males (3.80%), with a sex ratio (M/F) of 0.60 (Figure 2).

Table 1. Distribution of frequency and percentage of status and type of HIV.

Status and type of HIV	Frequency	Percentage % [IC 95%]
NEGATIVE HIV	1770	80.1%

Continued

POSITIVE HIV-1	432	19.5%
POSITIVE HIV-2	2	0.1%
POSITIVE HIV1-2	6	0.3%
Total	2210	100.0

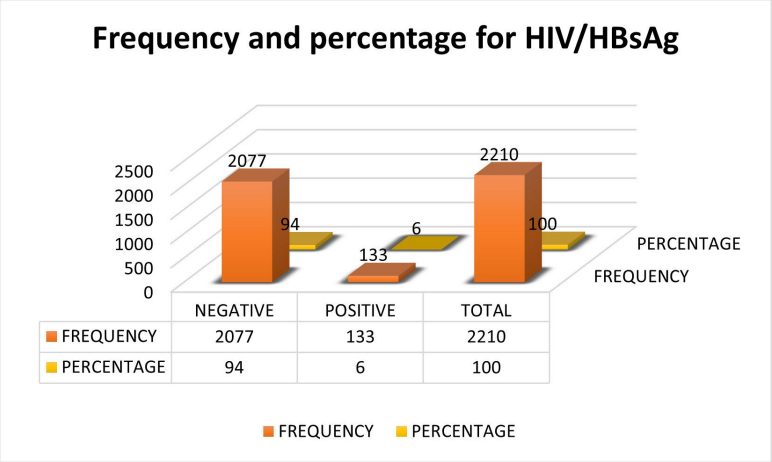

Figure 1. Frequency and percentage for HIV/HBsAg.

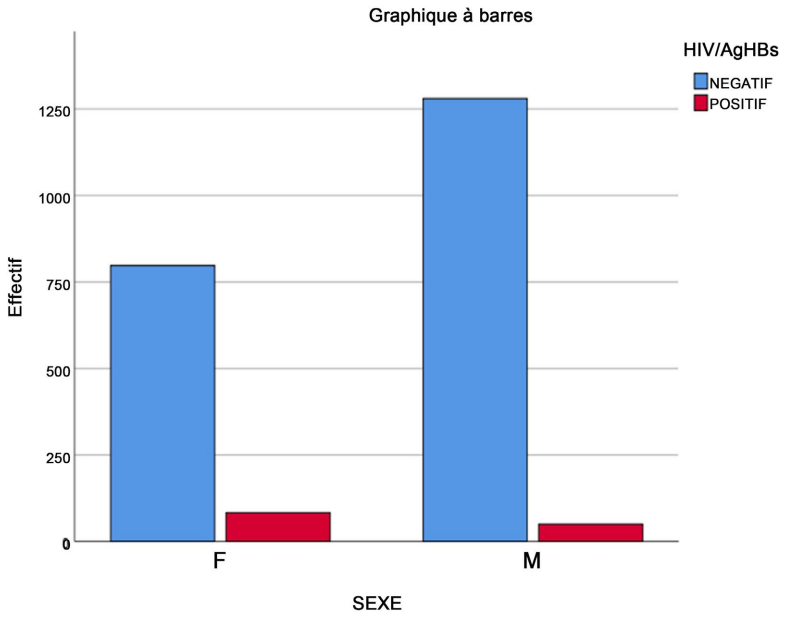

Figure 2. HIV/HBsAg prevalence by sex.

We observe that males were the most represented in the total sample with 1,329 (60.1%) participants, giving a sex ratio (M/F) of 1.50. The most represented age group was patients aged 25 to 35 years, with 36.8% of the sample, followed by those aged 18 to 25 years, with 30.0%, with extremes ranging from 18 to 70 years old (**Table 2**).

We note that married individuals constituted the dominant group with 44.8%

of respondents, followed by single individuals with 37.3% (Table 2 and Figure 3).

Other professions accounted for 20.7%, and civil servants accounted for 16%. In terms of educational attainment, higher education accounted for 40.9%, followed by secondary education at 32.5% (Table 2). Hepatitis B vaccination: during our study, none of the patients had been vaccinated against HBV, representing a prevalence of 100% unvaccinated against HBV (Table 2).

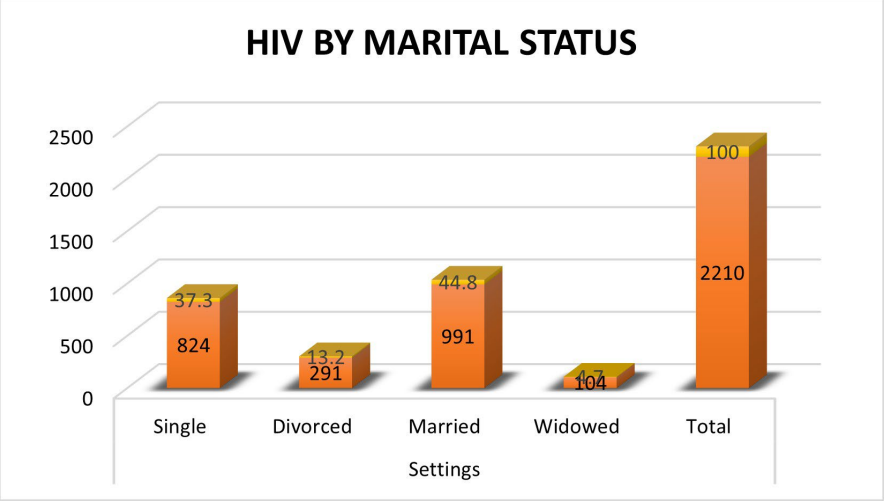

Figure 3. HIV*Status married.

Table 2. Distribution of sociodemographic and vaccination status.

Settings	Workforce (n)	Percentage % [IC 95%]
	Sex	
Males	1330	60.1
Females	880	39.9
	Age Groups	
[18 - 25[	663	30.0
[25 - 35[	814	36.8
[35 - 45[	499	22.6
[45 - 55[	167	7.6
[55 - 70]	67	3.0
	Married status	
Married	991	44.8
Single	824	37.3
Divorced	291	13.2
Widowed	104	4.7
	Level of education	
Higher	904	40.9
Secondary	718	32.5

Continued

Primary	263	11.9
Not in school	325	14.7
Occupation		
Student	320	14.5
Pupil	133	6.0
Civil servant	354	16.0
Military personnel	228	10.3
Retailer	269	12.2
Housewife	293	13.3
Unemployed	156	7.1
Other	457	20.7
Status vaccinal		
Vaccinated	0	0
Not vaccinated	133	100

4. Discussion

The prevalence of HIV/HBV co-infection in this study was found to be 6%; this prevalence is close to that reported by Manga N. M. *et al.*, in Senegal, which was 6.5% [9]; Hamidine I. *et al.*, in Niger (Zinder), 6.45% [10]; and in Togo by M. R. TOGAN *et al.*, 6.5% [13]. On the other hand, Zezerti *et al.* found a prevalence of HIV/HBV of 4.17% in N'Djamena [14].

This high or moderate prevalence could be explained, on the one hand, by the absence of a vaccination policy for adults, unlike children who receive the vaccine as part of the expanded program on immunization, and the lack of mass screening campaigns. Added to this are other risk factors for co-infection, such as having multiple sexual partners and engaging in unprotected sex.

Higher prevalences of HIV/HBV co-infection have been reported in China by Y. X. Y. A. N. *et al.*, 12.49% for HIV/HBsAg [15]; in Wilson *et al.*, 23.7% [16]; in Benin (Parakou) by Dovonou *et al.*, 16.9% [17]; in N'Djamena, Chad by Bessimbaye *et al.*, 16.1% [18]; in Burkina Faso by ILBOUDO, 15.3% [19]. The difference between these prevalence rates and those in our study is related to the methodological approach (often a retrospective study; the inclusion criterion of patients already infected with HIV and receiving antiretroviral treatment; and also the study period, which has an influence).

The average age of our patients was 35, ranging from 18 to 70; this can be explained by the fact that HIV infections and other viruses with the same modes of transmission are frequently observed in young adults who are physically and sexually active.

For HIV status and type, we obtained an HIV-1 infection rate of 19.5%; HIV-2 of 0.1%, and HIV1-2 of 0.3%. This result is consistent with those found by Bes-

simbaye *et al.* in Chad, where 99.98% were HIV-1 positive compared to 0.2% HIV-2 positive, confirming that HIV-1 is the predominant type in Central Africa in general and Chad in particular [18].

In our study, HIV/HBV co-infection was predominantly found in women, 9.40%, with a sex ratio (M/F) of 0.60. The predominance of women is consistent with data in the literature; in Cameroon, the predominance is female [7]; in Sénégal, Ndiaye M and al., found that women predominated, accounting for 78.13% [20]; in Libreville, Magalie and al., found that women predominated with a sex ratio of 0.7 [21]. Several factors explain women's vulnerability to HIV in our context, including biological vulnerability. Women are 2 to 4 times more at risk of HIV during sexual intercourse than men, as the fragility of the vaginal wall offers multiple routes of transmission for HIV and also increases the risk through IST, according to the WHO [22].

Among our patients, married individuals accounted for 44.8%, a result similar to those found by M. A. Bolti *et al.*, with 46.6% married [22]; Boateng *et al.* found that a majority, 49.5% of the subjects were married [23]. Married individuals are most at risk. This increase among married individuals can be explained by the refusal to disclose HIV status to a spouse for fear of stigmatization and breakup of the couple [22].

In our study, other professional statuses accounted for 20.7%, while civil servants accounted for 16.0%. Our results were similar to those reported by Hamidine I. *et al.*, in Niger, where other professions accounted for 17.58% and civil servants for 14.29% [10]. Other professions, homemakers, and civil servants were vulnerable because they were working.

Vaccination status: We found that none of the patients had been vaccinated against HBV. Our results differ from those found in Lomé (Togo) by TAKASSI O. E. *et al.*, testing for total anti-HBs and anti-HBc antibodies in HBsAg-negative patients showed that only 0.4% of patients had been vaccinated against HBV [24]. This could be explained by the fact that our methodologies differ in that we were unable to perform anti-HBs antibody serology in HBsAg-negative patients. The prevalence of HIV/HBeAg is 1.0%, while that of HIV/anti-HBc antibodies is 2.4%. We did not find any data on viral markers (HBeAg and anti-HBc antibodies) for hepatitis B in the literature reported in our study.

Patients co-infected with HIV/HBV were placed on triple antiretroviral therapy based on Tenofovir + Lamivudine + Dolutegravir (TLD) by doctors at treatment centers in accordance with the treatment regimen recommended by the Ministry of Public Health and Prevention. In cases of HIV/HBV co-infection in adults, adolescents, and children aged 3 years or older co-infected with HIV and HBV, the fixed-dose combination of Tenofovir + Lamivudine + Dolutegravir is the preferred option for starting triple antiretroviral therapy [4].

5. Conclusion

At the end of this study, it appears that the prevalence of HIV/HBV coinfection

was 6% in N'Djamena, with a predominance among women. The application of the current World Health Organization recommendations on screening and management of HIV/HBV coinfection will reduce morbidity and mortality.

Prevention through vaccination against hepatitis B virus in at-risk individuals remains the best strategy for reducing the prevalence of hepatitis B in the general population, and particularly among HIV-infected individuals. Large-scale national surveys are needed to determine the extent of HIV/HBV coinfection.

Author Contributions

All authors contributed to data acquisition, analysis, and interpretation; writing of the paper; critical review of its intellectual content; and final approval of the version to be published. All authors contributed to the conduct of this work. All authors also declare that they have read and approved the final version of the manuscript.

Ethical Considerations

The study was conducted in strict compliance with confidentiality requirements, and anonymity was ensured through the use of patient registration numbers. We obtained ethical clearance from the National Bioethics Committee of Chad under number N°056/MESRS/SE/SG/CBNT/SG/2025. Research authorizations were obtained from the various health centers in N'Djamena. All participants agreed and signed the informed consent form.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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