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Hepatitis B and C Profile, and Choice of ART Among HIV-Infected Patients: A Review of Patients of an Urban Tertiary Hospital Who Received Home Care

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Abstract

Due to similar routes of transmission, human immunodeficiency virus infection is often associated with the risk of co-infection with hepatitis B and/or C virus infection, the consequence of which is an accelerated progression to chronic liver disease. Screening for hepatitis and early commencement of antiretroviral therapy with tenofovir-based dual Nucleoside Reverse Transcriptase Inhibitor (NRTI) backbone has been recommended for co-infected persons as this could reduce the disease burden in them. Unfortunately, in developing countries, due to financial constraints, very few HIV care programs can provide these benefits for their patients. This study was undertaken at a center where hepatitis screening and tenofovir-based regimen were available, and aimed to assess the presence of co-infection with Hepatitis B and/or Hepatitis C in a population of HIV patients, and its impact on the choice of NRTI backbone in the patients' antiretroviral regimen. Methods: After excluding 12 records due to missing hepatitis screening results, data of 140 HIV-infected patients enrolled at the Jos University Teaching Hospital antiretroviral therapy (ART) clinic, who also received home based care from September 2008 to December 2013, were reviewed. Relevant information was extracted and analyzed using Epi info version 7. Results: Of 140 patients, 22.8% and 8.6% tested positive to HBV and HCV respectively, while 4.3% tested positive to both HBV and HCV. The age group 30-39 years had the highest frequency of those co-infected. More females tested positive to HBV (71.9%) and HCV (66.7%), but equal proportions of both genders had both HBV and HCV (50%). Of those who tested positive to hepatitis (81.6%) were on ART as follows: 22 (84.6%) of HBV co-infected, 3 (50%) of HCV co-infected and 6 (100%) of HBV/HCV co-infected were on the recommended ART regimen that contained dual NRTI backbone while 3 (11.5%) of HBV co-infected and 1(16.7%) of HCV co- infected were on ART regimen with the less ideal mono NRTI backbone. Three (eight percent) patients with hepatitis (1 HBV and 2 HCV) were not on ART. Conclusion: The rate of co-infection with HBV and HCV was high among these patients, and consequently, a majority of them were on the recommended dual NRTI backbone regimen. This reflects a reasonable extent of conformity with recommendations for HIV-hepatitis care. There is however a need to evolve improved strategies to ensure that, all patients are screened and placed on the appropriate regimen.

Keywords

Hepatitis, Human Immunodeficiency Virus, Antiretroviral Therapy, NRTI Backbone

1. Introduction

An overwhelming number of people worldwide have become infected with human immunodeficiency virus (HIV), and sub-Saharan Africa has been worst hit by this scourge. [1] Nigeria has the second largest number of people living with HIV. [2] Similar to HIV infection, hepatitis B virus (HBV) and hepatitis C virus (HCV) are endemic in Africa. [3] By virtue of the similar routes of transmission for HIV, HBV and HCV infections, (which include sexual intercourse, unsafe injections, and mother to child transmission), it is not unusual to find these infections coexisting in the same individuals, and this is becoming a fast growing problem of considerable concern. [3], [4] It has been reported that Nigeria may have the highest prevalence of HBV in sub-Saharan Africa. [5]

Globally, it is estimated that 2-4 million HIV-infected persons are co-infected with HBV and 4-5 million are co-infected with HCV. [4] Studies have shown that many HIV-infected persons are also co-infected with HBV and HCV, and the prevalence varies with risk factors that are associated with geographical location and lifestyle. [3], [4], [6] The prevalence of HBV and HCV is increased in HIV-infected individuals. [3]

HBV and HCV infections are associated with progression to chronic liver disease (CLD), which includes fibrosis, cirrhosis and hepatocellular carcinoma. [7]. Where HBV and or HCV infection exists in the presence of HIV infection, the progression to CLD is accelerated, and in addition, the risk for antiretroviral (ART)-related hepatotoxicity is heightened; thus causing decreased survival in such patients. [8] In patients infected with HIV, HBV and /or HCV, mortality primarily from liver disease ranks high among non-acquired immunodeficiency syndrome (AIDS) causes of death, and the risk of death is highest in HIV patients with both HCV and HBV. [9]

The advent of ART has greatly changed the course of HIV infection from a terminal to a chronic disease. Granted that access to ART has improved the survival of HIV- infected patients, the morbidity and mortality associated with coexisting HBV and/or HCV infection, has in turn become more obvious, and may result in poorer ART outcomes. [10] The World Health Organization (WHO) recommends the commencement of ART in HIV positive patients co-infected with HBV and/or HCV regardless of CD4 level. [11] Though ART poses a high risk for hepatotoxicity in co-infected patients, the risk of hepatotoxicity is far outweighed by the survival benefits and this is because the use of ART in such patients exerts a positive impact by reducing liver-associated morbidity and mortality. [12], [13] In the treatment of HIV-HBV coinfection, a tenofovir-based dual HBV-active ART regimen is preferred to lamivudine or emtricitabine HBV monotherapy due to development of resistance with monotherapy. However, tenofovir is not universally available in resource limited settings. [9] Where available, the preferred regimen is a fully suppressive ART regimen containing a fixed dose combination of tenofovir/emtricitabine, tenofovir/lamivudine or the individual drug combinations of tenofovir plus lamivudine as the nucleoside reverse transcriptase inhibitor (NRTI) backbone. [14] All of these antiretroviral drugs have dual activity against HIV and HBV.

It is recommended that all HIV-infected patients should be screened for HCV and HBV upon enrollment into a HIV care program [8]. The advantage of detecting the existence of coinfection is for the benefit of commencing ART early in such patients so as to reduce the morbidity and mortality associated with hepatic disease brought on by co-infection. Screening also helps in decision making for which ART regimen would best suit the co-infected patients. Unfortunately, in low socioeconomic settings like Nigeria routine screening as part of the ART management protocol is usually not always feasible due to costs, therefore, existing HBV and HCV infections may not be diagnosed. [15], [16] Additionally, because co-infected patients receive ART for HIV care, and most antiretroviral regimens contain either a lamivudine or emtricitabine backbone which has activity against HBV (as monotherapy), the possibility of HBV resistance due to HBV monotherapy is likely to arise. [9], [17] Such patients become a source for transmitting resistant hepatitis virus. It is expected therefore that where screening for hepatitis is available all HIV-hepatitis co-infected patients should be on an ART regimen containing dual NRTI. For HIV/HCV coinfections, patients have been treated with PEG-IFN/rivabarin, and more recently with direct-acting antivirals. [18] In developing countries, there is limited access to HCV treatment due to high cost and the complexities of patient management. [19]

Home based care could be an avenue for spreading such blood borne infections if the practice of universal precautions is below standard. Many HIV infected patients in sub-Saharan African countries receive healthcare services at home in the form of home based care, a strategy that has been recognized as a necessary component of HIV care [20]. Home based care givers and family members who care for these patients are at risk of infection with HIV, and by virtue of shared routes of transmission, HBV and HCV infections as well if the patient is co-infected. The following factors enhance the acquisition of infection in caregivers: most HBC patients live in crowded conditions that promote poor hygiene; protective materials for observing universal precautions may be lacking, be in short supply or be substandard; there is a negative disposition to the use of protective devices. [21]

Because hepatitis screening and tenofovir-based ART regimen are not commonly available as part of the ART care package in developing countries including Nigeria, and our centre is privileged to provide these services, we were interested in assessing and documenting the pattern of ART use in co-infected patients. The aim of this study was to describe the profile of HBV and/or HCV co-infected persons living with HIV/AIDS and the choice of NRTI-containing ART regimen in a population of HIV infected patients who received homebased care, with a view to highlighting the role

of hepatitis screening in ART programs, as well as to promote the importance of universal precautions in home based care practice.

2. Materials and Methods

The study was a retrospective study using secondary data of HIV-infected patients in an adult ART center, who also received home based care. The study was carried out at the adult ART clinic of the AIDS Prevention Initiative in Nigeria (APIN) Centre, Jos University Teaching Hospital (JUTH), a tertiary hospital located in the urban city of Jos, the capital of Plateau State, Nigeria. The state is situated in north central Nigeria and is spread over an area of 26,899 square kilometers with an estimated total population of 3,206,531. [22] The adult ART clinic provides care and treatment for non-emergency, adult HIV-infected patients enrolled into its program. Patient care is sometimes extended into the patients' homes in the form of home based care services. APIN Centre has the privilege of being equipped with a standard laboratory that carries out most of the tests necessary for HIV diagnosis, care and monitoring, including screening tests for HBV (hepatitis B surface antigen [HBsAg]) and HCV (antibodies against hepatitis C virus [anti-HCV]) which is done at the point of patient enrollment or later if it is discovered that this was not done at enrollment. A positive test for hepatitis qualifies a patient to be immediately placed on a dual NRTI ART regimen irrespective of CD4 cell count. Patients who are already on a mono NRTI regimen and thereafter found to have hepatitis are switched to a dual NRTI ART regimen. All of this is possible because of availability of testing and relevant drugs as part of the ART care package. Patients with a positive HIV test are eligible to enroll in the program. Patients are referred to this center from within and outside the hospital, as well as from neighboring states.

Data was obtained from the APIN/PEPFAR electronic data bank of the adult ART clinic where all patients' records are routinely stored. The health records of 152 adult HIV-infected patients aged 18 years and above, attending the adult ART clinic, and who had received home visits during the study period from 1st September 2008 to 31st December 2013 were reviewed. Incomplete laboratory results were updated from the laboratory data bank. Twelve records were excluded due to missing HBsAg and anti-HCV results, and only the remaining 140 were reviewed. The patients' basic sociodemographic and clinical characteristics of age, sex, marital status, level of education, risk for HIV infection, WHO clinical stage of disease, baseline CD4 cell count, baseline viral load, ART status, HBsAg and anti-HCV serology results were retrieved.

2.1. Data Analysis

Data obtained was analyzed using Epi info version 7 statistical software package (CDC, Atlanta GA). Variables were presented as frequencies and percentages, and Chi square was used to compare differences in proportions. The fisher exact was used where cells contained less than five observations. A confidence interval of 95% was used, and a P value of <0.05 was considered statistically significant.

2.2. Ethical Consideration

Approval for the study was granted by the Ethical Review Committee of Jos University Teaching Hospital. Written informed consent was obtained from all patients prior to their enrollment into the APIN program. All information obtained was kept anonymous and confidential.

3. Results

3.1. Sociodemographic and Clinical Characteristics

The health records of 140 patients were reviewed; 103 (73.6%) were females. The age range was 18 to 61years. The age group 30 – 39 years had the highest number of patients (37.86%). Most of the patients (47.1%) were married and more than half of them had either secondary (31.4%) or tertiary (26.4%) education. The commonest clinical stage was WHO stage 3 (40.7%). Only 8.6% of patients had a baseline CD4 count level equal to or above 350 cells per mm3, and only 0.7% of them had an undetectable baseline viral load of less than 200 copies/mL. Heterosexuality (95.0%) was found to be the most frequently occurring risk factor for disease transmission. A fraction of patients (13.6%) were not yet on ART. Table 1 summarizes the patients' clinical and sociodemographic characteristics.

3.2. HBV, HCV and HBV/HCV Seropositive Status in Relation to Sociodemographic and Clinical Characteristics

Of the total number of patients, 22.8% and 8.6% tested positive to HBV and HCV respectively, while 4.3% tested positive to both HBV and HCV. The age group 30-39years had the highest percentage of patients that tested positive to HBV (46.9 %), HCV (58.3%) and HBV/HCV (66.7 %). More females than males tested positive to HBV (71.9%) and HCV (66.7 %), but equal proportions of females and males had both HBV and HCV (50%), however the differences were not statistically significant. HBV seropositivity was found to be most frequent in married patients (34.3%), while HCV (41.7 %) was most frequent in the widowed, and HBV/HCV (50 %) was more frequent in single patients. The differences related to marital status were not statistically significant. For all the patients that tested positive to HBV and/or HCV, the commonest risk factor was being heterosexual and greater proportions of the patients that tested positive to HBV, and/or HCV had detectable viral load, CD4 count less than 350 cells/mm3, belonged to WHO stage 3 and were on ART; however none of these associations showed any statistically significance. Similarly, though more patients with secondary and tertiary education tested positive to HBV and/or HCV, it was not of significance statistically. The relationships described are summarized in Table 1 below.

3.3. Hepatitis Seropositivity and Choice of NRTI ART Regimen

Thirty-eight (27.1%) of the 140 HIV-infected patients tested positive to hepatitis B and/or C. Of these, 68.4% had co-infection with HBV only; 15.8% had coinfection with HCV only and 15.8% had coinfection with both HBV and HCV. Majority of them (81.6%) were on ART as follows: 22 (84.6 %) of HBV co-infected, 3 (50%) of HCV co-infected and 6 (100%) of HBV/HCV co-infected were on ART regimen that contained dual NRTI backbone while 3 (11.5%) of HBV co-infected and 1(16.7%) of HCV co- infected were on ART regimen with mono NRTI backbone. A total of 3 (7.9%) patients with hepatitis (1 HBV and 2 HCV) were not on ART (Table 2).

Table 1. *Sociodemographic and clinical characteristics of patients (n=140).*

	Overall	**HBV positive**		**HCV positive**		**HBV/HCV positive**	
	Total n= 140	**n=32(22.9%)**		**n=12(8.6%)**		**n=6(4.3%)**	
Variables	**Freq (%)**	**Freq (%)**	**P value**	**Freq (%)**	**P value**	**Freq (%)**	**P value**
Age group (Years)							
18 – 29	49 (35)	11 (34.4)	0.75	2 (16.7)	0.55	1 (16.7)	0.70
30 – 39	53 (37.9)	15 (46.9)		7 (58.3)		4 (66.7)	
40 – 49	30 (21.4)	4 (12.5)		3 (25)		1 (16.7)	
50 – 59	7 (5.0)	2 (6.2)		-		-	
>60	1 (0.7)	-		-		-	
Gender							
Female	103 (73.6)	23 (71.9)	0.85	8 (66.7)	0.61	3 (50.0)	0.20
Male	37 (26.4)	9 (28.1)		4 (33.3)		3 (50.0)	
Marital status							
Single	32 (22.8)	10 (31.3)	0.62	4 (33.3)	0.22	3 (50.0)	0.39
Married	66 (47.1)	11 (34.3)		2 (16.7)		1 (16.7)	
Separated	11 (7.9)	3 (9.4)		1 (8.3)		-	
Divorced	4 (2.9)	2 (6.3)		-		-	
Widowed	27 (19.3)	6 (18.7)		5 (41.7)		2 (33.3)	
Education							
None	23 (16.4)	6 (18.8)	0.95	1 (8.3)	0.62	1 (16.7)	0.96
Primary	36 (25.7)	7 (21.9)		2 (16.7)		1 (16.7)	
Secondary	44 (31.4)	11 (34.3)		4 (33.3)		2 (33.3)	
Tertiary	37 (26.4)	8 (25.0)		5 (41.7)		2 (33.3)	
Risk factor							
Heterosexual	133 (95.0)	31 (96.9)	0.45	12 (100)	0.73	6 (100)	0.85
Heterosexual and Blood transfusion	5 (3.6)	-		-		-	
Unknown	2 (1.4)	1 (3.1)		-		-	
WHO stage							
I	26 (18.6)	4 (12.5)	0.44	-	0.40	-	0.55
II	34 (24.3)	5 (15.6)		3 (25)		2 (33.3)	
III	57 (40.7)	15 (46.9)		6 (50)		2 (33.3)	
IV	23 (16.4)	8 (25)		3 (25)		2 (33.3)	
Baseline CD4 (cells/mm^3)							
<350	128 (91.4)	29 (90.6)	0.89	10 (83.3)	0.35	5 (83.3)	0.50
≥350	12 (8.6)	3 (9.4)		2 (16.7)		1 (16.7)	
Baseline viral load (copies/mL)							
<200	1 (0.7)	-	0.63	-	0.77	-	0.84
≥200	139 (99.3)	32 (100)		12 (100)		6 (100)	
On ART							
Yes	121 (86.4	31 (96.9)	0.096	10 (83.3)	0.76	6 (100)	0.33
No	19 (13.6)	1 (3.1)		2 (16.7)		-	

Freq= frequency; HBV = hepatitis B virus; HCV = hepatitis C virus.

Table 2. *Distribution of HBV, HCV and HBV/HCV seropositivity according to ART NRTI backbone (n=38).*

Variables	**HBV only n=26 Frequency (%)**	**HCV only n=6 Frequency (%)**	**Both HBV and HCV n=6 Frequency (%)**
ART status ART regimen contains dual NRTI backbone	22 (84.6)	3 (50.0)	6 (100)
ART regimen contains mono NRTI backbone	3 (11.5)	1 (16.7)	-
Not on ART	1 (3.9)	2 (33.3)	-

ART= Antiretroviral therapy; NRTI = Nucleoside reverse transcriptase inhibitors

4. Discussion

The use of ART has majorly improved the clinical course and management of HIV, but this has been complicated by coinfection with HBV and/or HCV infections which share the same mode of transmission. In this study which reviewed

data of a population of 140 HIV-infected patients receiving care at an ART health facility, who also received home based care, 22.9% of them were found to be HBV infected while 8.6% were HCV infected and 4.3% were both HBV and HCV infected. We also found that 81.6% of those infected with hepatitis were on dual NRTI backbone regimen. There were no sociodemographic and clinical laboratory differences between patients with HBV, HCV or dual HBV/HCV co-infection.

The prevalence of hepatitis co-infection in this study is on the high side and rather alarming when taking into account the probable consequences. A cross sectional study within the same clinic location among patients who presented for HIV counselling and testing (HCT) reported a seropositivity of HBV (15.5%), HCV (3.9%) and HBV/HCV (5.2%). (23) It is not surprising that the rates are lower than what we found in this current study because the patients in our study were all HIV co-infected while the HCT patients were not all likely to be HIV-infected.

There are several similar studies that have documented HBV and HCV co-infection rates in patients with HIV; the findings have demonstrated varying degrees of relatively high prevalence rates. [24] - [28] These ranged from 11.9% (Ibadan) to 30.6% (Abeokuta) for HBV, and 4.8% (Ibadan) to 23.5% (Abeokuta) for HCV. [25], [28] Among these studies, the highest rates for HBV, HCV and HBV/HCV were found in Abeokuta, and the least rates for HBV and HCV were found in Ibadan while the lowest HBV/HCV rate was 0.6%(Benin). [24], [27], [28] The rates found in this current study fitted within these ranges reported in other Nigerian studies with high prevalence rates. Some other Nigerian studies conducted separately in different regions have recorded low prevalence rates compared to the earlier mentioned studies, and the low rates ranged between 0.4%-2.7% for HBV, 0%-0.7% for HCV and 0%-0.4% for HBV/HCV. [15], [29] These studies which were unrelated were conducted separately in a semi-urban population, a group of clergy men and a group of prisoners. Being clergy and semi-urban dwellings are social factors that may be associated with lower risk of infection and may account for the lower prevalence reported in these groups. This wide variance in prevalence rates within Nigeria is not out of the ordinary, as prevalence rates have been known to vary between geographical regions even within the same country. [6] It is worthy of note that the studies with higher prevalence were more recent than the studies with low prevalence suggesting a rising rate of co-infection.

In Cameroon, researchers reported results that were comparable to our study in terms of the predominant sociodemographic characteristics being female gender, age group 31 – 40 years and sexual contact as main attributable risk factor. [17] The HBV and HCV prevalence rates of 23.7% and 7.2% respectively were close to ours but the HBV/HCV rate of 1% was much lower than ours.

A meta-analysis in sub-Saharan Africa to investigate HBV and HCV coinfection in HIV-infected patients showed mean prevalence rates of 15% and 7% respectively. [3] These rates are lower than what is expected for sub-Saharan Africa where these infections are endemic, but can be accounted for by the low rates recorded in some countries compared to others in the same study.

In Asia, wide variances in prevalence rates have also been recorded. The rates in this study are higher than the rates reported in two similar studies in south India and Cambodia. [10], [30], [31] An earlier study in south India showed HBV and HCV rates of 9% and 2.2% respectively whereas a more recent study in the same region showed 15% HBV and 8.3% HCV and 2.5%HBV/ HCV. In Cambodia, the rates were HBV 11% and HCV 5.3%. [10]

The two studies in south India had results that differed from ours, but still depicted a similar trend with studies in Nigeria whereby the more recent studies show a higher prevalence than previous studies. This trend is probably a reflection of the growing epidemic in Asia and Africa. Another similarity observed between our study, the other Nigerian and sub-Saharan African studies as well as studies from this part of Asia is that HBV infection occurs at a higher prevalence than HCV infection, and combined HBV/HCV infection is always lowest. [10], [24] - [28], [30], [31] A plausible explanation for this is that the predominant risk factor for transmission in these studies is heterosexual contact. One more similarity between these studies is that more women than men were infected.

In contrast to this observation, reports from studies in other regions of Asia (Vietnam and Iran) show the reverse with HCV infection occurring at a much higher prevalence than HBV infection. [6], [32] The prevalence rates for HBV, HCV and HBV/HCV were 13.4%, 67.2% and 36.3% for Iran, and 8.4%, 35.4% and 6.5% for Vietnam respectively. [6], [32] The likely reason for this reversed prevalence pattern in these two studies can be linked to the fact that IDU was the main risk factor for transmission. Another difference between this index study and the Iranian and Vietnamese studies is that more men than women were infected.

In Midwestern Brazil, the prevalence of HIV coinfection with HBV, HCV and dual HBV/HCV was 33.5%, 9.7% and 4.4% respectively. [33] Except for combined HBV/HCV infection which was the same as ours, the figures are higher than what we found in our study. Apart from differences which may be attributed to geographical region and lifestyle, the high HBV rate could also be attributed to the fact that in addition to Hbsag, other serological markers were used to test for HBV. The predominant risk factor for transmission was sexual contact (hetero-, homo-, and bisexual) though other risk factors (IDUs, blood transfusion, tattooing) also contributed, but to a lesser extent.

The rates in this study also differed from rates found among patients studied in Western Europe and the USA, where overall HBV and HCV rates were found to be 6-14% and 25-30% respectively with overall HCV rates being higher than HBV rates. [4] Just as in the Vietnamese and Iranian studies, the prevalence rate of HBV was lower than HCV prevalence in contrast to our study in which the prevalence rate of HBV was higher than that of HCV. [6],

[32] In the Western Europe and USA study, the highest risk factor for HBV was men sleeping with men (MSM); 9-17% while the highest risk factor for HCV was IDU (72-95%). [4] A tenable explanation for the differences would be the variations in the risk factors for transmission. No IDU or MSM was recorded in our study population.

The prevalence of HBV, HCV and HBV/HCV seen in HIV patients in this study is relatively high. Though screening for hepatitis is not part of most ART programs in developing countries like Nigeria, our center is privileged to be able to provide hepatitis screening for patients at the point of enrolment into the ART program. The benefit of screening is to allow early diagnosis of hepatitis co-infection and thus early commencement of appropriate HAART regimen irrespective of CD4 count level, which otherwise would have been commenced when CD4 levels drop to 350 cells/mm3 or below and possibly with a less appropriate ART regimen. Early commencement of ART in co-infected patients is based on guidelines recommended by WHO. Though HAART has been associated with hepatotoxicity, this does not outweigh the benefits of early commencement of ART in HIV-hepatitis co-infected patients. HAART not only mediate the recovery of CD4 cells and reduce HIV-related inflammation, but the NRTI backbones such as lamivudine, emtricitabine and tenofovir have additional antiviral activity against HBV. The use of dual NRTI (i.e tenofovir/emtricitabine or tenofovir plus lamivudine) evades the risk of developing HBV resistance. Tenofovir is often not readily available in developing countries with limited resources. Our center is one of the few to have access to tenofovir as a first-line drug. Annual repeat screening tests are recommended for all HCV patients and those HBV patients who have no natural or vaccine-induced immunity, [14] this is not currently practicable in our environment due to financial constraints.

In patients who have a negative result when screened for hepatitis, the benefit is that they can receive the hepatitis B vaccine to reduce the risk of subsequent co-infection. There is currently no vaccine for HCV, but patients can be enlightened on preventive measures, risk reduction modifications in lifestyle and regular monitoring of liver disease.

Results of this study showed that of all the 38 patients who were co-infected with hepatitis, 81.6% of them were on a regimen containing dual NRTI (tenofovir/emtricitabine) which is the ideal recommended, while 10.5% were on a HAART regimen containing mono NRTI(lamivudine) which is not ideal because of the risk of HBV resistance. The fact that a majority of patients with hepatitis were on the recommended regimen for HIV-hepatitis coinfection does imply that hepatitis screening was beneficial in influencing the recommended choice of ART regimen. It was expected that all the patients with a positive hepatitis test should have been on the recommended choice. However, despite the availability of hepatitis screening as part of the HIV care package and accessibility to dual NRTI-containing ART at our center, there were gaps in the system that hindered maximum utilization of the benefits. This is evidenced by the results of this review which revealed 4 hepatitis patients who were on mono NRTI regimen instead of the recommended dual NRTI regimen and 3 hepatitis patients who were not on ART during the period under review; additionally, 13 patients' data were excluded from the study at the beginning because they had no hepatitis test results. This shows that despite the availability of hepatitis screening as part of ART care package, and accessibility to the recommended antiretroviral regimen for HIV-hepatitis co-infection, enrolled patients may still miss out on some of these available benefits for various reasons that reflect gaps in the system. Further studies of this nature could identify the gaps in the system, possible reasons for them, and are likely to suggest solutions on how to close them.

The significance of this study in home based care is that this group of patients may pose a problem as potential sources of infection transmission to their caregivers, and ultimately to the community particularly if universal precautions are not properly adhered. The typical caregivers are mostly untrained family members and other lay persons with limited understanding of the importance of universal precautions. It is therefore recommended that part of the HIV care package should include proper training of informal caregivers on how to practice home based care including universal precautions according to standard recommendations while also ensuring that they are regularly retrained. They should also be provided with the correct basic materials to protect themselves while carrying out their tasks.

Limitations of this study are the small sample size and the data analyzed was not collected randomly, but was obtained from a cohort of patients who had home based care, a subpopulation which may not be reflective of the general clinic population or the population in Plateau State, Nigeria. Since home based care provides an avenue for blood borne transmission of disease, studying this population made up of only home based care patients is still relevant. Other limitations were the use of only Hbsag and anti-HCV serological tests as screening methods for diagnosis of hepatitis, further confirmatory tests were not done because they were not available. Perhaps the use of other immunological tests as well as HBV and HCV ribonucleic acid (RNA) tests may have given a different profile from what was reported. In spite of these limitations, the findings of this study are compatible with other similar studies in Nigeria, and the results recorded by this study are applicable in enhancing the care of HIV-hepatitis co-infected patients.

5. Conclusion

In conclusion, this study has shown that hepatitis screening and thus hepatitis positive serostatus impacted on the choice of ART regimen, and within the available resources, this was to a reasonable extent in conformity with the recommendations for HIV-hepatitis care. Since hepatitis screening and tenofovir-based regimen are not commonly available in developing countries such as Nigeria, wherever they exist, as in our centre, they should be maximally

utilized. More needs to be done to ensure that all enrolled patients are screened for hepatitis and placed on the appropriate dual NRTI backbone regimens. There is also a great need to incorporate these services into all HIV care services.

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