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Research Article

Increasing trend of Viral Morbidity and Mortality even in an Era of HAART Intervention Strategies: A Study of Mono and Co-infection of Subjects Accessing Care in Some Selected Facilities in Niger Delta

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ABSTRACT

Across the globe, vulnerable subjects are burdened with mono infections of HIV, Hepatitis B and C virus infections; however, with the increasing trend of robust awareness and intervention advocacy targeted towards early diagnosis, prevention and other management strategies in place, it is expected that the prevalence of the infection would be drastically reduced in an appreciable manner among vulnerable groups in our communities. Nonetheless, it is strongly believed that commensurate preparedness and early detection and smart management of co-infections, especially in the developing communities' remains key and paramount, if the fight must be moved to the next level of robust health care priority outcome. However, there seems to be practical evidence of scarcity of information and probably dearth of robust reliable data in the region, thus this present study investigated viral mono and co-infections (dual and triple) among selected subjects in some selected facilities. Nonetheless, this observational cross sectional study recruited 3,062 subjects, with about 250 from a cohort of HIV subjects. Laboratory diagnosis involved sequential testing using both qualitative (MP rapid kits and ELISA) and quantitative (Molecular-primer design q16 real-time PCR). Nevertheless, Gpower version 3.2 was used to estimate the sample size, even as the qualitative and quantitative data analysis involved the use of frequency and percentage outcome for descriptive analysis, while Chi square, correlation for association and odd ratio were explored using SPSS version 21, even as hypothesis were tested at 0.05 significant level. Significant difference was observed between the mono and co-infection rates; education, marital status and body mass index also showed evidence of significance ($p<0.05$) with chi square. Furthermore, exposure to most risk factors appeared small and general low sero-prevalence. Moreover, low incidence rates of 2.8% and 2.4% for Hepatitis B and C were observed respectively. Most risk factors correlated with viral infection. Further risk estimate using odd ratio showed two or more-fold increase for the exposed, although low disease frequency was reported here, but a retrospective review from this region showed much lower rate meaning, there is a progressive disease frequency transition therefore; care must be taken including adherence to the universal safe practices and precautionary measures. However, vaccination against Hepatitis infection as a preventive measure and its compulsory incorporation in the HIV management procedure must be strongly underpinned in the region, if we must check and manage the increasing trend in our remote communities in good time.

Keywords: Mono; Co-infection; Increasing trend; Viral, Morbidity; Era; HAART; Niger Delta; Intervention

INTRODUCTION

Viral mono infection is an issue of concern globally, but an individual is more burdened if co-infected with multiples of viral particles. Nonetheless, viral co-infection is an issue of concern due to its devastating effects in the body functional mechanism of the host. Also, Human Immunodeficiency Virus (HIV) alone presents to an individual and the nation at large with lots of challenges, ranging from physical, socio-economic factors in a case of mono-infection however, there is a rapidly growing public health concern about co-infection of the viral burden in an individual. The contribution of Hepatitis viral infections to various dysfunctions in subjects with co-morbid HIV infection cannot be overemphasized. Moreover, viral infections of Human

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Immunodeficiency Virus (HIV) and Hepatitis (especially Hepatitis B Virus (HBV) and Hepatitis C (HCV) virus are increasingly overwhelming disease pathogens, with common or same modes of transmission, as well as comparable risk factors as asserted by Santiago-Munoz et al. following a study which demonstrated the prevalence of *Hepatitis B and* C among HIV gravid women. This places an individual with mono infection at a risk of co-infections, especially when fundamental safe and safety practices are neglected in our everyday routine procedures [1].

According to 2005 Australian HIV Observational Database report, the initiation of highly active antiretroviral therapy (HAART) regimens to a large extent has drastically reduced the effect of HIV mono infection however, the upsurge of co-infection effects among patients have less emphasis which needs to be brought to limelight [2]. Furthermore, the Swiss HIV Cohort Study and an African based study have put forth that HAART exposes HIV positive individuals to co-infection outcome with Hepatitis viruses, hence they have higher chances of developing drug toxicity, due to HAART effects and interaction with critical body organs, thereby predisposing them to last stage of HIV infection, characterized with AIDS defining illness, than when compared to HIV mono infected subjects [3,4].

Similarly, toxicological studies over the years have been able to establish toxic drug effect on some vital organs of the body like the liver and kidney, some of these reported concerns about morbidity of the hepatic organ at present, has been the leading cause of death among HIV infected persons as a negative impact of the therapy thus, the contribution of Hepatitis viral infections to various dysfunctions in individuals with co-morbid HIV infection cannot be overemphasized [5]. This has been observed in mono infection of HIV however, HIV co-infected patients with hepatic disease are increasingly becoming a significant cause of mortality at the moment. However, stratification of the risk of death from liver disease among HIV population, showed to be highest in patients co-infected by both HCV and HBV (triple co-infection) according to Ceron et al [6]. In addition, the France based study further revealed that dual co-infections with HIV poses a huge clinical risk as HIV patients co-infected with HCV (HIV/HCV) had the second highest chances of death, this will be followed by HIV/HBV dual co-infection with a mortality risk of 44%, 29% and 21% for triple co-infection (HIV/HBV/HCV) respectively.

Nevertheless, the study was however, within the scope of co-infection with no comparative analysis basis for mono infection among the studied subjects respectively. Plausibly, viral mono infections have been studied and mechanisms of actions well understood however, little or nothing is known about the interplay of these viruses and immunologic effects, especially in co-infections pattern of interactions. Also, co-infection is a trend occurring in the background of a dramatic decline in the incidence of opportunistic infections, and the rate of AIDS-related mortality among HIV patients in the era of HAART, irrespective of the fact that associated risk factors may probably have played a contributory role in co-morbidity [7]. Besides, information is very rare on co-morbidity of Hepatitis viruses (HBV and HCV) infections among patients infected with Human Immunodeficiency virus (HIV) particularly triple co-infection in Nigeria and none for adult within the Niger Delta region. Thus, this study is expected to estimate the prevalence of viral mono infections (HIV, HBV and HCV) and viral co-infections of HBV and/or HCV sero-positivity within and outside a cohort of people living with HIV/AIDS in Niger Delta, Nigeria. It is firmly believed that data generated from this study, would definitely help towards developing a robust road map on how to manage the disease and the analysis and conclusion drawn from the study would also add meaningfully to the existing body of knowledge for use by the entire scientific communities across the globe.

STUDY AREA DESCRIPTION

Niger Delta is a region in Nigeria that cut across South-West (Ondo State), all South-South States (Rivers, Bayelsa, Delta, Edo, Cross River, Akwa Ibom) and South-East (Imo and Abia States) consisting of different ethnic groups of the oil producing communities in Nigeria [8]. This region is marked with lots of industrial and commercial activities with oil/gas as its mainstay also; this has predisposed the occupants to an unparalleled environmental menace [8].

METHODOLOGY AND EXPERIMENTAL

The study employed an observational cross sectional approach; about 3062 subjects were recruited into this study and included was a HIV cohort of 250 subjects. All study participants met the eligibility criteria of no previous history of Hepatitis/liver disease and consents were obtained. Laboratory diagnosis employed in this study was the sequential testing system, both qualitative and quantitative methods. MP multisure rapid test kits (MP Diagnostics) were used as the first line of test. Differential diagnosis of HIV 1 and HIV 2 were performed as well, thereafter, all positive samples (HIV, HBV and HCV) proceeded to qualitative Enzyme Linked Immunosorbent Assay (ELISA) technique. Apdia microplate system (AD Touch-Microplate Reader and AD Wash-Microplate washer) was used for the analysis with Apdia ELISA-Belgium kits for HIV, HBV and HCV for confirmatory following the double antibody sandwich method for cut-off. Furthermore, reactive/positive samples were quantitatively analysed with the molecular technique which involved the use of real-time Polymerase Chain Reaction-PCR (Primer Design-genesig q16 real-time PCR machine and consumables from United Kingdom) for confirmatory viral load estimation. Pre analytical materials were from BD USA. Methodological classification of sero-status include: patients whose sero-status were reactive/positive to only HIV or HBV or HCV and negative to others were classified as been mono-infected by HIV or Hepatitis B (HBV) or Hepatitis C (HCV) respectively whereas, subjects who were reactive/positive to any two viruses (dual co-infection) alone i.e. HIV/HBV or HIV/HCV or HBV/HCV whose sero-status were classified as HIV being co-infected with whichever of the Hepatitis viruses (either HBV or HCV) but not both or co-infected by only two variants of Hepatitis without HIV accordingly. Further classification involved patients whose sero-status was reactive/positive for all three viruses i.e. HIV/HBV/HCV thus, were said to be triply co-infected. Furthermore, HAART experienced were HIV subjects who had been on anti-retroviral drugs (HAART) for a minimum period of six months while HAART naive were those who had neither taken nor been placed on anti-retroviral drugs (HAART)

before. Ethical approval from the health facilities were obtained and informed written consent from the study participants who were out-patients and patients attending the ARD clinics of the various facilities were also secured.

Statistics analysis

Gpower version 3.2 was used to estimate the sample size. Qualitative data analysis involved the use of frequency and percentage for descriptive, while Chi square correlation were used for hypothesis testing at 0.05 significant level. Odd ratio was used to estimate risk. Data were presented in tables and chart /figures. Data were collated into excel spread sheet and exported into SPSS version 22 which was used for analysis.

RESULTS

The present study involved 3062 subjects out of which 250 subjects were from a cohort of HIV. Subjects were disproportionately stratified into male (68.8%) and female (31.2%) and a mean age of 29.5 ± 8.5. Socio-demographic variables of marital status, date of diagnosis (for HIV cohort only), education, age, body mass index and sex were considered however, only education, marital status and body mass index showed evidence of significance ($p<0.05$) (Table 1).

Furthermore Table 2 showed frequency distribution of risk factors as well as chi square; greater percentage of the participants had "No" as status for the shared transmission risk factors like about 2899 (94.7%) where non-smokers others are on Table 2.

The present study recorded sero-status of viral positivity and viral sero-prevalence for mono infections and co-infections. For the viral mono infections, HIV had the highest sero-positive and hepatitis C had the least (272, 39 and 24). In like manner, the sero-prevalence of viral mono infections did not differ in the decreasing order of sero-prevalence (HIV>HBV>HCV). In addition, dual co-infections showed similar trend with HIV co-infection with Hepatitis C been the least for Hepatitis co-infected HIV subjects (6) however; co-infection of two Hepatitis viruses (HBV/HCV) appeared to be the lowest for the general dual co-infection observed here in this study. Furthermore, sero-prevalence of 0.23%, 0.19% and 0.07% for HIV/HBV, HIV/HCV and HBV/HCV respectively were obtained. Nevertheless, triple co-infection sero-positive of HIV/HBV/HCV was only 2 with a prevalence rate of 0.07% (Table 3 and Figure 1).

Incidence rate of Hepatitis in a Cohort of HIV Infected Subjects as observed during the period of this study revealed a dual co-infection of 2.8 per 100 person-years and 2.4 per 100 person-years for HIV/HBV and HIV/HCV respectively. While the incidence rate of triple (co-infection of HIV and viral Hepatitis B and C) was 0.8 per 100 person-years (Table 4 and Figure 2).

The observed Viral Infection Prevalence of 3062 subjects as obtained in this study revealed 10.94% and 0.56% for mono

Table 1: Frequency and Chi Square distribution of socio-demographic data of study participants.

Socio-demographic variables	Classification	Frequency (%)		Df	χ^2	p value
Marital status (N=3062)	Divorced	95 (3.10)		32	169.82	p<0.05
	Married	1761 (57.5)				
	Separated	58 (1.89)				
	Single	863 (28.2)				
	Widowed	245 (8)				
	Widower	40 (1.30)				
Date of diagnosis (For HIV Cohort Alone) (N=250)	Less than 1 year	19 (7.5)		4	8.6	p>0.05
	2-5 years	111 (44.4)				
	6-10 years	92 (36.8)				
	11-15 years	23 (9.2)				
	>15 years	5 (2)				
Education (N=3062)	No formal education	95 (3.1)		24	116.63	p<0.05
	Primary	364 (11.9)				
	Secondary	1455 (47.5)				
	Tertiary	1148 (37.5)				
Age (N=3062)	20-39 years	1703 (55.6)		4	30.39	p>0.05
	40-49 years	805 (26.3)				
	50-59 years	364 (11.9)				
	60-69 years	172 (5.6)				
	70-79 years	18 (0.6)				
	Mean ± SD 29.5 ± 8.5					
Body Mass Index (N=3062)	<18.50 (underweight)	95 (3.1)		302	362.5	p<0.05
	18.50-24.99 (normal)	1319 (43.1)				
	≥ 25.00 (overweight)	919 (30)				
	≥ 30.00 (obese)	729 (23.8)				
	Mean ± SD 21.75 ± 0.68					
Sex (N=3062)	Female	2107	-68.8	12	6.759	p>0.05
	Male	955	-31.2			

Table 2: Frequency and chi square distributions of viral infections and shared transmission risk factors.

Risk factors	Status viral infections	Frequency (%) *Shared transmission risk factors	DF	χ^2	p value
Smoking Status	No	2899 (94.7)	1	13.311	p<0.05
	Yes	163 (5.3)			
Traditional medicine use	No	2679 (87.5)	1	0 .737	p>0.05
	Yes	383 (12.5)			
Alcohol use	No	2315 (75.6)	1	0 .059	p>0.05
	Yes	747 (24.4)			
Blood transfusion	No	2719 (88.8)			
	Yes	343 (11.2)			
Multiple sexual partners	No	2661 (86.9)			
	Yes	401 (13.1)			
Unprotected sex	No	1929 (63)			
	Yes	1133 (37)			
Use of unsterilized Sharps	No	2137 (69.8)			
	Yes	925 (30.2)			
Sharing of sharps	No	2841 (92.8)			
	Yes	221 (7.2)			
Drug use	No	3062 (100.0)			
	Yes	0 (0.0)			

Table 3: Sero status and prevalence rate of viral mono and co-infections.

Sero Status	Mono Infection N=355 (10.94%)			Dual Co-infection N=15 (0.49%)			Triple Co-infection N=2 (0.07%)
Sero status within the total study population	**HIV**	**HBV**	**HCV**	**HIV/HBV**	**HIV/HCV**	**HBV/HCV**	**HIV/HBV/HCV**
Sero-positive	272	39	24	7	6	2	2
Sero-prevalence	8.89%	1.27%	0.78%	0.23%	0.19%	0.07%	0.07%
p value=p<0.05							

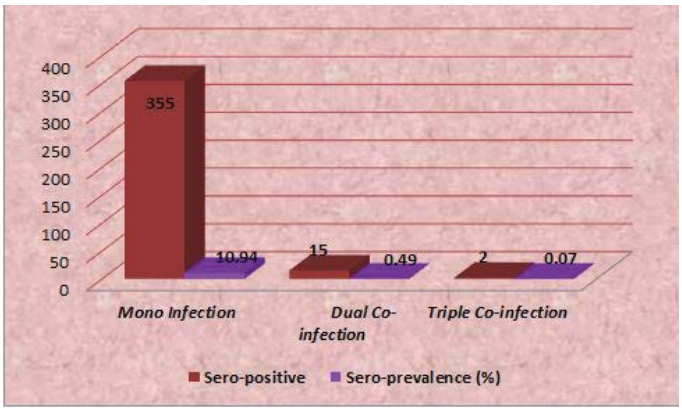


Figure 1: General sero status within the study population (Sero-positive and Sero-prevalence).

Table 4: Incidence rate of hepatitis in a cohort of HIV infected subjects.

Co-infections	Total PYs	Number of Sero-positive	Incidence Per 100 PYs
HIV/HBV	250	7	2.8
HIV/HCV	250	6	2.4
HIV/HBV/HCV	250	2	0.8
PY=Person-Years			

and co-infections respectively. In addition, 8.89%, 1.27% and 0.78% were mono infected for HIV, HBV and HCV accordingly. Further classification of viral co-infections revealed prevalence of

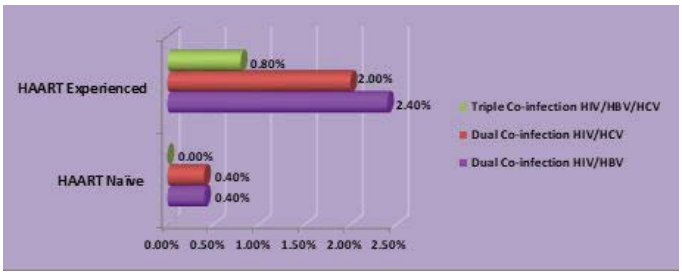


Figure 2: Incidence of Viral Co-infection within HIV Cohort.

0.49% and 0.07% for dual and triple co-infections respectively. From the general study population, dual viral infections reported were 0.23%, 0.19% and 0.07% for HIV/HBV, HIV/HCV and HBV/HCV in that order. On the other hand, the HIV cohort were differentiated based on their treatment history and exposure to Highly Active Anti-retroviral Therapy-HAART either as HAART naïve (those not on HAART) about 2.71% or HAART experienced (those on HAART) i.e. 5.45%. Prevalence of co-infection for the HIV HAART Naïve cohort were similar for the dual co-infection; 0.03% for HIV/HBV and 0.03% for HIV/HCV whereas, HAART experienced status had dissimilar prevalence of 0.19% for HIV/HBV and 0.16 for HIV/HCV (Table 5, Figure 3).

The correlation of some viral risk factors showed an association in most cases like; use of sharps, unsafe sexual habits and practices, socio-economic status, literacy-education (indirect), alcohol abuse, independent age factor etc. Whereas, no correlation

Table 5: Risk estimate using odd ratio.

Viral risk factors	Status	Odd ratio	95% Confidence interval	
			Lower	Upper
Blood transfusion	No	1	1.03	2.4
	Yes	2.07		
Sharing of sharps	No	1	2.51	12.62
	Yes	5.98		
Unprotected sex with presumed negative partner	No	1	0.34	3.26
	Yes	4.07		
Alcohol use before intercourse	No	1	1.67	4.79
	Yes	3.68		
Smoking	No	1	2.1	6.7
	Yes	8.09		
Vaccination against Hepatitis B	No	2.81	1.02	5.51
	Yes	1		
History of STD	No	1	2.49	18.71
	Yes	6.08		
Level of education (Educated)	No	2.67	1.08	2.11
	Yes	1		
Occupation/Income status (High)	No	3.03	1.24	2.81
	Yes	1		
Multiple sexual partners (More than one)	No	1	1.3	3.8
	Yes	2.57		

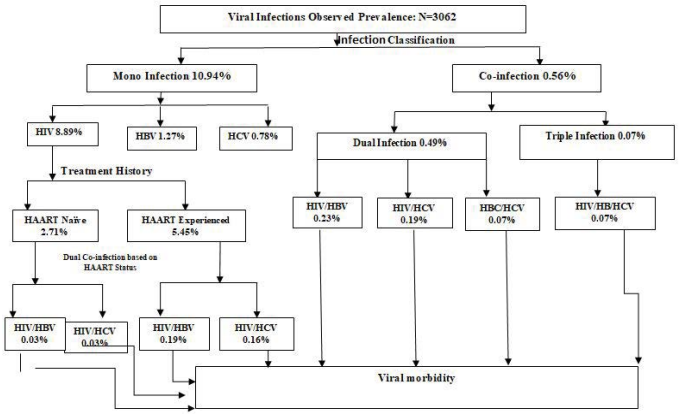


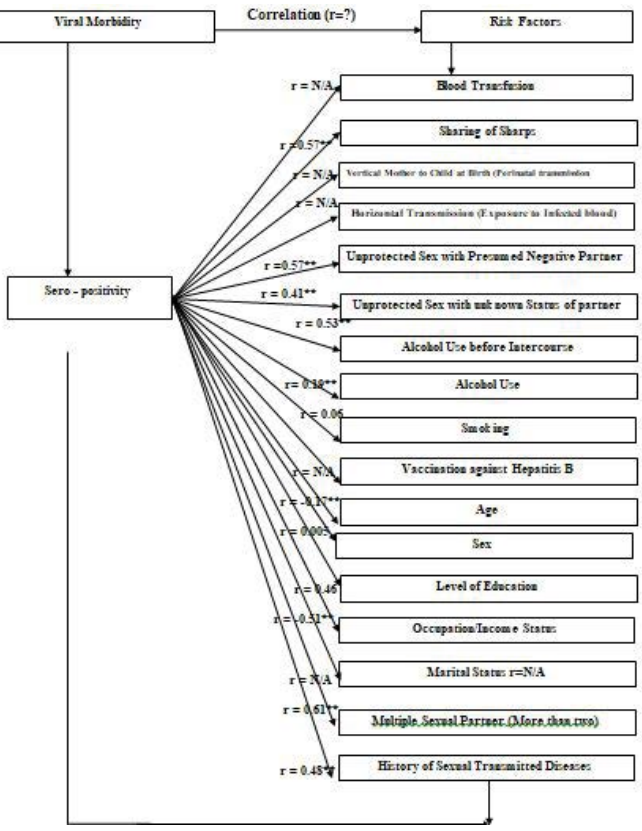
Figure 3: Schematic chart of observed viral infection prevalence.

between smoking and sex (Figure 4).

In addition, using odd ratio as a risk estimator to establish evidence of association between viral infection and exposure to some likely risk factors such as blood transfusion (OR=2.07; 95% CI, 1.03, 2.40), sharing of sharps (OR=5.98; 95% CI, 2.51, 12.62) and others as shown on table 5. Blood transfusion had a twofold rise risk exposure with possible infection outcome while those who share sharps were five times more likely to contract viral infections than others. Also, Unprotected Sex with Presumed Negative Partner as well as partner's status unknown showed an increased risk of over four times when compared to others. Similarly, Alcohol use before intercourse, smokers, those not vaccinated against Hepatitis, those with history of sexually transmitted diseases, non-educated people, low income earners and those with multiple sexual reported more than two fold rise thereby increasing the chances of been infected with these viruses.

DISCUSSION

Interestingly, the prevalence rates of viral infection as reported



Note: N/A=Not Available; **=Significant correlation.

Figure 4: Schematic diagram of the correlation between viral morbidity/ infection and some risk factors.

in this present study appeared low, with triple co-infection been the least, while mono infections had the highest prevalence rate. Similarly, the incidence rates of Hepatitis within the cohort of HIV infected subjects were low too. This lower incidence and prevalence rates in this present study refutes the assumption

of increased viral infections particularly among HIV infected subjects. However, HIV had the highest, while HCV was the lowest for viral mono infections in this study. Relatively, a significant difference exists between mono and co-infections in the infection rates and disease frequencies as seen here.

From the review of related literatures, the sero-prevalence of viral infections obtained in our study showed low rates when compared to the report of Forbi et al. who reported sero-prevalence of viral infections of Hepatitis B and C among HIV cohorts, within the North-Central Nigeria [9]. The study which defined the influence of these infections on $CD4^+$ lymphocytes cells among Human Immunodeficiency virus type-1 (HIV-1) infected subjects alone reported a high prevalence of over sixty percent for HIV mono-infection prevalence. Also, over twenty percent and eleven percent for HIV/HBV and HIV/HCV dual co-infections respectively. Furthermore, a triple co-infection (HIV/HBV/HCV) of about seven percent was reported as against less than one percent obtained in this present study, even as Uneke et al. observed high prevalence in Jos [10]. This high prevalence from the North-Central region of Nigeria and the Jos based study confirms Nigeria to be an endemic area of the dreaded infection. However, both studies were from the same geo-political zone of Nigeria so, does not probably reflect what is obtainable in other parts of Nigeria. Thus, this present study is a picture of Niger Delta region comprising more of all the South-South states, a few South-West and South-East part of Nigeria although, South-West was not captured in this study.

The prevalence of dual co-infection in our study is in contrast with a prior study performed in North central, Nigeria which comparatively assayed Hepatitis-B surface antigen (HBsAg) using ELISA technique to ascertain the prevalence of HBsAg among four hundred and ninety HIV-infected patients (comprised of both young and old adults). The study reported approximately thirty percent of the HIV subjects were co-infected with HBV which was higher than the rate observed in our study. Furthermore, our study is not consistent with the other studies which recorded higher prevalence [10,11]. Considering HCV in the same view, the rates of dual co-infection with HIV and HCV (HIV/HCV) obtained in this study is less than the reports of previous studies which range from sixty percent to eighty-five percent [12,13]. Furthermore, other studies had populations with rates of co-infection with HIV and HCV range from more than fifty percent to over ninety percent; these high rates of co-infection may probably be suggestive of the fact that the studies were likely among injection drug users as opposed to this present study which recorded none [14-16]. Nevertheless, there are other preceding studies in Nigeria in contrast with this present study prevalence rates; Kaote et al. reported an overall HCV prevalence of about three percent which is higher than what we observed [17]. However, it should be noted that the prevalence was among blood donors particularly in Rivers state of Nigeria. Nonetheless, a higher prevalence of HIV/HCV dual co-infection of approximately eight percent was reported by another researcher [18].

The result from our study could not proof the prior concept that co-infection of HIV/HCV accelerate rapidly to end-stage of liver disease, AIDS defining clinical outcome and death [3]; however, case of virologic failure in an era of HAART which some have argued like Ranieri et al. proposed low HCV viremia following initiation of HAART drug intervention treatment since the study was just a snapshot within the short possible time [19,20].

This study been carried out in an era of HAART as well considered both HAART naïve and HAART experienced demonstrate viral infection rates among these two categories although, low disease frequency was observed in all. All the same, the low prevalence in our study confers a benefit to the study population following the report of Forbi et al. [9] which revealed the effect of viral infection on $CD4^+$ counts especially co-infection of HIV and Hepatitis viruses (HBV and/or HCV) and even more with triple co-infection of HIV, HBV and HCV. Nonetheless, the treatment of either Hepatitis virus is complex because of pharmacokinetic interactions with components of HAART regimens in HIV infected subjects. Nevertheless, it is strongly believed that the phenomenon of HIV and Hepatitis viruses' co-infection has caused tremendous panic among infected population, even as it has aroused a lot of Public Health concern especially, in this era of HAART treatment option across the globe [9]. Although, the introduction of HAART treatment strategy has changed HIV/AIDS disease landmark from a stand point of lethal illness into a manageable chronic infection, and has been shown to be able to reinstate $CD4^+$ cells in HIV infected patients and reduced viral load significantly in an infected subjects [21]. On the other hand, the benefit of HAART could be compromised by co-infection with Hepatitis viruses as they have been implicated to have adverse effects on the prognosis of co-infections of HIV and Hepatitis infected subjects as underpinned in a study [4]. Specifically, Lamuvudine has been shown by earlier studies to inhibit replication of viral Hepatitis in over eighty percent of infected subjects, whether in mono or co-infection with HIV [22-25]. In addition, other researchers in their studies anticipated protective effect of lamivudine-containing ART regimens against viral Hepatitis B infection in its acute phase; nonetheless, there was no observed difference in the infection rates for ART regimens with lamivudine and those without. However, lamivudine-containing HAART regimens are used to treat those subjects perceived to be at highest risk for HBV infection. Nonetheless, the study was unable to differentiate treatment experienced subjects with regimens containing lamivudine or not [26]. In addition, co-morbidity increases disease burden moreover, the natural history of Hepatitis is identified to be complicated by HIV-co-infection, nevertheless the effect of viral Hepatitis (HBV) on the outcome of patients infected with HIV-1 is controversial according to a study [27]. Lamivudine resistant mutations in HBV treatment have adverse effects on HIV therapeutic response in the case of co-infection, hence such unhealthy outcome must be monitored closely, if we must achieve results

On the contrary, others have argued the negative effect of HAART in co-infection subjects. A prior study emphasized the impact of co-infection of HIV and viral Hepatitis with increased risk of liver cirrhosis and hepatocellular carcinoma risk. The large retrospective study although limited to HCV co-infection with HIV and comparatively only in the HAART and pre-HAART eras considered both mono and co-infection [28]; reported that during the pre-HAART era, there was an increased risk of cirrhosis in patients with co-infection compared to HCV mono infection however, during the HAART era a remarkable incidence of cirrhosis was lower in patients with HIV/HCV co-infection than HCV mono infection, even though the rate was unadjusted. Nonetheless, excluding confounding variables such as chronic HBV and alcohol co-infection was not suggestively related with cirrhosis. Furthermore, co-infection was not evidently associated with hepatocellular carcinoma regardless of the period of time,

however; consideration on the transmission of these viruses responsible for co-infection established similar risk factors irrespective of the era it was been transmitted [28].

This study after simultaneously taking into account some predisposing factors assumed shared routes of transmission for the viral infections studied with association between viral infection and likely risk factors. Viral infections are highly contagious and transmission is relatively high. Viral infections share similar risk of transmission such as blood transfusion, blood-to-blood contact, unprotected sex-Sexual transmission, vertical mother to child at birth (perinatal), during birth, unprotected sex, and by sharing needles, with relatively higher prevalence in the tropics [29]; on the other hand, the frequency of exposure to some of the risk factors examined in this study appeared to be low except that the exposed had a higher risk. Sirisena et al. reported high endemic profile of these viral infections in Nigeria [30] with approximately seventy-five percent of the populace likely to have been exposed to these viruses at one time or the other in their life, like in the case of HBV [31]. Exposure risk and possible outcome of viral infection as estimated with the odd ratio showed a minimum of two fold rise in the risk of been infected for those exposed when compared to those not exposed. There are indications of associations between viral infections and these risk factors as seen in the results of chi square and correlation which revealed statistical significance. The significant result from these measures of association and disease frequency obtained in this present study is in consonance with previous studies of eminent researchers [32,33].

Furthermore, higher incidence of viral infections has been proven to be associated with risk factors such as recent alcohol abuses or injection drug use. This is because, substance abuse like alcohol and cigarette predisposes users to engage in high-risk behaviours however, this study recorded a low history of alcohol use and use of alcohol before intercourse was a significant risk factor associated with viral infection this could be as a result of the induced hypnotic effect of alcohol on the user so, the hypnotic effect will make the individual not to take right decision of the universal safe practices. Furthermore, viral co-infection as obtained in our study (although a few was recorded in this study) suggest that some infected subjects neglect adherence to basic risk-reduction messages such as, safe sex and/or safe use of sterilized objects and sharing of sharps practices respectively.

The risk of no vaccination against HBV which is a readily available vaccine in the area of this present study was shown to be linked to the chances of acquiring this infection. Vaccination is an issue in the area of this present study; in spite of guidelines recommending vaccination of HIV-infected patients by the Centre for Disease Control and Prevention [33], only a few patients were vaccinated within the HIV cohort in this current study. Others have incomplete vaccination and majority were unvaccinated in the total study population. Similarly, another study recorded low vaccination among HIV subjects [27]. Nevertheless, the study of Wortley and Farizo also, reported large number of unvaccinated HIV patients in their study [34]. This may possibly be due to the fact that vaccination has not be compulsorily incorporated in the HIV management procedure or the view that immunologic impairment with resultant decreased vaccine response seen in HIV infected individuals could render the vaccination less potent and efficacious [35-37], thereby causing a temporal increase of the level of HIV RNA in the plasma [38,39]. The low number of unvaccinated subjects calls for urgent attention towards integration of preventive care instead of curative especially for high risk persons despite their sero-status.

However, the empirical findings from our study could not be comparably linked to earlier observations carried out in Nigeria like the result from this present study contradicts the definition of HBV high endemicity of over seven percent in an adult population. Moreover, the Jos found study reported high prevalence (more than twenty-five percent) of dual co-infection of HBV in HIV infected patients. Similarly, Ekpo et al. is not in inconformity with this present study. Factors driving these regional dissimilarities are unclear however, it is important to understand that cross-study comparison may be misleading because of variations in the methods or techniques used in diagnosis and overall study design. Although our sample was larger and diverse than those in parallel previous studies, nevertheless, a convenience sample drawn from only selected public health facilities from different states within the Niger Delta region may not be free from bias so, there could be a level of regional bias as one of the state (precisely Ondo state) was not represented in this present study. Also, in course of recruitment inclusion selection was for only those who gave their consent thus, selection bias is obvious as individuals who did not consent to participate in the study are different in many important ways from those who participated. Furthermore, social desirability bias was not ruled-out; in essence, during the evaluation of the socio-demographics and exposure risk status, study participant may had presented socially desirable behavioural lifestyle and/or under reported undesirable ones.

CONCLUSION

Generally, the study reported low disease frequency with mono infection being more prevalent than co-infections and triple co-infection. The dual co-infection of HBV/HCV was the least as at the time, the study was carried out within the selected region of Nigeria. In retrospective archives from the selected facilities revealed a much lower rate before the advent of our study however, the presence of one or two co-infections reported in our study shows an upward transition in disease frequency; thus, a call for urgent attention.

Furthermore, from a historic view point, apart from shared routes of transmission of these viral infections, the mechanism of viral interplay is not clearly understood however, several earlier studies suggest that HIV disease modifies the natural history of Hepatitis infection which consequently leads to an accelerated course of progression from chronic active Hepatitis to cirrhosis, end-stage liver disease even death therefore, the low prevalence rates confer a positive effect on the study population.

Although, this study has shown that the burden of viral co-infections (dual and triple) of Hepatitis viruses with HIV is insignificant; the identification of some risk factors which predisposes these patients to co-infection with these organisms and the evidence of association established here have shown that the universal safe practices and precautionary measures were strictly not adhered also, it has pinched consideration to inadequate knowledge of the complete mechanism of the epidemiology of these viral co-infections in Nigeria; particularly the probable contradicting reports from other studies within Nigeria which reported higher co-infection rates. Further studies

are needed to understand disease frequency and risk stratification based on the different geo-political zone, even state levels to give a definitive locale-specific epidemiology of these viral co-infection pathways. Also, indoctrination of vaccination with the available vaccines like Hepatitis B will be a reasonable approach to decrease the likelihood and curb the disease especially now that the prevalence is still low in this study population thus, it should be made mandatory prevention strategy on entry to an HIV treatment programme furthermore, routine check-up is advised as most of the subject either did not know their Hepatitis status or had long been tested especially the risk population like the HIV cohort and an integrated dual-diagnosis treatment approach should be encouraged.

In addition, Highly Active Antiretroviral Therapy (HAART) has slowed the progression of HIV disease and decreased the rate of HIV-associated mortality however, the effect of HAART in co-infection is a controversy as different empirical studies have argued between negative and positive effects with ample evidence however, the study recorded low infection rates even among HAART experienced and the HAART combination used were not ascertained. Thus, further research should be done to evaluate the effect of HAART.

ETHICAL APPROVAL

The ethical approval for the study was approved by the ethical and research committee of Rivers State Ministry of Health, Port Harcourt, Nigeria.

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CONFLICT OF INTEREST

None observed among authors

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