Prevalence and Determinants of Undetectable Viremia among HIV/AIDS clients receiving care in Akwa Ibom State~~state~~, Nigeria

Abstract

Background: Globally the benefits of undetectable viremia in preventing the transmission of HIV/AIDS have been established.

Objective: The study aimed to assess the prevalence and determinants of undetectable viral load amongst HIV/AIDS clients receiving care and treatment in RISE-supported~~RISE supported~~ facilities in Akwa Ibom State~~state~~, Nigeria.

Methods: A descriptive cross-sectional study was conducted using secondary data from a validated Retention and Audit Determination Tool (RADET) file generated in September~~,~~ 2021. This was cleaned, imported into, and analyzed using a statistical~~statistical~~ package for social sciences (IBM SPSS) statistical package version 25. The prevalence~~Prevalence~~ of undetectable viremia was determined using descriptive statistics and factors associated with undetectable viremia were assessed using chi-square analysis. Binary logistic regression was used to identify the determinants of undetectable viremia at an alpha level of <0.05 at a 95% confidence interval.

Results:out of 47,575 recipients on care, 85.7% had undetectable viremia.Residing in rural areas (p<0.001, OR=1.3), respondents aged 15-19 years (p=0.005, OR=0.6), and 20 years and above (p=0.027, OR=0.784), those placed on MMD 6 (p<0.001, OR=0.696) were more likely to have undetectable viremia. While students (p=0.026, OR=1.2) and those employed (p=0.002, OR=1.096) were less likely to have undetectable viremia.

Conclusion: This study reported a high prevalence of undetectable viremia. The determinantswere occupation, residing in rural areas, age, and being on MMD 6. Multiple interventions that include phone reminders and behavioral~~behavioural~~ modelsto support self-care amongst urban dwellers are imperative. Differentiated interventions that include~~includes~~ operation Triple Zero ~~and plus~~ (OTZ and OTZ plus) and Community Adherence Treatment Supports (CATs) targeting the pediatric age group are needed to support the adherence to ART and undetectable viremia.

Keywords: Undetectable viremia, HIV/AIDS, Antiretroviral therapy, RISE, Akwa Ibom state

Introduction

HIV/AIDS remains a pandemic in the world,~~world~~ with about 38 million persons living with the disease of whom 70% of these persons reside in sub-Saharan Africa[1]. Nigeria is one country in~~one of the countries in~~ the world with the highest number of people living with the Human~~Human~~ Immunodeficiency Virus (HIV)[2]. About 1.9 million Nigerians are living~~There are about 1.9 million Nigerians living~~ with HIV/AIDS and a prevalence of 1.4% among~~amongst~~ 15-64 years – 1.9% amongst females and 1.1% amongst males. The prevalence~~Prevalence~~ of HIV amongst children 0-14 years was 0.2%[3]. Akwa Ibom state remains the epicenter of the disease with 5.6% of its populace living the pandemic[3].

In making HIV/AIDs cease~~ceasesto~~ being a disease of public health importance in 2030, in line with UNAIDS' vision 95-95-95 goals, every recipient on care shouldnot only have seamless access to Antiretroviral therapy (ART) but have an undetectable viral load (viral load <50 copies/ml of plasma)[4]**.** This is needed for the achievement of Undetectable equals to Untransmitable (U=U) an important determinant toward~~towards~~ an HIV/AIDS-free~~AIDS-free~~ generation. Viral load is the only objective surrogate endpoint in measuring the progress of HIV/AIDS and treatment success and every recipient on care need to be supported with several strategies including a behavioral model to improve adherence to ART aimed at the achievement of this goal.Poor adherence to ART has serious consequences for HIV-infected patients, including failure to prevent viral replication, an increased likelihood of developing viral resistance, the development of clinical complications, and shortened survival[5-7].

Human Immunodeficiency Virus Viral load suppression and undetectable viremia, in particular, has been shown to improve the quality of life~~lives~~ of people living with HIV[8]. Studies have shown a strong correlation between poor adherence to ART (<95% adherence) and high viral load leading to poor clinical outcomes[9, 10]. Other studies have shown significant associations between socio-demographic, psychosocial, behavioral, and clinical factors and their influence on viral load suppression[11, 12]. However, a study by Silveiraand colleagues indicated that there was~~were~~ no significant association of sex, clinical status, current immune status, and changes in treatment

regimen on undetectable viral load suppression at 80 copies/ml[13]. But rather, medication adherence had the greatest effect in ensuring undetectable viral suppression[13].

A significantSignificant proportion of recipientsrecipient on care in RISE-supportedRISE supported facilities in Akwa Ibom state have undetectable viral after six months of adherence to ART medications. Considering viral load suppression as a key attribute in reducing significantly vertical and horizontal transmission of HIV in the populace and subsequently leading to HIV/AIDs free generation, this study aimed to assess the prevalence, associated factors, and determinants of undetectable viremia amongst recipientsrecipient of care in risingRISE supported facilities of Akwa Ibom Statestate, Nigeria.

TMEC/RISE Support on HIV Epidemic Control in Nigeria

Meeting Targets Maintaining Epidemic Control, Reaching Impact Saturation and Epidemic Control of HIV/AIDS (TMEC/RISE) is a 5-year USAID-fundedUSAID funded project that commenced in October 2019. It is managed by a consortium that comprises of Jhpiego (programmatic and administrative lead) and ICAP (technical lead) and supports five states in Nigeria namely – Akwa Ibom, Adamawa, Niger Cross River, and Taraba States in supporting the UNAIDS vision 95-95-95 aimed at preventing HIV/AIDS as a public health threat by 2030. Akwa Ibom stateRISE supports sixty-two (including a quaternary facility)) health facilities are located in the northern part of the state across ten (10) local government areas (LGAs).

Methodology

Akwa Ibom state, the study center, is located in South-southern Nigeria. The study utilized a descriptive cross-sectional design carried out in September, 2021. The study population comprised of recipients of care attending the ART clinic across 61 supported health facilities. A secondary data was generated from a validated Retention and Audit Determination Tool (RADET) file. All recipients ofon care in RISE-supportedRISE supported facilities for at least six (6) months were included in the study.

The generated RADET file was cleaned and imported into and analyzed using the statistical package for social sciences (IBM SPSS) statistical package version 25. Analysis of data included

descriptive statistics~~of~~ data using mean and standard deviation for quantitative variables like age, duration on ART, and viral load copies, counts, and frequencies for qualitative variables like sociodemographic variables. Factors associated with undetectable viremia were assessed using chi-square analysis. Binary logistic regression was used to identify thedeterminants of undetectable viremia at an alpha level of <0.05 at a 95% confidence interval.

Results

Table 1: Sociodemographic characteristics of respondents

Sociodemographic Characteristics		Frequency (%)
Age (years)		
	0-9	661 (1.4)
	10-14	313 (0.7)
	15-19	431 (0.9)
	≥20	45,784 (97.0)
X ± SD		37.09 ± 11.3
Sex		
	Male	17,146 (36.0)
	Female	30,429 (64.0)
Marital status		
	Single	17,506 (36.8)
	Married	27,158 (57.1)
	Separated	586 (1.2)
	Divorced	315 (0.7)
	Widowed	2,010 (4.2)
Population setting		
	Rural	30,331 (63.8)
	Urban	17,244 (36.2)
Education		
	None	2,042 (4.5)
	Primary	8,837 (19.3)
	Quranic	73 (0.2)
	Junior Secondary	865 (1.9)
	Senior Secondary	31,092 (67.8)
	Post Secondary	2,922 (6.4)
Occupation		
	Unemployed	23,725 (51.4)
	Student	2,133 (4.6)
	Employed	20,131 (43.6)
	Retired	143 (0.3)

Almost all 45,784 (97%) ~~the~~ respondents were 20 years and above majority of which majority were females 30,429 (64%). Over half 27, 158 (57.1 %) of them were married, and the majority 30,331 (63.8%) of the respondents reside~~resides~~ in rural settings. The majority~~Majority~~ 32,957 (69.7%) of the respondents had secondary education. Unemployed category 23,725 (51.4%) accounted for over half of the respondents (Table~~table~~ 1).

Table 2: ART Parameters of respondents

Variables	Frequency (%)
ART regimen	
TDF-3TC-DTG	46,671 (98.1)
ABC-3TC-LPV/r	612 (1.3)
TDF-3TC-NVP	245 (0.5)
AZT-3TC-ABC	1 (0.0)
AZT-3TC-LPV/r	7 ((0.0)
AZT-3TC-NVP	3 (0.0)
AZT-3TC-TDF	5 (0.0)
TDF-3TC-ATV/r	4 (0.0)
TDF-3TC-EFV	4 (0.0)
TDF-3TC-LPV/r	18 (0.0)
TDF-3TC-NVP	1 (0.0)
Others	3 (0.0)
MMD Status	
MMD<3	9,143 (19.2)
MMD3-5	37 (0.1)
MMD6	38,395 (80.7)
ART Enrolment Setting	
Clinical Platforms (Chemists/PMVs/Dispensary)	6,135 (12.9)
Clinical Platforms (Laboratories)	39 (0.1)
Clinical Platforms (PHCs/Private Clinics/Nursing Homes)	170 (0.4)
Community	24,101 (50.7)
Community-Based~~Community Based~~Organisation	99 (0.2)
Facility	17,030 (35.8)
Viral load status (undetectable status)	
Undetectable (≤ 50 copies/ml)	35,996 (85.7)
Detectable (>50 copies/ml)	6,028 (14.3)
Viral load status (status of suppression)	
Suppressed (<1,000 copies/ml)	40,438 (96.2)
Unsuppressed (≥1,000 copies/ml)	1,586 (3.8)

Majority of the respondents had undetectable viremia 35,996 (85.7%) and are placed on MMD6 38,395 (80.7%). Half 24,101 (50.7%) of the respondents were enrolled in~~at~~ the Community and only 39 (0.1%) were enrolled through the Laboratory Clinical Platform and almost all 46,671 (98.1%) ~~the~~ respondents were on TDF-3TC-DTG (table 2).

Over half of the respondents with undetectable viremia were unemployed ($\alpha^2 = 13.97$, $p = 0.003$) and those that reside in rural areas were 1.33 times more likely to have undetectable viremia ($\alpha^2 = 101.43$, OR = 1.33, $p < 0.001$). Almost 90% of the respondents between the age group 15-19 years had undetectable viremia ($\alpha^2 = 26.34$, $p < 0.001$). Almost 90% of the respondents with undetectable viremia were placed on MMD6 ($\alpha^2 = 156.17$, $p < 0.001$) table 3.

Students (p=0.026, OR=1.2) and those employed (p=0.002, OR=1.096) were more likely to have detectable viremia, and ~~and~~ this was~~were~~ statistically significant. Respondents that reside in rural areas were 1.26 times more likely to have undetectable viremia, and ~~and~~ this was statistically significant (p < 0.0001, OR = 1.26, 95%CI [1.194 – 1.343]). Similarly, those 15-19 years (p=0.005, OR=0.6) and 20 years and above (p=0.027, OR=0.784) were more likely to have undetectable viremia, and~~and~~ this was statistically significant. Respondents on MMD 6 were 1.44 times more likely to have undetectable viremia, and ~~and~~ this was statistically significant (p < 0.001, OR = 0.696, 95%CI [0.642 – 0.753]) table 4.

Table 3: Factors associated with Undetectable Viremia amongst respondents

Variables		Viral load		Chi-square~~Chi square~~ statistics
		≤ 50 copies/mls Freq (%)	>50 copies/mls Freq. (%)	p-value~~p-value~~
Occupation of respondents				
	Unemployed	18,640 (53.3)	2,963 (51.5)	α^2 = 13.97
	Student	1,641 (4.7%)	319 (5.5)	**p = 0.003***
	Employed	14,576 (41.7)	2,456 (42.7)	
	Retired	115 (0.3)	12 (0.2)	
Population Setting				
	Rural	23,330 (87.0)	3,501 (13.0)	α^2 = 101.43; OR = 1.33
	Urban	12,666 (83.4)	2,527 (16.6)	**p <0.001***
Age of respondents (years)				
	0-9	487 (79.4)	126 (20.6)	
	10-14	245 (82.5)	52 (17.5))	α^2 = 26.34
	15-19	346 (89.4))	41 (10.6))	**p <0.001***
	≥20	34,611 (85.7)	5,755 (14.3)	
MMD Status				
	MMD<3	4,410 (12.3)	1,092 (18.1)	α^2 = 156.17
	MMD3-5	31 (0.1)	4 (0.1)	**p <0.001***
	MMD6	31,555 (87.7)	4,932 (81.8)	

**p<0.05*

Table 4: Determinants of Undetectable Viremia amongst respondents

Variables	Regression coefficient (B)	p-valuep value	OR	95% CI Lower	Upper
Occupation – unemployedunemployed[a]		0.002			
Student	0.155	**0.026****	1.167	1.019	1.337
Employed	0.092	**0.002****	1.096	1.033	1.163
Retired	-0.485	0.111	0.615	0.339	1.118
Population setting - Rural	-0.236	**<0.001****	1.266	1.194	1.343
Age in categories- 0-9yrs[a]		0.032			
10 – 14 yrs	-0.228	0.249	0.796	0.541	1.173
15 – 19 yrs	-0.560	**0.005****	0.571	0.388	0.841
≥20 yrs	-0.244	**0.027****	0.784	0.631	0.972
MMD status - <MMD 3[a]		<0.001			
MMD 3-5	-0.478	0.373	0.620	0.216	1.777
MMD 6	-0.363	**<0.001****	0.696	0.642	0.753

**binary logistic regression; **p=0.05; a - reference categories*

Discussion

WHO targets to end HIV/AIDS as a public health problem by 2030 with the introduction of the ambitious "95-95-95" strategy to attain this target and the third 95 (at least 95% of the recipient ofon care are virally suppressed) being one of the key determinants towards this goal[14].The quantification of the viral load in the plasma is a predictor of the progression of the disease [15-17] and, along with CD4 lymphocyte counts, has been used to monitor therapeutic responses [17, 18]. Viral load within the RISE project was measured using either Roche orAbbottAbott whose limit of detection is 20 copies/ml and 40 copies/ml respectively.

This study reported that 96.2% of recipients on care had suppressed viral load (<1,000 copies/ml) with 85.7% having undetectable viremiasix (6) months after ART initiation. This is significantly higher than the 43.1% suppression reported by the Nigeria HIV/AIDS and Impact Survey (NAIIS)[3]. This is also significantly higher than undetectable viremia of 48.4% reported by Silveira and colleagues [13]in Brazil but similar to 92% reported by a recent study by Mogosetsi and colleagues in South Africa[8]. This was possible since almost all the respondents were on TDF-3TC-DTG which is the recommended first-linefirst-line ART regimen that has been proven to be very effective with fewer side effects and pills.

The determinants of undetectable viremia wererespondents 15-19 years and 20 years and above residing in rural areasand those placedplace on MMD 6.This is consistent with previous studies

that reported increasing age and adherence to ART as the predictor of undetectable viremia[13]. Those residing in the rural areas were more likely to have undetectable viremia compared with those residing in the urban areas and this was statistically significant. On a contrary, students and the employed were more likely to have detectable viremia and this was statistically significant. Although this study did not assess adherence to ART, being busy is a determinant of forgetfulness, the commonest reason for poor adherence to ART. Those residing in rural areas are less likely to have drug holidaysholiday or forget their medications, stigma, and discrimination and they are more likely to have better adherence to ART.

Almost all the respondents between the age group 15-19 years had undetectable viremia at bivariate analysis.Respondents within the age group 15-19 years and 20 years and above were more likely to have undetectable viremia and this was statistically significant at multivariate analysis. This is consistent with other studies that reported that the prevalence of undetectable viral load increased with age[19, 20]. Other more recent studies also corroborated that the older age group (> 40 years) was associated with better viral load suppression among patients on ART[21, 22].Adults are more likely to imbibe the right behavior needed for self-care to support good adherence to ART compared with pediatric clients whose care and treatment areis more dependent on caregivers or their parents.

Respondents placed on MMD 6 were 1.44 times more likely to have undetectable viremia compared with those on MMD3-5 and MMD3. Multi-month dispensing 6 (MMD 6) is a type of Differential Service Delivery (DSD) Model where stable clients – adherent to ART with fewer or no signs and symptoms,are placed on antiretrovirals (ARVs) for six (6) months thereby reducing the clinic visits and burden on healthcare providers. This allows healthcare workers to focus on newly enrolled and virally unsuppressed clients that will need more extensive and specific interventions to support their care and treatment. It is imperative to report that despite being placed on ARVs for six months with clinic visitsvisitlimited to twice a year and virtual adherence support, a significant number of them had undetectable viremia compared with other MMD statusesstatus.

This study on undetectable viremia is the first to be conducted in Akwa Ibom Statestate, Nigeria. Another strength of this study is the large sample size that gives it adequate power to detect a difference if it exists. However, it utilized a secondary data and it did not assess adherence to ART – the most important determinant of undetectable viremia. Subsequent studies should preferably utilize primary data where several variables can be captured in the tools of data collection that can include an assessment of adherence to ART – both by self-report and the use of a nonjudgmental method like Morisky Medication Adherence Assessment (MMAS 8).

Conclusion and recommendations

This study reported a high prevalence of undetectable viremia. The determinants of undetectable viremia were residing in rural areas, increasing age (15-19 years and 20 years and above), and being on MMD 6.Interventions to increasescale up undetectable viremia among the careamong recipient ofon care that isare employed and residing in urban areas areis highly imperative. These should include a behavioralbehavioural model aimed at improving the client's self-care. Differentiated interventions that includeincludesoperationoperation Triple Zeroand plus (OTZ and OTZ plus) and community adhesion treatment support (CAT)Community Adherence Treatment Supports (CATs) targeting the pediatric age group are needed to supportsupport the adherence to ART and undetectable viremia. Subsequent studies should preferably utilize primary data where several variables can be captured in the tools of data collection that can include an assessment of adherence to ART – both by self-report and the use of a nonjudgmental method like Morisky Medication Adherence Assessment (MMAS 8).

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References

1. UNAIDS calls for greater urgency as global gains slow and countries show mixed results towards 2020 HIV targets [press release]. 2020.
2. National Agency for the Control Of AIDS (NACA). Revised National HIV and AIDS Strategic Framework 2019-2021. 2019.
3. Federal Ministry of Health (FMOH). Nigeria HIV/AIDS Indicator and Impact Survey. 2018.
4. World Health Organization. Consolidated Guidelines on HIV prevention, testing, treatment and service delivery and monitoring: Recommendations for a Public Health Approach. 2021.
5. Arnsten JH, Demas PA, Farzadegan H, Grant RW, Gourevitch MN, Chang CJ, et al. Antiretroviral Therapy Adherence and Viral Suppression in HIV-Infected Drug Users: Comparison of Self-Report and Electronic Monitoring. Clin Infect Dis. 2001;33(8):1417-23.
6. Gifford AL, Bormann JE, Shively MJ, Wright BC, Richman DD, Bozzette SA. Predictors of Self-Reported Adherence and Plasma HIV Concentrations in Patients on Multidrug Antiretroviral Regimens. J Acquir Immune Defic Syndr. 2000;23(5):386-95.
7. Miller LG, Hays RD. Adherence to Combination Antiretroviral Therapy: Synthesis of the Literature and Clinical Implications. . 2000;10:177-85.
8. Mogosetsi NJ, Mabuza LH, Ogunbanjo GA. The Prevalence of HIV Load Suppression and Related Factors Among Patients on ART at Phedisong 4 Clinic, Pretoria, South Africa. The Open Public Health Journal.11:135-46.
9. US Department of Health and Human Services Panel on Antiretroviral Guidelines for Adults and Adolescents. 2013. Available from: http://aidsinfo.nih.gov/contentfiles/lvguidelines/adultandadolescentgl.pdf.
10. Gao X, Nau D, Rosenbluth S, Scott V, Woodward C. The relationship of disease severity, health beliefs and medication adherence among HIV patients. AIDS Care 2000;12(4):387-98.
11. Castel A, Greenberg A, Young H, Kalmin M. On behalf of the DC Cohort Executive Committee Disparities in viral suppression among a large cohort of HIV infected persons in Washington DC 2014.
12. Mattson C, Freedman M, Fagan J, et al. Sexual risk behaviour and viral suppression among HIV-infected adults receiving medical care in the United States. AIDS 2014;28(8):1203-11.
13. Silveira MPT, Draschler MdL, Leite JCdC, Pinheiro CAT, Silveira VLd. Predictors of undetectable plasma viral load in HIV-positive adults receiving antiretroviral therapy in Southern Brazil. Brazilian Journal of Infectious Diseases. 2002;6(4):164-71.
14. Lokpo SY, Ofori-Attah PJ, Ameke LS, Obirikorang C, Orish VN, Kpene GE, et al. Viral Suppression and Its Associated Factors in HIV Patients on Highly Active Antiretroviral Therapy (HAART): A Retrospective Study in the Ho Municipality, Ghana. AIDS Research and Treatment. 2020;2020:9247451.
15. Hubert JB, Burgard M, Dussaix E, et al. Natural history of serum HIV-1 RNA levels in 330 patients with a know date of infection. AIDS 2000;14:123-31.
16. Rashid M, Schechter M. Manuel de HIV/AIDS. Rio de Janeiro, Br: Revinter. 2001.
17. Skidmore SJ, Zuckerman M, Parry JV. Accuracy of plasma HIV RNA quantification: a multicentre study of variability. J Med Virol 2000;61:417-22.
18. Eron JJ, Yetzer ES, Ruane PJ, et al. Efficacy, safety, and adherence with a twice-daily combination lamivudine/ zidovudine tablet formulation, plus a protease inhibitor, in HIV infection. AIDS. 2000;14:671-81.
19. Grabar S, Pradier C, Corfec EL, et al. Factors associated with clinical and virological failure in patients receiving a triple therapy including a protease inhibitor. AIDS 2000;14:141-9.

20. Valdez H, Lederman MM, Wolley I, et al. Human immunodeficiency virus 1 protease inhibitors in clinical practice. Arch Intern Med 1999;159:1771-6.
21. Ellman T. Multi-country viral load outcomes: How far are our patients from “undetectable”? . 2012.
22. Torian L, Xia Q, Wiewel E. Retention in care and viral suppression among persons living with HIV/AIDS in New York City, 2006-2010. Am J Public Health 2014;104(9):e24-9.