



Review Article

## TOWARDS 95-95-95: A REVIEW OF THE LAST DECADE OF HIV VIRAL SUPPRESSION IN NIGERIA

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### ABSTRACT

The United Nations Programme on HIV/AIDS (UNAIDS) target to achieve 95% viral suppression for all countries remain a challenge for Nigeria. There is a plethora of information on HIV viral suppression. It is therefore imperative that it be reviewed and summarized in a single, comprehensive document.

This study reviewed narratively HIV viral suppression studies done within the last decade in Nigeria by retrieving applicable literature from PubMed, Google scholar, and Google Search using relevant keywords. From the review, 16 (50%) of the studies were on rates of viral suppression and factors that influence it while 10 (31.3%) were on interventions to prevent virological failure. Majority of the studies were carried out from 2019-2023 and more than half of the studies reviewed were retrospective (56.3%). Viral suppression in Nigeria is still below the United Nations Programme on HIV threshold of 95 %. However, based on all the efforts put in the last decade, we are on the right track towards achieving the goal by 2030.

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### INTRODUCTION

Since the first diagnosed infection of human immunodeficiency virus (HIV) in Central Africa in 1959, it has continued to be a global public health problem despite efforts to eradicate it [1]. By the end of 2022, an estimated 39.0 million people were living with HIV and 1.3 million people were newly infected worldwide [2]. Unfortunately, two-thirds of these people live in sub-Saharan Africa [2]. With approximately 1.9 million people infected with HIV in Nigeria, she ranks fourth in the global HIV disease burden [2, 3].

To address this prevalent issue, the United Nations Programme on HIV/AIDS (UNAIDS) set an ambitious 95-95-95 target by 2030, whereby 95% of those infected are aware of their status, 95% of those diagnosed receive continuous antiretroviral treatment and 95% of those treated are virally suppressed [4]. This is expected to prevent nearly 28 million HIV infections and 21 million AIDS-related deaths by 2030 [2].

Policies and programs tailored to HIV eradication have been developed and adopted in Nigeria over the years. Of particular note are the National HIV/AIDS Policy of 2009, the HIV/AIDS Emergency Action Plan 2001-2003, the National Strategic

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Action Framework 2005-2009, the National HIV/AIDS Strategic Plan 2010-2015 and the National Workplace Policy on HIV/AIDS, the National Strategy for Domestic Resource Mobilization and Sustainability for HIV 2021-2025, etc. [5]. However, significant gaps in viral suppression still exists. Currently, 95% know their status, 90% are receiving treatment and 86% have achieved viral suppression in Nigeria [6].

Viral suppression is the principle that drives prevention of HIV/AIDS transmission. It remains the most desired outcome in the treatment of patients with HIV/AIDS and the key to eradicating the HIV bane because undetected means untransmittable [7]. Many studies on HIV viral suppression and non-suppression have been conducted in Nigeria. However, we cannot assess the extent of research that has already been conducted, as no article reviewing HIV viral suppression studies has been published. Therefore, this study aims to narratively review all HIV viral suppression studies done in Nigeria within the last 10 years.

## METHODS

### Study Location

The study included published HIV viral suppression studies conducted in Nigeria over the past decade (2013-2023).

### Study Design

This was a narrative review of HIV viral suppression studies in Nigeria.

### Study Period

This study covered the period 2013-2023.

### Data Sources

Data was sourced from PubMed, Google Scholar and Google Search.

### Data Extraction

We searched electronic databases for articles on HIV viral suppression in Nigeria over the past decade. Search terms included various combinations of the following keywords: HIV/AIDS, Nigeria, viral suppression, 95-95-95 UNAIDS target, viral failure, and viral nonsuppression. The abstracts were checked for relevance. For an article to be included in the review, it must address the suppression of the HIV/AIDS virus during 2013-2023. Inclusion was not limited to one study design. Thus, both qualitative and quantitative studies were included. For each included article, information on authorship, year of publication, study design, measurement of viral suppression, and key outcomes were extracted. The data were presented in evidence-based tables.

## RESULTS

There were 32 articles in all that were reviewed and Figure 1 displays an article selection flowchart. The evidence-based table that includes a list of all the reviewed articles, their

authors, the year they were published, the journal and the main findings is shown below in Table 1.

### Distribution of Studies by Region

The majority of the studies were carried out in North central and South West and there was a paucity of information from south east region (Table 2).

### Distribution of Studies According to Age of the Study Population

Adults were the most represented age group in this study and very few studies were done specifically on children (Table 3).

### Periodic Distribution of Viral Suppression Studies

In this review, majority of the studies were carried out from 2019-2023 with the highest publications carried out in 2022 and no publication in 2013, 2015 and 2017. The periodic distribution of viral suppression studies is shown in Table 4.

## DISCUSSION

The rates of viral suppression in this study range from 83.67% and 85.4% to 87.4% and 91.0% [10, 32, 35, 38]. A study also documented 80% viral suppression in patients already receiving second-line therapy [22]. In adolescents, viral suppression ranges from 56.6% to 82%, and a pediatric-specific study reported 81.2% viral suppression [6, 19, 33]. Despite the fact that these results align with that of other African countries, they fall short of the UNAIDS target of 95% viral suppression [39,40]. Still, they suggest that the goal is possible in a country with limited resources albeit increased efforts are required especially for children and adolescents. In adolescents with HIV, a study documented only a 44.5% improvement in viral suppression even after completing enhanced adherence counseling (EAC) [29]. Thus, achieving viral suppression in this population requires more friendly psychosocial interventions that go beyond the enhanced adherence counselling.

Male gender, younger age, shorter treatment duration, low CD4 counts, poor treatment adherence, HIV/TB co-infection and WHO stage 3/4 have been documented as the most prominent predictors of virological failure in the studies reviewed [10, 28, 32, 3]. This is also consistent with the results of other countries. A study in Ethiopia agrees with all of the above factors as predisposing factors for treatment failure in addition to treatment interruption and lack of participation in a support group [41].

In children and adolescents, authors documented that viral suppression was associated with adherence, living parents, and parents/caregivers on routine medication, while virological failure was associated with male gender, double orphan, poor adherence, the person whom the child lives with and treatment interruption [7, 19, 29, 33].

Age of status disclosure is another important factor that play a role in viral suppression. Too early disclosure usually leads to a lack of understanding and in turn, treatment failure. Too late disclosure results in suspicion of parents/caregivers, defiance, and also treatment failure [29]. To buttress this, a study

documented that most of the patients with virological failure had status disclosure at the age of ten which was considered late,

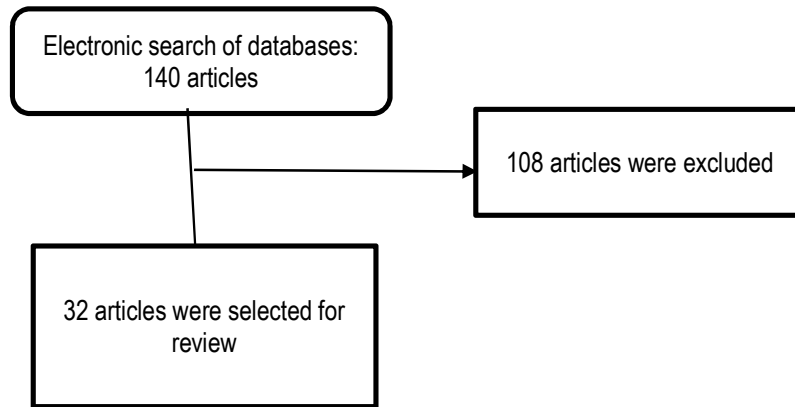


Figure 1: Study articles selection flowchart

**Table 1: Evidence-based tables of viral suppression**

Ref	Author	Title	Year	Journal	Study Design	Key Findings
[8]	Abudiore, Amamilo, Campbell <i>et al.</i>	High acceptability and Viral suppression rate for first-line patient on dolutegravir-based Regimen: an early adopter study in Nigeria.	2021	PLOS ONE	Descriptive observational prospective	Dolutegravir based-regimen was highly acceptable and effective as an alternative to NNRTI-based regimen. It was associated with few side effects, increased appetite, and weight gain which needs further evaluation.
[9]	Mbah, Iroezindu, Esber, Dear <i>et al.</i>	Assessing the impact of HIV support groups on antiretroviral therapy adherence and viral suppression in the African cohort study.	2021	BMC Infectious Diseases	Retrospective	HIV support group participation was not significantly associated with adherence and viral suppression.
[10]	Abdulahi, Ibrahim, Okeji <i>et al.</i>	Viral suppression among HIV-positive patients on antiretroviral therapy in northwestern Nigeria.	2021	BMC Infectious Diseases	Retrospective	Percentage of viral suppression was high (90.4%) and was associated with high CD4 counts, education, unemployment, etc.
[11]	Onwuamah, Okpokwu, Audu <i>et al.</i>	Low levels of HIV-1 drug resistance mutations in patients who achieved viral re-suppression without regimen switch: a retrospective study.	2020	BMC Microbiology	Retrospective cohort study	Patients who resuppressed without a regimen switch, had few underlying drug resistant mutations and were still largely susceptible to their first line regimen. They also showed improved adherence after the first virological failure.
[12]	Nwogu, Ngene, Babalola <i>et al.</i>	Comparison of efavirenz levels in blood and hair with pharmacy refills as measures of adherence and predictors of viral suppression among people living with HIV in Nigeria.	2022	AIDS Research and Therapy	Cross sectional	Drug levels in hair was a better predictor of actual drug ingestion and can be used in conjunction with traditional pharmacy refill methods to adequately predict virological suppression.
[13]	Folayan, Zuniga, Ally <i>et al.</i>	Differences in adoption of COVID-19 pandemic related preventive behaviour by viral load suppression status among people living with HIV during the first wave of the pandemic.	2023	BMC Research Notes	Retrospective	Poor adherence to antiretrovirals, is positively associated with poorer use of COVID 19 preventive behaviours although only significant for wearing of face masks and hand washing.
[7]	Dixon-Umoh, Ikpeme.	Viral suppression and predictors among adolescents receiving care for HIV/AIDS in a tertiary healthcare centre in Uyo, South-South Nigeria.	2020	Journal of AIDS and HIV Research	Retrospective	Viral suppression among the adolescents was close to UNAIDS target for 2020 (82%) and was associated with living parents, parents/caregivers on routine medication and being on Tenofovir-Lamivudine-Dolutegravir-based regimen.

[14]	Aina, Yesuf, Salisu, Ezeanolue, Mensah, Dakum.	Patient and health facility attributes associated with retention and virologic suppression in private for-profit health facilities in Nigeria.	2022	Aids Research and Therapy	Retrospective	Private for-profit facilities despite little support can provide quality care for people living with HIV. With appropriate technical support and engagement, they can help accelerate the achievement of the 95-95-95 UNAIDS goal.
[15]	Badejo, Noestlinger, Jolayemi <i>et al.</i>	Multilevel modelling and multiple group analysis of disparities in the continuity of care and viral suppression among adolescents and youths living with HIV in Nigeria.	2020	BMJ Global Health	Retrospective	Differences exist in magnitude of effects across age groups based on baseline antiretroviral regimen and pattern of care continuity and differences were also found for health facility level which can explain the difference in outcome for each specific patient group.
[16]	Tomescu, Crompton, Adebayo <i>et al.</i>	Factors associated with viral load non-suppression in people living with HIV in Nigeria: a cross-sectional analysis from 2017-2021	2022	BMJ Open	Cross sectional	Males, younger age, being on treatment for less than a year, receiving care from small and medium scale facilities, receiving care at secondary or tertiary facilities, receiving care in public facilities and patients in Edo, Niger and Borno were indicative of viral non suppression.
[17]	Meloni, Agbaji, Chang <i>et al.</i>	The role of point of care viral load monitoring in achieving the target of 90% suppression in HIV-infected patients in Nigeria: study protocol for a randomized controlled trial.	2019	BMC Infectious Diseases	Randomized controlled trial	The trial will find out if point of care viral load monitoring is feasible and acceptable in a typical Nigerian ART setting and whether it can improve viral suppression.
[18]	Ekejiuba, Timbiri, Chizoba <i>et al.</i>	Effects of phone based enhanced adherence counselling (EAC) among virally unsuppressed Key population.	2023	Cureus	Non- randomized prospective intervention	No statistical significance difference was seen between the phone and conventional EAC although the higher suppression was found with phone based EAC.
[19]	Yiltok, Cordelia, Agada <i>et al.</i>	Clinical profile and viral load suppression among HIV positive adolescents attending a tertiary hospital in North central Nigeria.	2020	J Med Trop	Retrospective	The viral suppression rate is 56.6% and is related to double orphan, adherence, and the person whom the child lives with.
[20]	Ahonkhia, Banigbe, Adeola <i>et al.</i>	High medication possession records ratios associated with greater risk of virological failure (VF) among youth compared with adults in Nigerian cohort.	2018	Clinical Science	Retrospective Cohort	Medication possession ratio (MPR) was high overall and there is a strong association between low MPR and risk of VF. Yet, 26% of adolescents with high MPRs still had virological failure (VF).

[21]	Casalini, Bateganya, Akolo, <i>et al.</i>	Increasing multi-month dispensing (MMD) of antiretrovirals and assessing the effect on viral load suppression among children and adolescents receiving HIV services in Nigeria.	2023	PLOS ONE	Retrospective	MMD was feasible among Children and adolescents living with HIV without compromising viral suppression. expanded eligibility criteria, line listing eligible children, monitoring pediatric antiretroviral stock and data use contributed to positive result.
[22]	Bouzidi, Murtala-Ibrahim, Kwaghe <i>et al.</i>	Disengagement from HIV care and failure of second-line therapy in Nigeria: a retrospective cohort study 2005-2017.	2022	Journal of acquired immune deficiency syndrome	Retrospective	Viral failure of 20% at endpoint associated with elementary occupations. 33% disengagement though 26% later re-entered into care. Disengagement was associated with males, aged under 30, starting ART earlier, less educated and starting second line on lower CD4 counts.
[23]	Ekwueme, Torbunde, Anaba <i>et al.</i>	The third 90: Viral suppression among HIV-positive Children and Adolescents in 10 Nigerian States.	2018	Scientific Poster	Retrospective	Viral suppression rate was 65.9%. Adolescent boys were more suppressed than girls.
[24]	Bahemana, Esber, Dear, Ganesan <i>et al.</i>	Impact of age on CD4 recovery and viral suppression over time among adults living with HIV who initiated antiretroviral therapy in the African cohort study.	2020	AIDS Research and Therapy	Retrospective	Time since ART initiation was the primary driver of CD4 recovery and viral suppression rather than age thus, immune recovery does not differ among older ART initiators.
[25]	Taiwo, Kuti, Kuhns <i>et al.</i>	Effect of text messaging plus peer navigation on viral suppression among youth with HIV in the icare Nigeria pilot study.	2022	Journal of Acquired Immune Deficiency Syndrome	Prospective intervention	icare combination intervention daily two-way messaging and peer navigation was promising for improving ART outcomes among adolescents and young adults with HIV 15-24 years in Nigeria.
[26]	Chun, Abutu, Milligan <i>et al.</i>	Low level viraemia among people living with HIV in Nigeria: a retrospective longitudinal cohort study.	2022	Lancet Global Health	Retrospective Cohort	Low level Viraemia 51-199cells/ml is associated with poor virological outcomes and should be examined to avoid transmission.
[27]	Akpan, Nwanja, Ukpong.	Reaching viral suppression among people with HIV with suspected treatment failure who received enhanced adherence counselling (EAC) in southern Nigeria: a retrospective analysis.	2022	Open Forum Infectious Diseases	Retrospective Cohort	Viral re-suppression rate was 74% but EAC completion rate was low. Hence, additional intervention beyond the basic EAC is recommended especially for patients that require extension of their EAC.
[28]	Ndembi, Murtala-	Predictors of first line antiretroviral therapy failure among adults and adolescents living with HIV/AIDS in a large prevention and treatment program in Nigeria.	2020	AIDS Research and Therapy	Retrospective	There is high burden of drug resistance among patients failing on therapy, Immunologic criteria poorly predicted virological failure. Predictors of

	Ibrahim, Tola, <i>et al.</i>					immunologic failure were females, entry into care by VCT, WHO stage 3 or 4, low CD4. While the predictor for virological failure was low CD4 <200cells at baseline.
[29]	Orji, Onyire, Ojukwu, Oyim-Elechi.	The outcome of intervention, characteristics and determinants of treatment failure in HIV infected adolescents on first-line antiretroviral therapy at a tertiary health institution in southeast Nigeria.	2022	Nigerian Journal of Medicine	Retrospective	EAC improved viral suppression by 45.5%. Treatment failure is influenced by age, gender, socioeconomic class, orphan status, sexual exposure, type of ART and status disclosure.
[30]	Osinusi-adekanmbi, Stafford and Ukpaka.	Long term outcomes of second-line antiretroviral therapy in resource limited settings.	2014	Journal of international association of providers of AIDS care	Prospective observational cohort	The highest degree of viral suppression was observed at 12 months. Rates of viral suppression long term was affected by mortality.
[31]	Somi, Dear, Reed.	Perceived satisfaction with HIV care and its association with adherence to antiretroviral therapy and viral suppression in the African Cohort.	2021	AIDS Research and Therapy	Prospective Observational	Majority were satisfied with the care they received but it was not significantly associated with viral suppression. reduction in clinic waiting time and improvement in the training and proficiency of health workers can help further.
[32]	Musa, Yusuf, Gbajabiamila <i>et al.</i>	Incidence and risk factors for first-line antiretroviral therapy failure among adult Nigerians.	2014	Nigerian Journal of Clinical and Biomedical research	Retrospective	First line treatment failure rate was 12.6% and was associated with young age and male gender.
[33]	Ebonyi, Oguche Ejeliogu <i>et al.</i>	Risk factors for first-line antiretroviral treatment failure in HIV 1 infected children attending Jos University Teaching Hospital, Jos, North central.	2014	British Journal of Medicine and Medical Research	Retrospective	Rate of treatment failure was 18.8% and was associated with previous antiretroviral exposure, not receiving cotrimoxazole prophylaxis before ART initiation, and having severe immune suppression at baseline.
[34]	Ahmed, Adekoya, Onwuamah <i>et al.</i>	Mechanism of viral suppression among HIV elite controllers and long term non progressors in Nigeria and south Africa.	2022	Viruses	Descriptive literature review	The transmission of attenuated HIV particles from previous non- progressors, mutations to less virulent strains.
[35]	Sunkanmi, Paul, Peter, Affiah <i>et al.</i>	Factors influencing viral load non-suppression among people living with HIV in Borno State, Nigeria: a case of Umaru Shehu Ultra -Modern Hospital.	2020	Journal of advances in Medicine and Medical Research	Retrospective	Virologic non-suppression rate was 16.33%. the odds increased with children and young adolescents, last clinical stage. The odds of virological failure decreased in patients on 2 <sup>nd</sup> and third line regimen.

[36]	Agu, Uchendu, Nsonwu, Okwuosa, Achukwu.	Prevalence and associated risk factors of periphery artery disease in virologically suppressed HIV-infected individuals on antiretroviral therapy in Kwara State Nigeria: a cross-sectional study.	2019	BMC Health	Public	Cross sectional	Viral suppression with combined antiretroviral therapy, and long-term treatment is associated with dyslipidemia, with an increased risk of peripheral artery disease.
[37]	Akpan, Ukpong, Nwanja <i>et al.</i>	Strategies for improving viral suppression among children living with HIV considered to be failing first-line antiretroviral therapy.	2023	International journal of pediatric research	of	Retrospective	In multi-disciplinary team approach and tailored quality assurance, individual intervention led to better health outcomes in finishing EAC and viral re-suppression.
[38]	Meloni, Chang, Esien <i>et al.</i>	Long-term outcomes on antiretroviral therapy in a large-scale up program in Nigeria.	2016	PLOS ONE		Retrospective	1.8% of patients died, 30.1% were lost to follow-up, 0.1% withdrew from treatment and 85.4% achieved viral suppression. Younger age, ART regimen other than TDF/EFV, lower CD4 counts, higher viral load, and inadequate adherence were predictors of virologic failure.



**Table 2: Distribution of Studies by Region**

S/N	Region	Frequency	Percentage (%)
1	Northeast	3	6.8
2	Northcentral	15	34.1
3	Northwest	3	6.8
4	South-south	6	13.6
5	Southeast	2	4.5
6	Southwest	10	22.7
7	Nigeria	5	11.4
	Total	44	

**Table 3: Distribution of studies according to age of the study population**

S/N	Age group	Frequency	Percentage (%)
1	Children	1	3.2
2	Children and adolescents	3	9.7
3	Adolescents 10-19	3	9.7
4	Adolescents and young adults	2	6.5
5	Adolescents and adults 15 years and above	4	12.9
6	Adults	15	48.4
7	All ages	3	9.7

**Table 4: Distribution of viral suppression studies by period**

S/N	Year of publication	Number of studies	Percentage (%)
1	2013-2015	3	9.4
2	2016-2018	3	9.4
3	2019-2021	13	40.6
4	2022- 2023	13	40.6
	Total	32	

and another study reported that a disclosure age of seven was protective against treatment failure [29, 42].

Before switching to second-line therapy, patients should be tested for drug resistant mutation and scheduled for mandatory enhanced adherence counselling to improve adherence. Then viral load should be rechecked for viral re-suppression. This is because a study documented that there is a possibility that patients could achieve renewed viral suppression by improving adherence without switching to second-line [11]. Although from their research, these patients had few resistant drug mutations and were largely still susceptible to their current first-line therapy which may pose as an advantage not applicable to everyone [11]. Additionally, completing EAC in record time has been proven to improve outcome and probably prevent switching to second-line therapy as another study documented a viral resuppression rate of 74% after EAC [27]. When all this fails and virological failure

still persists, patients should still be counselled and switched to second-line.

From the studies reviewed, participating in a support group, patients receiving their viral load result on the same clinic visit and actions taken immediately based on the results as opposed to the next clinic day, measuring of antiretroviral levels in blood and hair alongside traditional adherence measurement indicators, bridging the gap between the level of care received in different healthcare facilities by adopting and maintaining a uniform standard, adoption of daily two-way messaging and peer navigation strategy, providing the phone based enhanced adherence counseling option to patients, paying attention to patients with low-level viremia to ensure that they have undetectable levels are all effective ways to prevent and reduce viral suppression in Nigeria [9, 12, 15, 17, 18, 25, 26]. Increased utilization of private for-profit facilities are also suggestive of better virological outcomes as

reported by a study in North Central Nigeria [14]. Undeterred by challenges like poor regulation, small-sized facilities, and financial burden on the patients which can discourage donor agencies, private for-profit facilities have offered quality care and this is expected to increase with more support and engagement [14]. Although not rampant in Nigeria, a systematic review also verified the utility of antiretroviral concentrations in hair as a predictor of antiretroviral ingestion and adherence [43].

In Zambia, a study documented that long travel distances and lack of money to health institutions impacted their adherence and attendance of EAC sessions negatively underscoring the need to provide the option of the phone-based adherence counseling for patients who may desire it [44]. For children and adolescents, lack of transport fare to clinic facilities was also one of the major reasons given for drug nonadherence according to a study in southeast Nigeria [29]. Multi-month dispensing can be adopted just like for adults to remedy this [21]. Although this has been met with challenges relating to supply chain and clinician hesitancy but with regular remote stock monitoring and using of technological applications to calculate specific pediatric dosage, it can thrive [21].

Regarding perceived satisfaction, a study in Texas documented those patients who felt satisfied with their level of care had better virological outcomes compared to those who did not [45]. Thus, it is important to periodically measure patients' level of satisfaction and the factors that lead to poor adherence like HIV-associated stigma, forgetfulness, and complicated regimen should be addressed using adherence-enabling tools such as simplified regimens, more counseling to internalize the need for adherence, adoption of an adherence partner, use of reminder tools, etc.

Finally, this study, provides insights into how much work has been done towards achieving HIV viral suppression in Nigeria, the percentage of viral suppression already achieved including factors that either propagate or negate viral suppression and possible interventions. To foster the achievement of the UNAIDS 95% viral suppression by 2030, interventions should be tailored to individuals, age groups, health facilities, etc. All hands must be on deck to track and evaluate performance. Patients should be encouraged to join support groups and factors responsible for the low uptake of support groups should be studied and investigated. Additional research is also needed on the practicability of antiretroviral hair levels as an index for adherence measurement in the Nigerian system. Long-term non-progressors and patients who achieved viral re-suppression without switching to second-line regimen should also be studied for more insights.

## CONCLUSION

This study provides a significant representation of HIV viral suppression researches in Nigeria in the last 10 years. Studies on HIV viral suppression peaked in the last five years possibly because of increased global determination to achieve set targets

and end the HIV scourge. As Nigeria is yet to achieve the 95% viral suppression goal set by UNAIDS, there still remains enormous research possibilities for the future.

## STUDY LIMITATION

There was a possibility that we missed out relevant publications during the search process that may have contributed to the data and body of knowledge.

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## COMPETING INTERESTS

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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