Evaluation of the Adherence and Viral Load Completion Accomplishments After Antiretroviral Therapy Initiation-Namibia

Article by A. Ntumba[1, 2], L. Kazembe[3]
[1]Katutura State Hospital, Windhoek, Namibia
[2] Public Health, Texila American University, Guyana,
[3]Department of Statistics and Population studies, University of Namibia, Windhoek, Namibia
E-mail: alexisntumbatshiyemba@gmail.com

Abstract

Background: Namibia enrolled 93% of HIV patients into ART programme.

Objectives: To evaluate adherence and viral load completion accomplishments after ART initiation.

Methods: Retrospective cohort study using quantitative method. SPSS was used to analyze the data. Three sets of analyses reported. First compare the age, sex, CD4 and adherence to ART. Then patients with ≥95% adherence to those <95% and viral suppression at 6 and 12 months.

Results: About 69% adhered to treatment at least 95%. Of the 614 patients with viral load records, 73.3% (n=450) had viral suppression at 6 months. At 12 months, a total of 518 with viral load records,85.9% had viral suppression. Among the patients with adherence of at least 95% at six months, 75.2% had viral suppression. At 12 months, 89.4% of patients who adhered at least 95% of ART had viral suppression.

In multivariate binary regression, the study revealed that those who adhered more than 95%, were 1.65 times more likely to suppress the virus compared to those who did not (p=0.029). The results further showed that having CD4 > 200 at ART initiation was likely to be associated with viral suppression (OR=1.55, 95% CI 1.03-2.33).

Conclusions: The adherence to ART, viral load accomplishments, viral suppression did not reach the expected outcomes, targets set by UNAIDS. Although, close to 90% of patients at 12 months showed viral suppression, the number of patients checked for viral load were far from 90% of patients (about 54.5%) ever started on ART.

Keywords: HIV; Antiretroviral Therapy; ART adherence; viral load completion accomplishments, viral suppression, UNAIDS targets.

Introduction

The world is currently working towards elimination of HIV/AIDS. According to UNAIDS (2014) by 2020, 90% of all people living with HIV will know their HIV status, 90% of all people diagnosed HIV infected will receive sustainable ART and 90% of all people receiving ART will have their viral load suppressed. It is important to link 90% of people infected with HIV to HIV prevention, care and treatment, diagnosing 90% of people who do not know their status is the first step. Countries need to improve the effectiveness of HIV testing services in order to reach HIV infected people to be linked to HIV prevention, care and treatment (WHO, 2015). Furthermore, WHO (2015) stated that all HIV testing services (HTS) should continue to be provided within WHO essential 5 Cs: Consent, Confidentiality, Counselling, Correct test results and Connection to which is linked to HIV prevention, care and treatment, quality HIV testing, accurate HIV test results, diagnosis and coordination with laboratory services to support quality assurance. Countries need to come up with innovative strategies to ensure that almost all people have access to HTS for linkage to prevention, care and treatment of those infected.

All eligible patients need to be initiated on ART. Once on ART, patients need to be monitored in order to detect early gap for prompt intervention. One of the main objectives of ART is to provide the

opportunity for people to be productive in their work and daily life. Thus, a measure of productivity may be used as one indicator of the success of an ART programme. Functional status and weight both serve this purpose (WHO, 2006). In addition, the revised clinical staging is based on current clinical signs and it is therefore possible to go down in clinical stage, indicating an improvement with treatment. With ART, it will be common for a patient to move down in clinical stage (WHO, 2006). The viral load and CD4 count can be used to monitor response of ART in patients on ART. Currently the viral load is considered as a gold standard to monitor the ART response. The use of CD4 counts is additionally helpful to monitor response to ART, evaluate possible treatment failure and make decisions on discontinuing prophylaxis. Finally, periodic monitoring of CD4 counts when there is ample laboratory capacity can be useful to monitor disease progression prior to ART and detect treatment failure (WHO, 2006).

The Ministry of Health and Social services (MoHSS) in Namibia began rolling out the voluntary counselling and testing (VCT) in 2004. According to the Namibian Demographic and Health survey (2013), the HIV testing services have recently improved that there was a remarkable increase in the last six years, from 55% of women and 34% of men aged 15-49 in 2006/7 to 81% and 63% respectively. Although, there is an increase, the coverage does not reach 90% of the Namibian population. More efforts are needed to contribute to the 90-90-90 target. In light of the Namibian HIV program to contribute to 90-90-90 target set by UNAIDS health personnel attending patients on ART report that a number of patients on ART are defaulting treatment and adherence jeopardized. Many will agree that poor adherence will lead to resistance/poor viral suppression and poor outcomes. Whilst the Namibian HIV patients are lucky to have access to free ART, they seem not to demonstrate a degree of responsibility in terms of adhering to treatment and vigilance to HIV/AIDS.

The current study has therefore been designed to examine the viral load accomplishments and viral load suppression at six months and twelve months after ART initiation. The aim of the study is to evaluate the adherence and viral load completion accomplishments and associated factors after ART initiation and determine the significance of association between adherence and viral suppression at six and twelve months after ART initiation. This will help identify the viral load completion accomplishments, challenges and suggest plans to close the identified gaps. This study will help decision-makers to assist in achieving the 90-90-90 targets set by UNAIDS.

Materials and methods

Study setting

The study was carried out in Windhoek, capital city of Nambia. The city has 7 health facilities: one intermediate hospital, one tertiary hospital, one health centre and eight clinics. All the facilities are offering ART services. This study was carried out at two facilities of which one was a clinic, and the other an intermediate hospital.

Study design

A quantitative, retrospective cohort study design was used. The study population consisted of all HIV patients aged 16 and above on treatment attending the ART services at two facilities in Windhoek-capital city of Namibia. Two health facilities were purposely selected. In the second stage of sampling, participants in these facilities were sampled systematically whereby every third file in the facilities was selected until the desired sample size was achieved.

The sample size was estimated at 942, to detect a relative risk of 2 between the exposed and non-exposed. The following are assumption:

- Two-sided significance of 95%; a power of 80%, ratio of sample equal to 1 between the exposed (less than 95% adherence to ART) and un-exposed (at least 95% adherence to ART);
- Percent of unexposed with outcome equal to 5% and percent of exposed with outcome equal to 10%.

The sample was selected from two health facilities using proportional stratified sampling based on the client population in each clinic. A total of 943 patients were selected of which 430 (45.6%) patients from facility 1and 513 (54.4%) patients from facility 2.

Data collection

A check list to collect data was used. First the simple random sampling of the patients' files was done, followed by a systematic sampling whereby every third file was selected until the desired sample was achieved. The data were collected in a single round of existing data in the chosen facilities for a period of a month, between August 7 and September 8, 2017.

The check list consisted of the following:

Section 1: Demographic data: (1). age, categorized less than 25 years, 25-49 years and 50 years and more to have three categories. The age of at least 16 was chosen as it is the age of sexual consent and also of intellectual ability; (2). Sex, female or male; and (3). Marital status whether single=1, married=2 and other=3. Other meaning any other marital status including widow, widower, divorcee;

Section 2: The weight, CD4 count at ART initiation, WHO staging at ART initiation, co-morbidity such TB, Hepatitis at ART initiation, drugs regimen, adherence records, treatment default, the viral load accomplishments and suppression at 6 and 12 months WHO stage was classified in four groups: stage 1, 2, 3 and 4 of which stage 3 and 4 are of high level of immune suppression; (5). CD4 at ART initiation, categorized into < 200 and > 200, of which patients with CD4 less than 200 are considered highly suppressed; (6). Adherence records and defaulting during the first 12 months of treatment, 95% of adherence was the cut off since 95% is considered enough to suppress viral load; (7). Viral load test and suppression at six and twelve months.

Data analysis

The data was captured in Excel spreadsheet and imported to SPSS version 22 for analysis. The analysis used descriptive statistics including means, 95% confidence intervals and percentages. This was presented sin tabular and graphical summaries. Crude associations were assessed using cross-tabulations of adherence scores against demographic variables, CD4 at ART initiation were performed. Chi-square tests and odds ratios were used to assess associations from cross-tabulations. All p-value < 0.05 were considered statistically significant. To identify factors associated with adherence and viral load we used both the bivariate and multivariate logistic regression. Again p<0.05 was used for significant association.

Ethical considerations

The approval for the study was sought from the Research Ethical Committee of Texila American University and the Ministry of Health and Social Services of the Republic of Namibia. The researcher got permission from the facilities where patients' files were evaluated.

Results

Table 1 shows adherence with basic democratic characteristics, whilst table 3 shows adherence with WHO and CD4 at ART initiation. There was no significant difference (p=0.138) of ART adherence between patients attending Katutura Health Centre and Okuryangava clinic; 67.7% 9 (n=429) of Patients attending Katutura Health Centre and 71.2% (n=513) of patients attending Okuryangava Clinic adhered to treatment more than 95%. With regard to the age group, there was also no significant difference (p=0.088) of ART adherence between patients of different age groups; 61.2% (n=129) of patients aged less than 25 years, 70.6 % (n=772) of patients aged between 25-49 years and 65% (n=40) of patients aged at least 50 years were adherent to ART at more than 95%. In fact, there was a significant difference (p=0.047) of ART adherence between males and females; 72.7 % (n=388) of males were adherent against 66.6% (n=554) of females at least 95%. Regarding marital status, there was no significant difference (p=0.831) between singles, married and others; 68.5% (n=782) of single patients, 71.3% (n=115) of married patients and 66.7% (n=6) of other adhered to at least 95% of ART.

Table 1. Adherence with basic demographic characteristics

Variable	Categories	Adherence			
		>95%	<95%	n	X^2(p-value)
Facility	Katutura	67.7	33.3	429	2.02 (0.138)
	Okuryangava	71.2	28.8	513	
Age	<25 yrs	61.2	38.8	129	4.85(0.088)
	25-49 yrs	70.6	29.4	772	
	>=50 yrs	65.0	35.0	40	
Sex	Male	72.7	27.3	388	3.99 (0.047)
	Female	66.6	33.4	554	
Marital Status	Single	68.5	31.5	782	0.371 (0.831)
	Married	71.3	28.7	115	
	Others	66.7	33.3	6	

Regarding WHO and CD4 at ART initiation (Table 2), there was no significant difference (n=0.205) of WHO stage with ART adherence; 71% (n=68) of patients stage 1, 70% (n=93) of patients stage 2, 64% (n=101) of patients stage 3 and 56 (n=27) adhered to at least 95% of ART. Regarding CD4 at ART initiation, there was a significant difference (p=0.023) of ART adherence between patients who initiated ART with a low CD4 less than 200 and those who initiated ART with a CD4 of at least 200 (Table 2).

Table 2. Adherence with WHO and CD4 at ART initiation

Variable	Categories	Adherence			
		>95%	<95%	n	X^2 (p-value)
WHO stage	Stage1	71.00	29.00	689	4.58 (0.205)
	Stage 2	70.00	30.00	93	
	Stage 3	64.00	36.00	101	
	Stage 4	56.00	44.00	27	
CD4 at ART initiation	<200	67.00	33.00	354	5.18 (0.023)
	>=200	74.00	26.00	519	

This study revealed that patients with an adherence of at least 95% suppress the viral load. Among the patients with adherence of at least 95% at six months, 75.2% (n=508) suppressed the viral load, whilst 24.8% did not manage to supress their viral load. For those who adhered at less than 95%, 64.5% (n=105) suppressed the viral load at six months and 35.2% did not supress the viral load. There was a significant difference ($X^2 = 4.85$, p=0.028) in viral suppression between those who adhered to ART at least 95% and those less than 95%. (Table 3)

There was a significant difference ($X^2 = 27.56$, p=0.009) between patients at 12 months, 89.4% (n=442) of patient who adhered to at least 95% of ART suppressed the viral load, whilst 10.6% of patients did not. For those who did not adhere at least 95%, 66.7 (n=75) supressed the viral load and 33.6% did not (Table 3).

Table 3. Viral load suppression with at least 95% adherence at six and twelve months

		Viral Suppression at 6 months			
Variable	*Categories*	*Yes*	*No*	*n*	X^2*(p-value)*
Adherence	*>95%*	75.2	24.8	508	4.85 (0.028)
	<95%	64.8	35.2	105	
		Viral Suppression at 12 months			
Variable	*Categories*	*Yes*	*No*	*n*	X^2*(p-value)*
Adherence	*>95%*	89.4	10.6	442	27.56 (0.009)
	<95%	66.7	33.6	75	

The study further revealed, using the estimates from the multivariate logistic regression, that those who adhered more than 95%, were 1.65 times more likely to suppress the virus compared to those who did not (p=0.029) (Table 4). The results further show that having CD4 more than 200 at the initiation of ART was likely to be associated with viral suppression (OR=1.55, 95% CI 1.03-2.33). Suppression of viral load was associated with place of care (health facility). Those who receive care from KHC were less likely to suppress compared to those who did so from OC (OR=0.53, 95% CI: 0.35-0.76) (Table 4). For all other variables including WHO stage, age, sex and marital status, there was no evidence of suppression when one considered the adjusted model.

Table 4. Estimates from the multivariate logistic regression

Variable	Categories	Coef	Standard Error	Wald	df	p-value	Odds Ratio	95% C.I. for Odds Ratio	
								Lower	Upper
Intercept	-	0.368	1.26	0.43	1	0.51	2.30	0.86	4.83
Adherence	Yes	0.51	0.23	4.79	1	0.029	1.65	1.05	2.58
	No (Ref)	0					1.00		
CD4 at ART Initiation	>200	0.44	0.21	4.35	1	0.037	1.55	1.03	2.33
	<200 (Ref)	0					1.00		
WHO Stage	Stage 1	-0.92	0.62	2.21	1	0.137	0.39	0.12	1.34
	Stage 2	-0.44	0.66	0.45	1	0.501	0.64	0.178	2.33
	Stage 3	0.05	0.65	0.01	1	0.946	1.05	0.29	3.77
	Stage 4 (Ref)	0					1.00		
Facility	Katutura	-0.64	0.21	9.41	1	0.002	0.53	0.35	0.76
	Okringava (Ref)	0					1.00		
Age	<25 yr	-0.57	0.54	1.09	1	0.297	0.57	0.19	1.65
	25-49 yr	-0.21	0.46	0.20	1	0.654	0.81	0.32	2.02
	50+ yr (Ref)	0					1.00		
Sex	Male	-0.09	0.19	0.22	1	0.638	0.91	0.62	1.34
	Female (Ref)						1.00		
Marital Status	Single	-1.63	1.24	1.72	1	0.189	0.19	0.02	2.23
	Married	-1.44	1.26	1.31	1	0.253	0.24	0.02	2.79
	Others (Ref)	0					1.00		

Discussion

This study aimed to evaluate adherence to ART treatment in a cohort of HIV patients between 2010 and 2015. It further explored the association between treatment adherence and viral load suppression. The high level of adherence ($\geq$ 95%) is paramount to achieve viral load suppression and prevent treatment failure. Unfortunately, the adherence to treatment in this study showed that 69.1% adhered to treatment and 30.9% adhere less. This is consistent with the study by Eyassu et al (2016) and Suleiman & Momo (2016). Eyassu et al showed adherence of at least 95% to ART was 77.0% (n=290), whilst Suleiman & Momo revealed that among persons living with HIV/AIDS in Bayelsa state in Nigeria, 73.4% (n=601) were adherent to at least 95%. Although the two studies by Eyassu et al and Suleiman & Momo showed a better ART adherence, they are both below the expected 90% set by UNAIDS. This study further revealed that 25.2% of the patients defaulted treatment and 74.8% did not default treatment. Again, with a quarter of patients who ever started on treatment defaulting on medications jeopardized viral suppression of a least 90% of patients ever started on ART. This is consistent with the study conducted in Ethiopia by Berheto et al (2014) showed that 26.7% (n=2133) of patients living with HIV were lost to follow-up.

Regarding the viral load suppression at six months, 614 (65.1%) patients had their viral load records of which 450 (73.3%) had their viral load suppressed and 163 (26.5%) had their viral load not suppressed. At 12 months, a total of 518 (54.9%) had their viral load suppression recorded of which 445 (85.9%) had their viral load suppressed and 72 (13.9%) had their viral load not suppressed. The viral suppression had improved at 12 months, nevertheless, this did not reach the expected 90% of UNAIDS targets. Hence, a lot still need to be done to reach at least 90% of viral suppression. The 2014 study conducted by Barnabas et al in Kwazul Natal (South Africa) and Mbarara district (Uganda) showed that 77% (n=77) of patients achieved viral suppression by 12 months. Many will agree that the viral suppression is quite similar although the current study showed a good viral suppression at 12 months. Elul et al (2013) showed that of the 837 patients, 94% and 78% of patients in Rwanda reported perfect adherence for the last 3 and 30 days, respectively. Eighty-three percent had viral suppression.

Thus, whether in the current study, the study in South Africa and that conducted in Rwanda showed that we are still having challenges in reaching the 90% target of viral suppression set by UNAIDS.

This study showed that a CD4 more than 200 might improve treatment outcomes. This is consistent with Fox et al (2010)'s study revealing that patients initiating ART with higher CD4 counts (more than 200) had reduced tuberculosis, mortality, and less virologic failure than those initiated at lower CD4 counts (CD4 less than 200). In addition, the study revealed that patients with a baseline CD4 count $\leq$200 had a five-fold increase risk versus those with CD4 count> 200. Regarding virologic failure, the patients with CD4 $\leq$200 at baseline had nearly twice the crude risk of virologic failure as those > 200. Thus, this strategy of starting all patients infected with the virus to start on ART will improve the ART outcomes.

Further, this study revealed that there was no significant difference (p=0.138) of at least 95% ART adherence between patients attending Katutura Health Centre and Okuryangava clinic. This is because all the patients attending the two facilities shared same or similar culture and socio-economic characteristics. Moreover, there was no significant association of at least 95% adherence to ART and age and marital status. Thus, age and marital status do not affect adherence to ART. This is consistent with the study conducted in Oromia, where the study showed no significant association seen between non- adherence to antiretroviral therapy among adult person living with HIV/AIDS and age, marital status and educational level (Dibaba & Hussein, 2016). It is also in line with Ejigu, Ahmed & Mohammed (2014) study that showed that there was no difference between males and females on ART adherence in South West Ethiopia; the average adherence rate was 98.1% among males and 99.5% among females.

However, this study showed that males' patients are adherent than females' patients. Probably, in Namibia males generally do not go for HIV test, when they do decide to go for a test, they also take responsibility, whilst women are exposed to HIV test while pregnant or when a child id suspected having HIV.

In fact, there was a significant difference (p=0.047) of ART adherence between males and females; 72.7 % (n=388) of males were adherent against 66.6% (n=554) of females at least 95%. An early viral suppression translates into good adherence to ART. Hence this study is not consistent with Rangarajan et al (2016) study where of 828 males and 427 females, HIV viral suppression was 93%. Viral suppression was not significantly different between women and men (93.7% vs 92.9%).

Regarding marital status, there was no significant difference (p=0.831) between singles, married and others; 68.5% (n=782) of single patients, 71.3% (n=115) of married patients and 66.7% (n=6) of other adhered to at least 95% of ART. (Table 4) This is not consistent with the study conducted in central Ethiopia where single men or women (unmarried people) was associated with poor adherence to ART (Beyene, Gedif, Gebre & Engidawork, 2009). This is further confirmed by Kalichman et al (2015) that the unstained suppression participants were significantly less likely to be married and were of younger age. It is therefore to confirm that marital status plays a role in ART adherence. At the same time many will agree that if a married person discloses HIV status to his/her partner the support will likely improve adherence to treatment.

In this study, 89.4% (n=442) of patients who adhered to ART at least 95% at 12 months suppressed the virus. This is close to UNAIDS target of at least 90% of patients that should suppress the virus. This is almost consistent with Tsondai et al (2017) study where of the 3216 adults' patients' part of therapy adherence clubs in Cape Town, South Africa, of the 88.1% who had their viral load assessed, 97.2% had viral suppression. Although the target is met many will agree that only 81.1% of patients had their viral load assessed and others were lost to follow-up. Efforts are still needed to assess at least 90% of patients on ART. This also consistent with San Lio et al study (2008) where of the 284 patients who had treatment adherence >95% in Mozambique, 274 (96.5%) had a viral load <1000 copies/mL at the end of the 12 months' observation period. This is very good and meet the UNAIDS target of 90%. Thus, the adherence of at least 95% to ART will likely lead to at least 90% of viral suppression.

Results also showed that patients with an adherence of at least 95% suppress the viral load. This is consistent with Eller (2009) who stated that although moderate adherence can lead to viral suppression, the probability of viral suppression improves with every increase in ART adherence. Probably those who suppressed the virus were having moderate adherence to ART. This is evident, as the proportion that suppressed at 12 months was 89.4%, an improvement of 14.2% compared to the viral suppression at 6 months. This many improve further if these are retained in care. In fact, a study by Koss et al (2017) demonstrated that among 150 women initiated on treatment during pregnancy, 135 women were retained in care, of which 121 (80.7%) demonstrated viral suppression with a median of 4.2 years. The retention in care is associated with adherence to ART. Thus, higher levels of adherence or retention in care are associated with viral suppression. In addition, Carter (2017) revealed that over 85% (n=232) of women who started ART with a CD4 above 500, suppressed the virus. In the same vein, Carret et al (2017) revealed that women who initiated ART with a median CD4 of 217 had over 85% viral suppression at 3,6.12 and 18 months of ART. Although 85% suppressed the virus which is very good, 90% was not reached in both studies.

Many will agree that more efforts are needed to ensure that at least 90% of patients initiated on ART be assessed at six months and 12 months for viral suppression to meet the 90-90-90 targets set by UNAIDS. In addition, adherence does not give 100% viral suppression, other factors play also a role in suppressing the virus.

Limitations of the study

This study is not without limitation. First, the study did not identify the factors associated with defaulting as it was restricted to secondary data, thus, a further research dealing with only defaulters is paramount in order to identify factors of defaulting and plan evidence-based interventions. Moreover, it is also good to study those patients with at least 95% of adherence to understand the motives of their adherence.

Recommendations

The findings of this study lead to the following recommendations:

- The patients' files must have all details regarding physical address including erf number, street name and area. This may be necessary for easy defaulter tracing. The idea of treatment supporter is also necessary for adherence and also tracing of patients in case of defaulting.
- Defaulter tracing of patients should be organized when a patient does not report on his/her follow-up date to ensure that patients are traced and counselled again for ART adherence. Such patients must also have follow-up sessions of counselling with supporters.
- The treatment adherence is paramount for at least 3 sessions until the counsellor is satisfied with the understanding of the patient for a lifelong treatment commitment. In addition, ongoing adherence counselling is paramount in order to ensure at least 95% of ART adherence. The adherence sessions should be also conducted with a treatment supporter. We can even consider more than one supporter to achieve at least 95% of ART adherence and prevent defaulting.
- The facilities should ensure a standard records and viral load accomplishments at six and twelve months or closer for all expected patients. The records are of paramount importance for monitoring and evaluation.

Conclusions

The adherence to ART, the viral load accomplishments, the viral suppression did not reach the expected outcomes, targets set by UNAIDS. Although, close to 90% of patients at 12 months showed viral suppression, the number of patients checked for viral load were far 90% of patients ever started on ART. In this study we also see that patients with stage 1 disease and CD4 count of more than 200 showed high level of suppression. In addition, almost a quarter of patients ever started on treatment defaulted ART.

This is far from expected 90%. Although, the efforts made by the Namibian government is encouraging as we can see patients suppressing the virus, more efforts are still needed to ensure that at least 90% of patients adhere to ART in order to expect at least 90% of viral suppression and thus be part of 2030 HIV elimination. For Namibia to reach 90-90-90 targets set by UNAIDS, the health information to encourage people to be tested for HIV should include the fact that knowing HIV status at early stage when stage I disease or/and CD 4 more than 200 is associated with high viral suppression. The viral suppression is associated with reduced HIV transmission.

Acknowledgments

References

[1]. Adriano JA, Dorado I, Brito AM & da Silva CAL (2015). Factors associated with non-adherence to antiretroviral therapy in adults with AIDS in the first six months of treatment in Salvador, Bahia State, Brazil. Cad. Saúde Pública, Rio de Janeiro, 31(6):1-11, jun, 2015.

[2]. Barnabas RV et al (2014). Initiation of ontiretroviral therapy and viral suppression after home HIV testing and counselling in KwaZulu-Natal, South Africa, and Mbarara district, Uganda: a prospective, observational intervention study. Lancet HIB. 2014 Nov;1(2): e68-e76.

[3]. Beaglehole, R., Bonita, R & Kjellstron, T (1993). Basic Epidemiology. Geneva: WHO.

[4]. Beer L., Heffelfinger J., Frazier E et al (2012). Use of and Adherence to Antiretroviral Therapy in a Large U.S. Sample of HIV-infected Adults in Care, 2007-2008.The Open AIDS Journal, 2012, 6, (Suppl 1: M21) 213-223.

[5]. Berheto T.M., Haile D.B. & Mohammed S. (2014). Predictors of Loss to follow-up in Patients Living with HIV/AIDS after HIV/AIDS after Initiation of Antiretroviral Therapy. N AM J Med Sci.2014 Sep; 6(9):453-459doi: 10.4103/1947-2714.141636.

[6]. Beyena KA, Gedif T, Gebre-Mariam T, Engidawork E (2009) Highly active antiretroviral therapy adherence and its determinants in selected hospitals from south and central Ethiopia, Pharmacoepidemiology, and Drug Safety 18:1007-1015.

[7]. Carter M (2017). Early ART highly acceptable and achieves excellent rates of viral suppression among young South African women. Available at www.aidsmap.com/Early-ART-highly...and...of-viral-suppression.../3133122/.

[8]. Garret N et al (2017). Acceptability of early antiretroviral therapy among South African women. AIDS Behav, online edition. DOI: 10.1007/s10461-017-1729-2(2017).

[9]. Chaiyachatia KH, Ogbuojib O, Priceb M, Sutharc AB, Negussiec EK & Ba¨rnighausen T (2014). Interventions to improve adherence to antiretroviral therapy: a rapid systematic review. S200 AIDS 2014, Vol 28 (Suppl 2).

[10]. Centers for Disease Control and Prevention (2011). Introduction to Program Evaluation for Public Health Programs: A Self-Study Guide. Atlanta, GA: Centers for Disease Control and Prevention.
Centers for Disease Control and Prevention (2012). Linkage to and retention in HIV Medical Care. Available at http://www.cdc.gov/hiv/prevention/programs/pwp/linkage.html. Accessed on June 9, 2016.

[11]. Chrhartishvili N., Rukhadze N., Svanidzel et al (2014). Evaluation of multiple measures of antiretroviral adherence in the Eastern European country of Georgia.

[12]. Collins English Dictionary (2016). Adherence definition and meaning/Collins English Dictionary. Available at https://www.collinsdictionary.com/dictionary/english/adherence. Accessed on May 20, 2017.

[13]. Dibaba B & Hussein M (2016). Factors Associated with Non-Adherence to Antiretroviral Therapy among Adults living with HIV/AIDS in Arsi Zone, Oromia. ISSN 2155-6113. Journal of AIDS & Clinical Research.

[14]. Ejigu MA, Mohammed MA (2014). Anti-retroviral therapy adherence and its determinants among adult patients living with HIV/AIDS in South West Ethiopia: A facility-based cross-sectional study, Gaziantep Med J20:52-58.

[15]. Eller LS (2009). Adherence, Resistance and Antiretroviral Therapy. Online available: https://aidsetc.org/sites/default/files/resources-files/nynj-nurse-mod2-09-ppt.

[16]. Elul B. et al (2013). High Levels of Adherence and Viral Suppression in a Nationally Representative Sample of HIV-Infected Adults on Antiretroviral Therapy for 6, 12 and 18 Months in Rwanda. Online available: https://doi.org/10.1371/journal.pone.0053586. Access October 11, 2017.

[17]. Eyassu M.A., Mothiba T.M. & Mbambo-kekana N. P. (2016). Adherence to antiretroviral therapy among HIV and AIDS patients at the Kwa-Thema clinic in Gauteng Province, South Africa. Afr J Prim Health Care Fam Med. 2016;8(2):924.

[18]. Fagbamigbe A.F., Adebayo S.B. & Idomudia (2016). Marital status and HIV prevalence among women in Nigeria; Ingredients for evidence-based programming. International Journal of Infectious Diseases. Volume 48, July 2016, Pages 57-63.

[19]. Fox M.P., Sanne I.M., Conradie F., Zeinecker J., Orrel C., Ive P., Rassool M., Dehlinger M., Van der Horst, James McIntyre & Wood R. (2011). Initiating Patients on ART at CD4 above 200 in Associated with Improved Treatment Outcomes in South Africa. AIDS. 2010 Aug 24:24(13):2041-2050 doi 10.1097/QAD.Ob013e32833c703e.

[20]. Gesesew H.A., Ward P., Woldemichael K. & Mwanri L. (2016). Prevalence, trend and risk factors for antiretroviral therapy discontinuation among HIV-infected adults in Ethiopia in 2003-2015. Online available https://doi.org/10.137/journal.pone.0179533 access on October 10, 2017.

[21]. Hosseinipour MC, Gupta RK, Van Zyl G, Eron JJ & Nachega JB (2013). Emergence of HIV Drug Resistance During First- and Second-Line Antiretroviral Therapy in Resource-Limited Settings. J Infect Dis. 2013 Jun 15; 207(Suppl 2): S49–S56. doi: 10.1093/infdis/jit107.

[22]. J Int AIDS Soc. 2014; 17(1): 18885.Published online 2014 Apr 9. doi: 10.7448/IAS.17.1.18885.

[23]. Eltom MA, Jemal A, Mbulaiteye SM, Biggar RJ (2002). Trends in Kaposi's sarcoma and non-Hodgkin's lymphoma incidence in the United States from 1973 through 1998. J Natl Cancer Inst. 2002; 94:1204–1210.

[24]. Kalichman ST et al (2015). Viral Suppression and Antiretroviral Medication Adherence Among Alcohol Using HIV Positive Adults. Int J Behay Med.2014; 21(5):811-820. Doi:10.1007/s12529-013-9353-7.

[25]. Karl P & Supa P (2013). Socioeconomic Factors in Adherence to HIV Therapy in Low- and Middle-Income Countries. Journal of Health Population and Nutrition, June 1, 2013.

[26]. Kim S., Gerver SM., Sarah Fidler S & Ward H (2014). Adherence to antiretroviral therapy in adolescents living with HIV: systematic review and meta-analysis. AIDS. 2014 Aug 24; 28(13): 1945–1956. Published online 2014 Jul 30. doi: 10.1097/QAD.0000000000000316.

[27]. HIV/AIDS Glossary? Viral Load/Definition/AIDS info. Available at https://aidsinfo.nih.gov/understanding-hiv-aids/glossary/877/viral-load. Accessed on May 20, 2017.

[28]. Koss CA et al (2017). Suppression and Retention in Care up to 5 Years After Initiation of Lifelong ART During Pregnancy (Option B+) in Rural Uganda. JAIDS Journal of Acquired Immune Deficiency Syndromes: 01March2017-Volume74-Issue3-p279-284.
doi: 10.1097/QAI.0000000000001228Epidemiology.

[29]. Kyser M1, Buchacz K, Bush TJ et al. Factors associated with non-adherence to antiretroviral therapy in the SUN study. AIDS Care. 2011 May;23(5):601-11. doi: 10.1080/09540121.2010.525603.

[30]. Lahuerta M., Ue F., Hoffman et al (2013). The Problem of Late ART initiation in Sub-Saharan Africa: A Transient Aspect of Scale-up or a Long-term Phenomenon? J Health Care Poor Underserved. 2013 Feb; 24(1): 359–383. doi: 10.1353/hpu.2013.0014.

[31]. Levira F., Agnarson A. M., Masanja H., Zaba B., Ekstrom A.M. & Thorson A. (2015). Antiretroviral treatment coverage in a rural district in Tanzania-a modelling study using empirical data. BMC Public Health201515:195. Online available https://doi.org/10.1186/s12889-015-1460-8 access October 9, 2017.

[32]. Mitiku H, Abdosh T & Teklemariam Z. (2013). Factors Affecting Adherence to Antiretroviral Treatment in Harari National Regional State, Eastern Ethiopia. ISRN AIDS Volume 2013 (2013), Article ID 960954, 7 pages http://dx.doi.org/10.1155/2013/960954.

[33]. Momo A. & Suleiman I.A. (2016). Adherence to antiretroviral therapy and its determinants among persons living with HIV/AIDS in Bayelsa state, Nigeria. Pharm Pract (Granada). 2016 Jan-Mar; 14(1):631.

[34]. Mulugira A et a (2017). High levels of viral suppression among East African HIV-infected women and men in serodiscordant partnerships initiating antiretroviral therapy with high CD4 counts and during pregnancy. AIDS Res Hum Retroviruses 2017 Sep 13.

[35]. Namibia Statistics Agency - Government of the Republic of Namibia (2014). 2011 Namibian Population and housing census 2011. NAM_NSA_PHC_2011_V01_PUMS. Windhoek-Namibia.

[36]. Namibia Ministry of Health and Social Services (MoHSS). (2014). surveillance Report of the 2014 National HIV Sentinel Survey. Windhoek. Namibia.

[37]. Namibia Ministry of Health and Social Services (MoHSS) and ICF International (2014). The Namibian Demographic and Health Survey 2013. Windhoek, Namibia, and Rockville, Maryland, USA: MoHSS and ICF International.

[38]. Namibia Ministry of Health and Social Services (MoHSS). (2013). Report on the 2010 HIV Drug Resistance Survey. Windhoek. Namibia.

[39]. Namibia Ministry of Health and Social Services (MoHSS). (2011/12). National Strategic Framework for HIV and AIDS 2011/12. Windhoek. Namibia.

[40]. Namibia Ministry of Health and Social Services (MoHSS). (2016). National Guidelines for Antiretroviral Therapy. Fifth edition 2016. Windhoek. Namibia.

[41]. Nuwagaba-Biribonwoha H et al (?). Factors Associated with Non-Adherence to Antiretroviral Therapy among Patients Attending HIV Care and Treatment Clinics. Online available: http://www.lapac.org/AdherenceConference/presentations/ADH7 80082.pdf.

[42]. Obua C, Kayiwa J, Waako P, Tomson G, Balidawa H, Chalker J, Ross-Degnan D & Rolf Wahlstrom R (2014). Improving Adherence to Antiretroviral Treatment in Uganda with a low-resource-Facility-based Intervention. Global Health Action. vol7 (2014).

[43]. Ortblad K.F., Lozano R., & Murray C.J.L (2013). The burden of HIV: insights from the Global Burden of Disease Study 2010. AIDS. 2013 Aug 24; 27(13): 2003–2017.

[44]. Rangarajan et al (2016). Factors associated with HIV viral load suppression on antiretroviral therapy in Vietnam. J Virus Erad. 2016 Apr 1; 2(2):94-101. PubMed.gov.

[45]. Reda AA & Biadgilign S (2012). Determinants of Adherence to Antiretroviral Therapy among HIV-Infected Patients in Africa. AIDS Research and Treatment.

[46]. Volume 2012 (2012), Article ID 574656.

[47]. Samji H, Censon A, Hogg RS, Modur SP, Althoff KN, Buchacz K, et al. (2013). Closing the Gap: Increases in Life Expectancy among Treated HIV-Positive Individuals in the United.

[48]. States and Canada. PLoS ONE 8(12): e81355.doi: 10.1371.pone.0081355.

[49]. San Lio MM., Carbini R., Germano P & al (2008). Evaluating Adherence to Highly Active Antiretroviral Therapy with Use of Pill Counts and Viral Load Measurement in the Drug Resources Enhancement against AIDS and Malnutrition Program in Mozambique. Oxford Journals Medicine & Health Clinical Infectious Diseases Volume 46, Issue 10Pp. 1609-1616.

[50]. Schaecher K.L. (2013). The Importance of Treatment Adherence in HIV. Available at http://www.ajmc.com/journals/supplement/2013/a472...hiv/a472_sep13_schaecher_s231. Accessed on November 11, 2017.

[51]. Silva MC, Ximenes RA, Miranda Filho DB, Arraes LW, Mendes M, Melo AC, et al. Risk-factors for non-adherence to antiretroviral therapy. Rev Inst Med Trop São Paulo 2009; 51:135-9.

[52]. Simoni JM, PhD, Amico KR, Pearson CR & Malow R (2008). Strategies for Promoting Adherence to Antiretroviral Therapy: A Review of the Literature. Department of Psychology, University of Washington, Campus Box 351525, Seattle, WA 98195, USA.

[53]. Thompson M (2011). Challenges of Improving Adherence to HIV Therapy. Am Fam Physician. 2011 Feb 15;83(4):375-379.

[54]. Tsondai PR, Wilkinson LS, Grimscrud A, Mdlalo PP, Ullauri A & Boulle A (2017). High rates of retention and viral suppression in the scale-up of antiretroviral therapy adherence clubs in Cape Town, South Africa. Journal of the International AIDS Society 2017, **20**:21649. Online available: http://www.jiasociety.org/index.php/jias/article/view/21649| http://dx.doi.org/10.7448/IAS.20.5.21649.

[55]. UNAIDS (2014). UNAIDS Report 2014. Geneva, Switzerland.

[56]. UNAIDS (2016). UNAIDS Report 2016. Geneva, Switzerland.

[57]. US Department of Health and Human Services (2014). Guidelines for the Use of Antiretroviral Agents in HIV-1 Infected Adults AND Adolescents. online available: https://aidsinfo.nih.gov/guidelines/html/1/adult-and-adolescent-arv/30/adherence-to-art. Access October, 2017.

[58]. WHO (2006). Patients monitoring guidelines for HIV care and Antiretroviral Therapy. World Health Organization 20, avenue Appia CH-1211 Geneva 27 Switzerland.

[59]. WHO (2006). From access to adherence: the challenges of antiretroviral treatment. World Health Organization 20, avenue Appia CH-1211 Geneva 27 Switzerland.

[60]. WHO (2012). Patient evaluation and antiretroviral treatment for adults and adolescents. WHO Regional Office for Europe Scherfigsvej 8 DK-2100 Copenhagen Ø, Denmark.