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EFFECTIVENESS OF ANTIRETROVIRAL THERAPY AMONG HIV INFECTED PATIENTS: A TEN –YEAR RETROSPECTIVE STUDY IN UNIVERSITY OF PORT HARCOURT TEACHING HOSPITAL

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ABSTRACT

Studies indicate that Antiretroviral (ART) medications has been effective in the management of Human Immunodeficiency Virus (HIV) among infected patients. This is evident as they have proven to reduce the HIV viral load, increase CD4 count and prevent resistance to ARV medications with less opportunistic infections and diseases thereby ensuring an increase in survival rate among HIV infected patients. Since HIV infection is chronic and exposure to ART medication is lifelong, there is need to evaluate it's effectiveness to ensure the successful management of the infection. This study aimed at evaluating the effectiveness of Antiretroviral therapy over the past ten(10) years,through assessment of patients' response to therapy using monitoring parameters such as CD4 count and Viral load. Also to identify the combination of ART regimen in relation to treatment guidelines and also identify the rate of switching therapy over the period. Retrospective cohort study design was used and data were collected for 383 HIV infected patients from the Institute of Human Virology of Nigeria (IHVN) database of the University of Port Harcourt HIV clinic after calculating the sample size. The data collected for each patient include antiretroviral regimen that has been used so far, CD4 count and Viral load from 2013 till 2022. The data was then analyzed using Microsoft Excel 2016 and the outputs were presented using figures, bar charts and line chart. From the data collected, ART regimens has been effective in the management of HIV among infected patients as it has proven to increase CD4 count while reducing the viral load among patients. Also the approved first line ART regimen was AZT-3TC-NVP from 2012 till 2022 however; this was switched to TDF-3TC (FTC)-DTG due to the former regimen inability to suppress the viral load probably due to the resistance of the virus to the medication. In the past Ten years, ART regimens have only been switched once (in 2018) to ensure adherence to therapy and effectiveness in the infection management. From the retrospective study conducted, it was observed that ART has greatly improved the survival rate of HIV infected patients as an increase in CD4 count indicates a probability of the body to be able to resist and fight potential infections and a suppression in viral load indicates a decrease in transmission rate.

KEYWORDS: Anti retroviral Therapy, Ten-year Effectiveness, UPTH.

INTRODUCTION

Human Immunodeficiency Virus (HIV) is a virus which attacks the human body's immune system. So far, there is no known cure for the virus, however, it can be duly managed with medications. But when not properly managed the infection can lead to Acquired Immune-deficieny Diseases (AIDs) in which case the body is prone to many other diseases or infections (opportunistic infections) due to compromised immune system. Research has shown that HIV may have been transmitted from Chimpanzees to Humans as far back as 1800s as the Chimpanzee version of the virus is called Simian Immuno-deficiency Virus (SIV) which has been hypothetically said to be passed to humans during hunt for meat in the wild. Antiretroviral Therapy (ART) can be described as any HIV treatment that uses a

combination of more than one drug in the management of HIV. These drugs help to keep the amount of virus in the plasma at a low undetectable level. Highly Active Antiretroviral Therapy (HAART) has proven to be efficacious in the management of Human Immunodeficiency Virus (HIV) in infected patients as it has been observed to improve survival among HIV-infected patients. HAART is a treatment regimen used in the management of HIV, it consists of combination of three or more drugs in the antiretroviral classes of the medications. Exposure to Antiretroviral Therapy in the management of HIV is usually lifelong therefore, it is necessary to evaluate the long term effect on survival of the population. Viral load of patients and their CD4 count at intervals over the past ten years were used as a yardstick to identify the improvement in the management of HIV infection in infected patients.

Recent survey indicates a national HIV prevalence of 1.4% in Nigeria among adults aged 15-49 years.[1] Previous study indicated a prevalence of 2.8%.[2] UNAIDS and the National Agency for the Control of AIDS estimated a population of about 1.9million people living with HIV in Nigeria.[3] The Federal Government of Nigeria introduced the use of Antiretroviral Therapy (ART) in 2002 through the National ART programme. Under this programme, adults and children were given unlimited access to ARV medications at a well subsidized rate with the help of the government and donor agencies. In 2004, the supply of the ARV medication to the country encountered challenges however in 2006, a new program was started with the aim of providing ARV drugs for free to HIV positive patients. In 2010, WHO launched the Treatment 2.0 strategy promoting simplification of ART with an acceleration in the treatment scale-up and full integration with prevention. WHO in July 2013 launched new guidelines with recommendations on Antiretroviral Therapy for adults and adolescents. This is to ensure that HIV infected patients have easy access to the medication which will be equivalent to make their life better as the disease will be kept at bay.[4]

The decision to start, switch or discontinue an antiretroviral therapy is determined by clinical and immunological parameters, this include the viral load and the CD4 count. HIV has a major impact on the socioeconomic status of individuals living with HIV since it was discovered in the world. Its effect has been evident in the health, welfare and criminal justice sectors as recent epidemiological data proves that HIV remains a public health issue that is persistently draining our economy as it has claimed over 25 million lives over the last decades.[5] Study conducted by Joints United Nations Programme on HIV and AIDS in 2014, showed that Nigeria has 9% of all people living with HIV in the world.[6]

In Table 1: Statistics of HIV/AIDS in Nigeria 2014.[7,8,9,10]

INDICATOR (IN MILLLIONS OR OTHERWISE INDICATED)	NIGERIA	SUB-SAHARAN AFRICA	GLOBAL
Estimated number of people living with HIV/AIDS 2014	3.2	25.8	36.9
Estimated number of children living with HIV/AIDS, 2014	0.4	2.3	2.6
Estimated number of deaths due to HIV/AIDS, 2014	0.21	0.79	1.2
Estimated number of new HIV infections, 2014	0.22	1.4	2.0
-Adult (15 yr. +)	0.17	1.2	1.8
-Children (<15 yr.)	0.058	0.19	0.22
Number of adult population (15 yr. +) estimated to be living with HIV/AIDS, 2014	3.0	20.3	34.3
-Adult women (15 yr. +)	1.7	12.1	17.4
-Children (<15 yr.)	0.36	2.3	2.6
% of young women (15-24 yr.) estimated to be living with HIV/AIDS, 2014	1.3	3.4	0.4
% of young men (15-24 yr.) estimated to be living with HIV/AIDS, 2014	0.7	1.4	0.3
Estimated number of AIDS orphans (0-17 yr.), 2014	1.6	10.9	13.3
Number of people estimated to be receiving ART, 2014	0.75	9.1	12.9

So far, there has been improvements on the antiretroviral medications used in HIV management but there has been no known cure; however, over the years the virus has so far been properly managed using antiretroviral medications to suppress the viral load and to improve the CD4 count of individuals that had being tested positive. Since the fight against this virus, there has being development of over two dozens of antiretroviral drugs and they are classified into seven main classes according to their mechanism of action. Research indicates that a combination of different classes of the drug is the best way to manage the HIV effectively and lower the occurrence of resistance by the virus. Antiretroviral has been proven to reduce transmission of the virus, decrease morbidity and mortality that are related to HIV at all stages of the infection. Also, ART cause the maximal and durable suppression of the viral load in the plasma and also confers substantial clinical benefits. In this study, the viral load and the CD4 count of the selected population were assessed over the span of ten years. This

would give detailed analogy of how effective the ART have reduced the viral load and increase the patient's CD4 count.

This study aim to evaluate the effectiveness of ART use over the past ten years in the selected population of HIV-infected individuals and also assess patient's response to therapy; identify the combination therapy for ART in relation to treatment guidelines used in management of HIV in the past ten years; assess patient response to treatment in the past ten years using monitoring parameters such as viral load, CD4 count and also observe possible resistance recorded over the years, as well as identify rate of switching of the ART within the period.

Study Design: The study is a retrospective based cohort study, that involves collection of data from files of HIV-infected patients receiving anti-retro viral drugs from the ARV unit of University of Port -Harcourt Teaching Hospital (UPTH) HIV clinic. Data collected include the ARV drugs combination that has been used for the management of the virus, CD4 count of patients, Viral load of patients, known resistance and side effects observed during medication use and level of the virus in the plasma.

Study area: The research was carried out in the HIV clinic of University of Port Harcourt Teaching Hospital. This facility is a Federal government owned establishment located along East -West Road Choba Port Harcourt, Rivers State, established in April 1980 but however commissioned by the Federal government in 1985. It is a known tertiary-care teaching and research facility in Rivers State, Nigeria and it is managed via a three-tier managerial system made up of – the Board of Management, Hospital Management Committee (HMC) and the Departments. The facility has various departments from the Accident and Emergency department to the Orthopaedic department, the Paediatric department, General Outpatient Department in addition to medical services, the facility also provides clinical education and training to students, nurses, and other healthcare professionals.[7] The HIV clinic in the University of Port Harcourt Teaching Hospital is sponsored by the Institute of Human Virology Nigeria (IHVN) since the year 2001 till date. The institute is responsible for the HIV testing of patients, counselling of patients and also the supply of Anti-retroviral medications to patients. The institute work in collaboration with other staff in the clinic to ensure transparency, honesty and accountability in anti-retroviral dispensing and also ensure that patients data are properly documented to check for medication efficacy and effectiveness.

Study population: The study population consists of people living with HIV/AIDS who were receiving medications for the management of the virus from the HIV clinic of University of Port Harcourt Teaching Hospital. The patients have been tested and confirmed HIV positive and have been on anti-retroviral medications for 10 years or more. These patients attended the clinic intermittently to refill their medications and also for routine check which include the CD4 count test, the plasma viral load test and also evaluate for opportunistic infections.

Sample size detrmination: Sample size determination is a means for the easy identification of an ideal subset which represents the population and produces strong, statistically significant results. It is used to make inference to a particular population size because it enables one choose the number of replicate in a research work. The sample size was calculated using the Kercjie and Morgan formula.[11]

$$\text{Sample size (n)} = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1+\left(\frac{z^2 \times p(1-p)}{e^2 N}\right)}$$

Where n = sample size; Z = confidence level (95% = 1.96); p = standard deviation (0.5); N = population size; e = margin of error (5% = 0.05)

Records showed that within the study period (10 years ago), the clinic had 2912 number of HIV patients who attended the clinic for anti-retroviral medications refill and management. This figure was used as the population size, and a sample size of 383 was obtained when substituted into the above formula.

Data collection: This study is a retrospective cohort study and it involves evaluation of already collected data from January 2013 to December 2022. Data including patients CD4 count from 2013 to 2022 and patient current viral load were collected from the University of Port -Harcourt Teaching Hospital -Institute of Human Virology Nigeria (IHVN) operated database. A total number of 383 patient data were collected then the data were cleaned, sorted and analyzed.

Inclusion criteria: Prior to the collection of data from a particular patient, some eligibility criteria were put into place. This eligibility criteria include: Patient must be confirmed to be HIV positive; Patient is registered in the ARV unit of the facility; Patient has been on ARV medications on or before December 2012; Patients CD4 count test has been carried out on the patient over the past 10 years.

Exclusion criteria: Despite being HIV positive, some patient data were not collected because they did not meet all the criteria for eligibility. Data from patients that started ARV medications after 2012 were not collected including data of patients that were not registered in the ARV unit of UPTH.

Ethical approval: Ethical approval was obtained from the ethics committee of UPTH. This approval gave the

researcher permission to obtain information from the staff in the medical records unit of the HIV clinic and also from the database of the Institute of Human Virology Nigeria (IHVN). Sample of the approval letter is attached in the appendix page of this project work.

Data analysis: The data was arranged, sorted, cleaned and analyzed using Microsoft Excel 2016. The outputs of different findings were presented using tables, bar chart and line chart.

RESULTS

Among 383 patients whose data were collected in respect to the study at the HIV clinic of University of Port - Harcourt Teaching Hospital, 258 (67.4%) were female while 125 (32.6%) were male. Also, 96 (25.1%)patients were between the age of 18-25yrs, followed by, 129 (33.7%) aged 26-40yrs and then 158 (41.3%). aged > 40yrs, It was also found that among the study participants 23% were married, 58% were single and 19% were divorced or single parents, Table 2.

Table 2: Socio-demographic data of Patients.

SOCIO-DEMOGRAPHICS	NUMBER (FREQUENCY) (n)	PERCENTAGE (%)
Sex		
Male	125	32.6
Female	258	67.4
Age (years)		
18-25	96	25.0
26-40	129	33.7
> 40	158	41.3
Marital Status		
Married	88	23
Single	209	54.6
Divorced	73	19
Undocumented	13	3.4

Antiretroviral Therapy combinations have been used for over 10 years in the management of HIV among infected patients in UPTH. The following combinations were used between 2013 and 2017, Table 3a.

Table 3a: shows ART combination medications used from 2013 to 2017 alongside the percentage of the sample size on the medication.

ART COMBINATION	NO OF PATIENTS (n)	PERCENTAGE (%)
TDF-FTC-NVP	1	0.26
TDF-FTC-EFV	1	0.26
TDF-3TC-NVP	4	1.04
TDF-3TC-LPV/r	4	1.04
TDF-3TC-DTG	1	0.26
D4T-3TC-NVP	1	0.26
AZT-3TC-EFV	3	0.78
AZT-TDF-NVP	6	1.57
TDF-3TC-EFV	17	4.44
ABC-3TC-NVP	3	0.78
AZT-3TC-NVP	342	89.31

Abbreviations: AZT- Zidovudine; 3TC- Lamivudin; FTC- Emtricitabine; EFV- Efavirenz -ABC- Abacavir; NVP- Nevirapine; D4T- Stavudine; DTG- Dolutegravir; LPV/r-Lopinavir/Rotinavir; ATV/r- Atazanavir/ritonavir Highly Active Anti retroviral Therapy (HAART) has proven to be more effective in the management of HIV infection. HAART is a combination of three or more anti retro vial agents belonging to different classes of ARV agent.[12, 13, 14]

Table 3b: showing ART medications used from 2018 - 2022 alongside the percentage of the population on the medication.

ART COMBINATION	NUMBER OF PATIENTS (n)	PERCENTAGE (%)
D4T-3TC-EFV	1	0.26
TDF-FTC-DTG	1	0.26
ABC-3TC-ATV/r	1	0.26
TDF-3TC-ATV/r	5	1.30
TDF-3TC-LPV/r	9	2.35
AZT-3TC-EFV	2	0.52

ABC-3TC-DTG	3	0.78
TDF-3TC-EFV	13	3.39
AZT-3TC-NVP	46	12.01
TDF-3TC-DTG	301	78.6

However, in 2018 ART medications were changed for all patients due to the following reasons: Resistance of the virus to the medications previously administered.; inability of the therapy to decrease patients' viral load; observed side effects (for example cough induced by the AZT-3TC-NVP combination) which in turn resulted to patients non-adherence.

The effectiveness of the first line regimen, (TDF-3TC-DTG) for adolescents and adult according to treatment guideline has been observed to yield a significant and impressive CD4 count and also suppress the viral load in patients, as well as improve patients' quality of life.[15] Also ABC-3TC-DTG was effective before it was withdrawn from some patients due to some adverse effects, it was observed that AZT-3TC-NVP has the ability to increase CD4 count but cannot effectively suppress the viral load compared to TDF-3TC-DTG and ABC-3TC-DTG. Factors that may have impacted on the data from the patients include adherence to therapy and also living a healthy lifestyle while taking all necessary precautions.

Table 4: shows average CD4 count of the study from 2013-2022.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
CD4 count	809.94	787.49	787.77	786	796.07	825.76	857.49	873.23	885.39	887.56

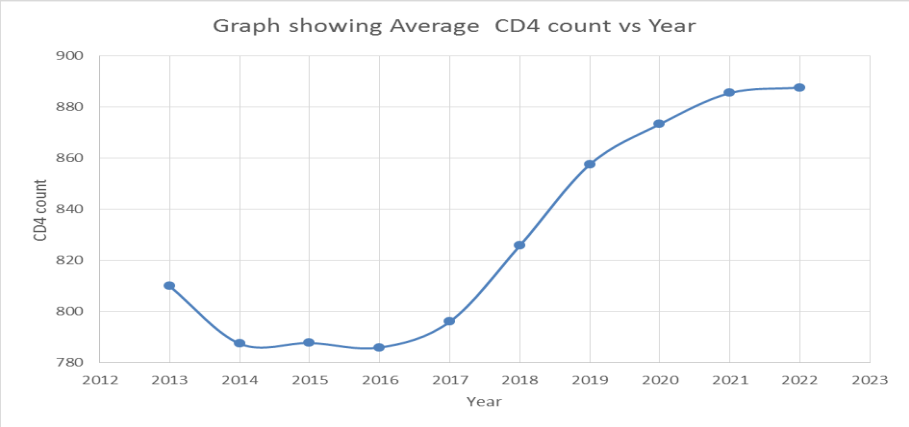

Fig 1: Graph showing average CD4 count of the study population over the study period of 2013 – 2022.

The result showed a steady continuous increase in patients' CD4 count as the year progress

Table 5: showing average viral load (copies/ml) of the studied population from 2013-2022.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Viral load (copies/ml)	216	218.46	212.82	164.78	158.44	155.33	147.44	153.22	216	218.46

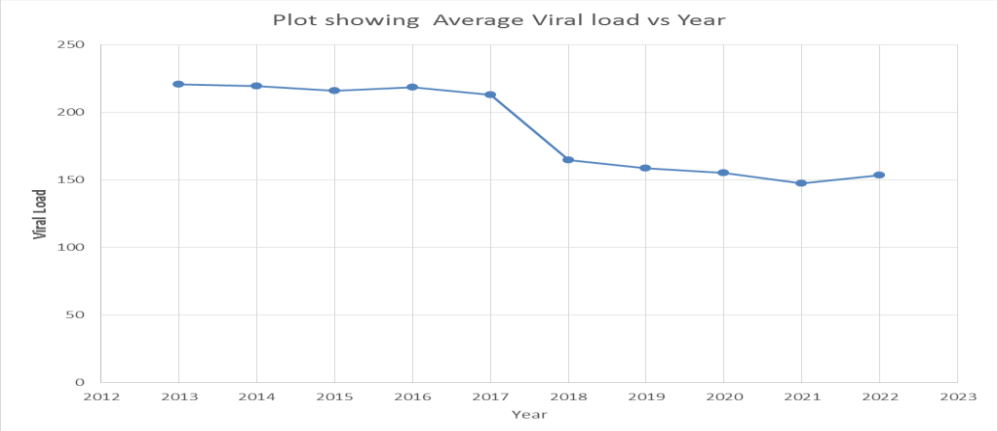

Fig. 2: Plot showing Average Viral load (copies/ml) of the study group over the period of 2013 – 2022.

Also with increase in years there was a gradual reduction in the patients' viral load, as shown in Fig 2.

Table 6: showing average CD4 count per year (2013-2017) in relation to ART regimen.

	CD4 2013	CD4 2014	CD4 2015	CD4 2016	CD4 2017
TDF-FTC-NVP	431	477	523	N/A	556
TDF-FTC-EFV	659	640	642	651	659
TDF-3TC-NVP	479.75	404.5	402.75	408	429
TDF-3TC-LPV/r	184.25	187.5	170	198.25	212.75
TDF-3TC-DTG	345	405	397	393	398
D4T-3TC-NVP	678	702	689	523	645
AZT-3TC-EFV	619.33	622	605.67	571.33	496.69
AZT-TDF-NVP	455.17	473.83	488.33	465.17	474.83
TDF-3TC-EFV	592.64	576.38	592.56	559.68	580.31
ABC-3TC-NVP	632.33	531.33	541.67	488.67	494.33
AZT-3TC-NVP	836.41	822.19	821.55	821.89	832.38

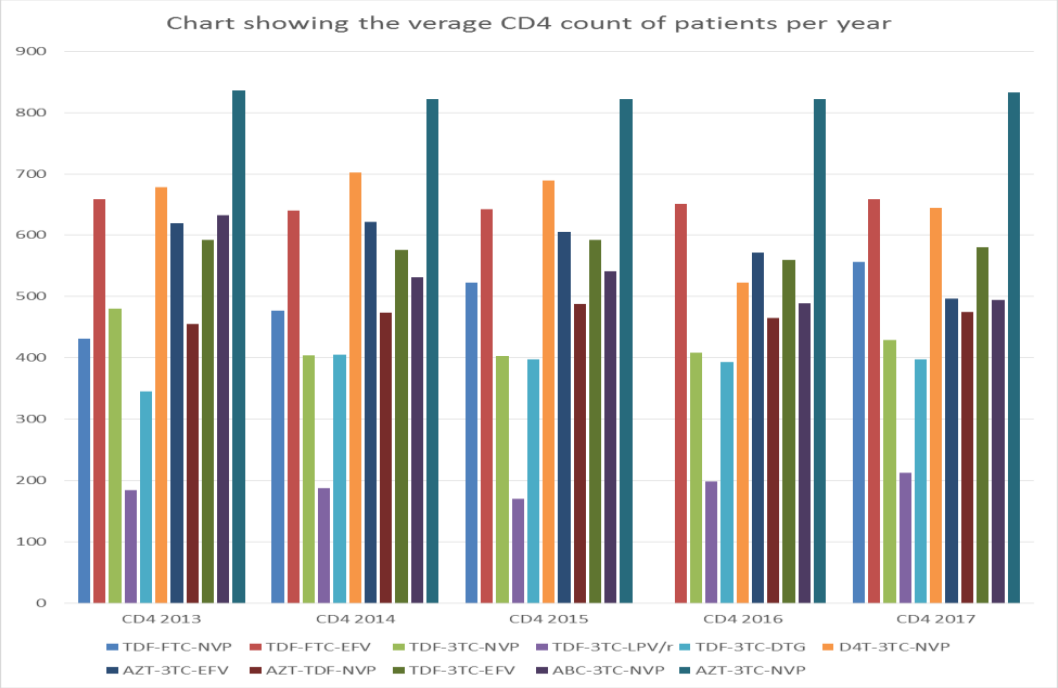

Fig. 3: Plot of average CD4 count of the studied group over the years (2013 - 2017) on various combination of HAART.

Table 7: showing average CD4 count per year (2018-2022) in relation to ART regimen administered.

ARV COMBINATION	CD4 2018	CD4 2019	CD4 2020	CD4 2021	CD4 2022
TDF-3TC-NVP	563	723	769	801	878
D4T-3TC-EFV	583	694	739	534	643
TDF-FTC-DTG	85	62	54	58	49
ABC-3TC-ATV/r	243	243	243	243	343
TDF-3TC-LPV/r	510.6	539.2	527.2	533.6	580.6
AZT-3TC-EFV	447	449	441	441	458.5
ABC-3TC-DTG	541	628.5	510.5	533.5	437
TDF-3TC-EFV	454.31	489.08	509.33	527.33	558.08
AZT-3TC-NVP	516.19	534.08	548	560	547.09
TDF-3TC-DTG	906.75	940.69	957.34	971.09	983.64

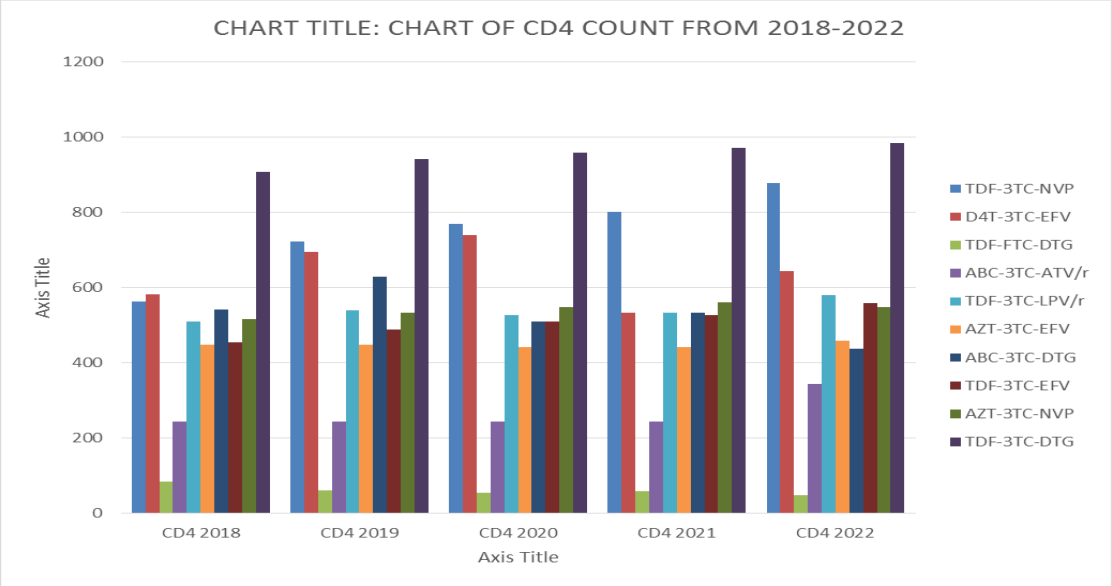

Fig 4: Plot of Average CD4 count over 2018 - 2022 in relation to HAART combination.

The result showed that the population on TDF-3TC-DTG combination showed the highest average CD4 count, followed by TDF -3TC- NVP combination, as shown in Fig 4.and TDF- FTC- DTC showed the least.

Table 8: showing average viral load (copies/ml) of study population on various HAART combination over 2013 – 2017.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
TDF-FTC-NVP	61	72	54	59	55	_	_	_	_	_
TDF-FTC-EFV	76	63	55	60	69	_	_	_	_	_
TDF-3TC-NVP	124	106	97	90	94	68	50	64	52	58
TDF-3TC-LPV/r	48	58	53	48	42	30	39	33	37	39
TDF-3TC-DTG	45	33	31	20	24	53	41	22	28	20
D4T-3TC-NVP	81	76	80	74	70	_	_	_	_	_
AZT-3TC-EFV	931	951	949	1001	948	972	933	941	895	975
AZT-TDF-NVP	802	802	802	802	802	_	_	_	_	_
TDF-3TC-EFV	67	63	59	64	66	69	65	68	60	67
ABC-3TC-NVP	73	79	77	72	70	_	_	_	_	_
AZT-3TC-NVP	120	109	119	113	94	104	106	115	121	105
D4T-3TC-EFV	_	_	_	_	_	54	49	37	33	20
ABC-3TC-ATV/r	_	_	_	_	_	74	79	70	68	66
TDF-FTC-DTG	_	_	_	_	_	59	64	48	33	29
ABC-3TC-DTG	_	_	_	_	_	62	44	45	31	20

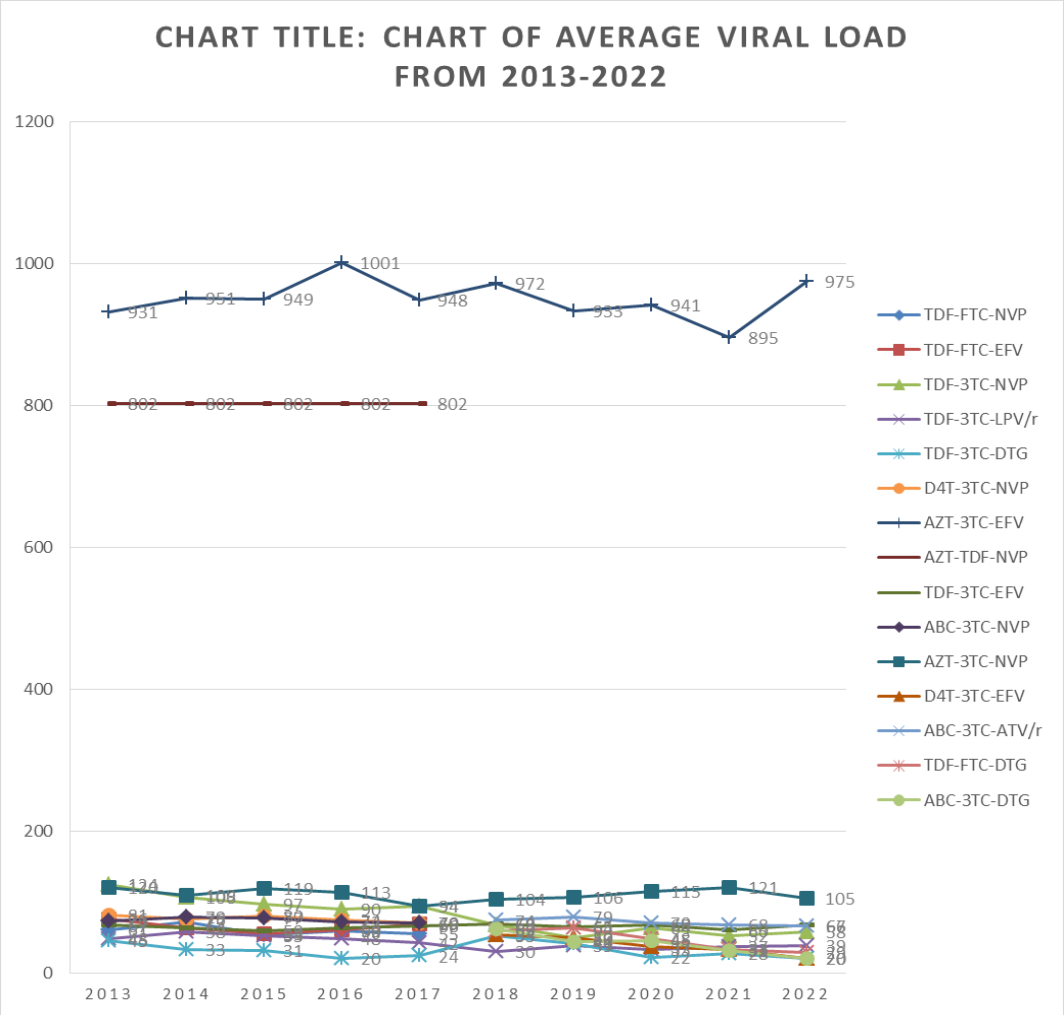

Fig 5: Plot of Average viral load (copies/ml) of study group over period of 2013 – 2017.

DISCUSSION

For adequate management of HIV, anti-retroviral drug combinations have been employed over the years. This is to ensure an increase in the patients CD4 count, suppress viral load, inhibit the ability of the virus to make copies of itself and also reduce the damage caused by the virus to the immune system. In this study, 258 (67.4%) were female while majority of patients whose data was collected are over 40 years of age (41.3%) followed by 26-40years (33.3%) then 18-25years (25.1%) which is somewhat similar to the study carried out in Mombasa, Kenya among HIV-1 infected patients[12] and very different from a study carried out in a United States-based Multicenter[13] with the possible reasons being the socio-econoomic status of the population, the study population, study design and other factors. It was observed that most (89.3%) of the study population were on AZT-3TC-NVP combination ART between 2013-2017. An average CD4 count of 836.41, 822.19, 821.55, 821.89, 832.38 in the year 2013, 2014, 2015, 2016 and 2017 respectively. Also, a viral load suppression of 120, 109, 119,113 and 94 copies/ml were recorded within the years respectively. However, between 2018-2022 a reduced number, percentage of 12.01% were on the ART combination (AZT-3TC-NVP). This was due to the side effects observed in patients, inability of the medication to successfully suppress the viral load as seen in Table 3b probably due to non-adherence of patients to medication which in turn resulted to resistance of the virus to the medication. A total of 0.26% of the study population was on the TDF-FTC-NVP combination. This percentage gave a viral load of 61, 72, 54, 59 and 55 copies/ml, in the years 2013, 2014, 2015, 2016, and 2017 respectively and also an average CD4 count of 431; 477; and 523 in the years 2013, 2014 and 2015 respectively with no result for 2016 and a CD4 count of 556 for 2017. However, this combination was discontinued due to the adverse reactions recorded and hypersensitivity of patients to the medication. An average CD4 count of 659, 640, 642, 651 and 659 were recorded for the the patients using the TDF-FTC-EFV combination in the years 2013, 2014, 2015, 2016 and 2017 respectively alongside a CD4 count of 76, 63, 55, 60, 69 respectively among 0.26% of the sample population. This combination was also discontinued as adverse effects were recorded.

A percentage of 0.26 were placed on the D4T-3TC-NVP combination. This gave a result of 678, 702, 689, 523, 645 as the CD4 count as at 2013, 2014, 2015, 2016 and

2017 respectively and a viral load of 81, 76, 80, 74, and 70 respectively. This combination was also discontinued in 2018 as adverse effects it cause led to patients non adherence.[16]

A percentage of 1.57% of the population size were placed on the AZT-TDF-NVP combination. However, a suppression in the viral load of the patient was not observed as a value of 802 was maintained from 2013 till 2017 but a CD4 count of 455.17, 473.83, 488.33, 465.17 and 474.83 were recorded for the said year. This combination was discontinued in 2018 due to its adverse effects and inability to suppress the viral load. Between the years 2013-2017 an average viral load of 73, 79, 77, 72, 70 alongside an average CD4 count of 632.33, 531.33, 541.67, 488.67 and 494.33 were recorded for 0.78% of patients who were on the ABC-3TC-NVP combination. This combination was stopped and withdrawn from the pharmacy in 2018 because of adverse effect.

Meanwhile, between the years 2013-2017 an average CD4 count of 479.75, 404.5, 402.75, 408 and 429 were recorded alongside a viral load (copies/ml) of 124, 106, 97, 90 and 94 respectively among 1.04% of the population size on TDF-3TC-NVP. However, in 2018 this proportion dropped to 0.26% as reports of adverse effects poised by the combination were brought into light. The average CD4 count recorded between the years 2018-2022 include 563, 723, 769, 801 and 878 alongside a viral load of 68, 50, 64, 52 and 58 respectively.

A percentage of 1.04% of the population size were placed on the TDF-3TC-LPV/r combination between 2013 to 2017.[16] This gave a CD4 count of 184.25, 187.5, 170, 198.25 and 212.75 alongside a viral load of 48,58, 53, 48, and 42 respectively in each of the years. This population was increased to 2.35% between 2018 to 2022 and a CD4 count of 510.6, 539.2, 527.2, 533.6 and 580.6 alongside a viral load of 30, 39, 33, 37 and 39 respectively.

In 2013-2017 a 0.26 percentage of the population were on TDF-3TC-DTG combination. A CD4 count of 345, 405, 397, 393 and 398 alongside a viral load of 45, 33, 31, 20 and 24 respectively in those years. However, in 2018 this percentage was increased to 78.6% due to ability of patients to tolerate the combination, ability of the medication to increase CD4 count and also suppress viral load. An average CD4 count 906.75, 940.69, 957.34, 971.09 and 983.64 alongside a viral load of 53, 41, 22, 28 and 20 for the years 2018, 2019, 2020, 2021 and 2022 respectively.

From 2013-2017, a percentage of 0.78% were placed on AZT-3TC-EFV combination.[16] A CD4 count of 619.33, 622, 605.67, 571.33 and 496.61 were recorded alongside an average viral load of 931, 951, 949, 1001 and 948 respectively between the years. However, from 2018-2022 the percentage population on this medication was reduced to 0.52% which then gave a CD4 count of 447, 449, 441, 441, 458 along side a viral load of 972, 933, 941, 895 and 975 respectively in those years. This medication was tolerated with minimal side effects hence the reason for its continual use.[17]

A 4.44% of the population size were placed on TDF-3TC-EFV from 2013-2017. From this population, a CD4 count of 592.64, 576.38, 592.56, 559.68 and 580.31 were recorded with a viral load of 67, 63, 59, 64 and 66 respectively in those years. However, the population was reduced to 3.39% of the population size in 2018 and a corresponding average CD4 count of 454.31, 489.08, 509.33, 527.33 and 558.08 along side a viral load of 69,65,68, 60 and 67 were recorded in 2013, 2014, 2015, 2016 and 2017 respectively.

The D4T-3TC-EFV combination was incorporated into the combinations used in the management of HIV in 2018. A 0.26% of the population size was placed on this medication and viral load of 54, 49, 37, 33 and 20 were recorded with a CD4 count of 583, 694, 739, 534 and 643 in the years 2018, 2019, 2020, 2021 and 2022 respectively.

The ABC-3TC-ATV/r combination, TDF-FTC-DTG combination and ABC-3TC-DTG combination were also incorporated into the list of ARV drugs in 2018.[16,18] A 0.26% of population were on ABC-3TC-ATV/r and TDF-FTC-DTG each and ABC-3TC-ATV/r gave a viral load of 74, 79, 70, 68 and 66 with a CD4 count of 243, 243, 243, 243 and 343 for the respective years of 2018, 2019, 2020, 2021 and 2022 while TDF-FTC-DTG recorded a CD4 count of 85, 62, 54, 58, 49 alongside a viral load of 59, 64, 48, 33, 29 respectively.

On the other hand, a 0.78% of patients were placed on ABC-3TC-DTG combination. The average CD4 obtained for each year between 2018-2022 are 541, 628.5, 510.5, 533.5 and 437 alongside a viral load of 62, 44, 45, 31 and 20 respectively for each year. Over the past ten years, it can be said that there's being an improvement in the management of HIV using Antiretroviral medications as they've greatly increase the CD4 count and reduce the viral load in HIV infected. Also, ART medication has greatly reduced HIV transmission in sero-discordant couples and people of high risk for example sex workers and also ensure resistance to diseases and infections among HIV patients.[19,20]

From 2013 till 2017 AZT-3TC-NVP combination was the most preferred drug according to the treatment guideline as it was administered for the management of HIV in most of the patients however, from the data collected it can be observed that though it increased CD4 count it did not reduce the viral load in the patients. Also, due to side effects complained by patients and resistance to the combination the AZT-3TC-NVP combination was withdrawn from being the first line treatment for the

management of HIV.[21] In 2018 TDF-3TC-DTG was adopted as the new first line combination for management of HIV among infected patients as it was observed that, it does not only increase the CD4 count but also reduce viral load among HIV infected patients with little side effects. Currently, majority of HIV patients on ART medications in UPTH are on the TDF-3TC-DTG combination and it has proven to be more effective than the AZT-3TC-NVP combination in reducing viral load as seen in the result presented in previous data from 2013 till 2022. This switch was done in 2018 when it was observed that the first line medication was not effective in the reduction of the viral load among majority of patients on the medication either due to resistance of the virus to the medication or due to the combination mechanism of action. Other reasons for switching the medication in 2018 include: patients' non-adherence to therapy due to side effects recorded while using the medications; deteriorating patients' health due to an underlying disease condition or opportunistic infection. Use of other drugs for other disease conditions which may cause drug-drug interactions when combined with some ART medications.

CONCLUSION

The effectiveness of HAART regimen in the management of HIV has been proven in this retrospective study, as an increase in the CD4 count and a reduction of the viral load were observed over the ten - year studied. Also, there were limited switch to more tolerated regimen administered according to treatment guideline in the management of HIV in infected patients, which assured patients' better adherence and overall health.

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