Impact of Differentiated Service Delivery Models on Retention and Viral Load Suppression among Art Clients in Communities in Eastern Uganda

Jemba Brian
Busitema University
Sinani Waiswa
Busitema University
Joseph Balinaine
Busitema University
Rosaria Lomuria
Busitema University
Gift Gloria Nabutanyi
Busitema University
Emmanuel Ongala
Busitema University
Benjamin Opus
Busitema University
Jacob Stanley Iramiot (jiramiot@gmail.com)
Busitema University
Paul Oboth
Busitema University
Mary Anwola Olwedo
Soroti University
Rebecca Nekaka
Busitema University

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Abstract

Background

; Although Uganda rolled out Differentiated Service Delivery models in 2017 to improve retention and achieve viral load suppression, these have remained low relative to UNAIDs targets of 95-95-95 by 2030. We determined the impact of facility and community DSD Models on viral load suppression and retention among ART clients in Katakwi district in North Eastern Uganda.

Methods;

A retrospective cohort study of all ART clients in the different approaches of DSD models who were active by 2017, were followed up to 2020. The primary outcomes were retention and viral load suppression of ART clients in different approaches. Eight health facilities providing ART services were purposively sampled and 771 ART clients were sampled out by simple random sampling out of 4742 total population on ART in Katakwi district. We analysed retention, viral load suppression, and their determinants by logistic regression method using STATA.

Results;

A total of 771 participants were sampled of whom 42.7% were male and 57.3% were females, with the mean age being 40 years. While retention rates at 95% CI of participants were 99.35% at 12 months, 94.03 at 24 months, 89.88% at 36months, and 84.57% at 48months. The viral load suppression rates were57.3% at 12 months, 70.3% at 24 months, 70.3% at 36 months, and 69% at 48 months. Retention was higher in the community-based DSD model as compared with the facility-based model. Viral load suppression was higher in the community-based DSD models in which CDDP had the highest achievement (92%) followed by CCLAD (79%) compared to the facility-based DSD models in which FBIM performance (34.3%) was far below the set standard of 95%, followed by FBG (65%) with FTDR having relatively better performance (80.9%).Being 40–59 years, receiving care from the general hospital, being married, having good current adherence, being on the first line of the current regimen, and being a female as other predictors of viral load suppression whereas being 40–59 years of age, having good current adherence, being on the current first-line regimen, and having no comorbidities were predictors of good retention.

Conclusions;

Both facility and community-based DSD models have led to improved retention and viral load suppression however community-based models have shown to be more effective than facility-based models through mitigation of barriers to effective HIV/AIDS care of patients on ART. Viral load suppression remained low below the UNAIDs target of 95% by 2030 albeit it improved over time.

Background

At the end of 2019, Of the 38 million people of the world's population that was Living with the Human Immune Deficiency Virus (HIV), 690000 HIV-related deaths and US $ 262 billion of the global economy was needed for HIV response in 2020. 59.7% of the HIV-related deaths occurred in low and middle-income countries where Uganda lies (1). Approximately 1.5 million people in Uganda were living with HIV by 2019 with a financing gap of US $ 918 million estimated by the financial year 2019/2020 (2).

To end the HIV pandemic, The United Nations general assembly through Joint United Nations Program on Human Immune Deficiency Virus (HIV)/Acquired Immune Deficiency Syndrome (UNAIDS) committed to ending the HIV epidemic by 2030 through the famous 95-95-95 targets. The target was aimed at ensuring that 95% of all people living with HIV know their HIV status, of which 95% should receive sustained Anti-Retroviral Therapy (ART), and 95% of all people receiving ART have viral suppression 2030 (3).

The last 95% UNAIDS target of achieving 95% viral load suppression is one of the goals of ART with good retention as its strong predictor and crucial determinant of successful HIV treatment outcomes though infrequently evaluated (4).

Retention and hence viral load suppression could not be achieved with the pre-existing but rather new approaches based upon the idea that HIV delivery should be offered in different formats to suit or fit the varying needs of the clients (5)(6). And as a result, Many

countries adopted several approaches such as Standardised Paediatrics Expedited Encounters for Drugs (SPEEDI) in Tanzania (7),Community ART distribution points(CAD),Community ART Groups(CAGs) plus 3months refills in Lesotho, Democratic Republic of Congo, Zimbabwe, and Malawi.(8),(9),(10) and (5). Which all showed positive outcomes in terms of retention of ART clients and Viral load suppression.

Uganda joined other countries that subscribe to United Nations and adopted various Differentiated Service Delivery (DSD) models. Differentiated Service Delivery models to Human Immunodeficiency Virus (HIV) treatment and care refers to the strategic mix of approaches to address the specific requirements of the sub-groups of clients living with HIV. This is contrary to the previous approach of *one coat fits all* approach to ART delivery where every person was treated the same way. The objective of DSD is to address individual needs, inform targeted interventions with better outcomes among clients, improve coverage and quality of care(11). DSD models include: Facility Based Individual Management (FBIM) for clients needing extra attention e.g. newly initiating ART clients; Facility Based Group (FBG) for complex or stable clients in need of peer support e.g. adolescent groups; Fast Track Drug Refill (FTDR) involving pick up from dispensing points or pharmacy after going via the triage desk; Community Client Led ART Delivery (CCLADs) in which clients form groups whose members (3–6) rotate in drug pick-ups; Community Drug Distribution Points (CDDPs) which involves clients (groups of about 50) picking up drugs and receiving their clinical evaluation when due from a community outreach point(11).

Uganda's viral load suppression rate was estimated to be at 87% (12) and lower for Katakwi district about 85.7% in 2019 this could be due to low retention rates noticed at about 59% despite the efforts by the Ministry of Health through different approaches, which limits Uganda from achieving the 95% viral load suppression of ART clients. The purpose of this study was to evaluate the impact of facility and community DSD models on the retention and Viral load suppression among ART clients in Eastern Uganda.

Methods And Materials

Study Design

The study design used was a retrospective descriptive cohort study.

Study Area

The study was conducted in Katakwi District which is located in the North-Eastern region of Uganda, lying between longitudes 33° 48' E - 34° 18' E and latitudes 1° 38' N – 2° 20' N.

It shares borders with the Districts of Napak in the North, Nakapiripirit in the East, Amuria in the West & North-West, and Soroti in the South –West, Kumi, and Ngora in the South.

The District Headquarters is situated in Katakwi Town Council, a road distance of about 380 km from Kampala, the National capital city by the most direct route and lies approximately between 1,050 –1,130 m above sea level. The district has a total area of 2,507 sq. km., land areas is 2,177 sq.km, and open water area and swamps is 177 sq. km. Land under cultivation is 720 sq. km, land under forest is 98.2 sq. km. and others are 53.5 sq. km. The district landscape is generally a plateau with a gently undulating plain with hills and inselbergs.

Health Services

Katakwi District Health system/department is comprised of one District Hospital and one health sub-District –Usuk Health Sub-District. It is manned and coordinated by the District Health Office headed by the District Health Officer. The department is mandated with the delivery of medical and health services which include: managing and functionalizing all health centers, providing maternity and child healthcare services, vector control, controlling communicable diseases especially malaria, HIV/AIDS, TB, and Leprosy, controlling other diseases and provide ambulatory services, promote environmental sanitation, promote health education, monitor quality of water supplies, supervise and monitor the private sector services.

Currently, the District has one (1) general hospital, one (1) health center four (IV), Seven (7) health centers III, and Twelve (12) health centers II. 8 health facilities are accredited to offer ART services of which 8 of them are implementing Differentiated service, delivery models. One hospital is Katakwi General Hospital, one health center IV which is Toroma HC IV, 4 health center III which include; Kapujan HCIII, Magoro HCIII, Aketa HCIII, Ngariam HCIII, and 2 Private not for profit(PNFP) which include; St Ann Usuk HCIII and St Kevin Toroma HCIII. The Uganda health system is organized hierarchically according to the population they serve. The National

Referral Hospital serves a population of 30,000,000, The Regional Referral Hospital-2,000,000, General Hospital-500,000, Health center IV-70,000, Health Center III-20,000, Health Center II-5,000, and Health Center I(Village Health Team)-1000 people (Amelia et al, 2017).

Study Population

The study population comprised of all ART clients diagnosed with HIV/AIDS and started on ART by the year 2017 and enrolled under any of the differentiated service delivery approaches in Katakwi District. The Health facilities that are offering ART services and adopted the DSD model approach were purposively selected (Table 1).

Table 1: Distribution of the Sample Size among Selected Health Facilities in Katakwi District.

Health Facility	Ratio	Facility Sample	Number of Clients Active on ART by 2017
Katakwi General Hospital	0.47	464	2231
Ngariam HC III	0.10	97	295
Magoro HC III	0.12	117	547
Aketa HC III	0.09	87	421
Toroma HC IV	0.09	87	464
Usuk HC III	0.06	58	264
Kapujan HC III	0.05	48	237
St Kevin Toroma HC III	0.02	19	83
Total	**1**	**977**	4305

Ratio: Attained by dividing the cumulative number of ART clients in a particular facility by the total population (summation of cumulative number in all facilities).

Facility sample: Derived through the multiplication of the attained ratio by the sample size.

Sampling Method

The purposive sampling method was used in the selection of Health facilities offering DSD models were used. A simple random sampling method was applied to pick ART numbers using the ART register from a pool of ART numbers in all the cohorts of ART clients who were on ART by the year 2017.

Inclusion Criteria

Cards of all HIV-positive clients who were enrolled on ART in Katakwi district by the year 2017.This included children, adults, males, and females.

Exclusion Criteria

ART cards with incomplete data, ART cards of dead clients or transferred out and ART cards of clients enrolled on ART after the year 2017.

Data Collection Methods

Data collection was done by documentation review of ART cards, viral load results, ART registers, and quarterly reports of October-December 2021 and results entered into predetermined data abstraction tool.

Data Analysis

Raw data in our predetermined data abstraction tool was fed into excel sheets, analysed using the STATA software program in form of proportions of the numbers of the patients that have been retained and have a suppressed viral load and their determinants using logistic regression analysis.

Limitations

Incomplete documentation of information in primary data tools like ART registers and missing data for some periods in registers for example for a given week or month.

Results

Baseline Characteristics

The total number of participants was 771 of which 42.7% were male and 57.3% were female with the mean age being 40 years (Table 2). The majority (86%) of the participants had been on ART for less than 6 years and the rest were above 6 years. Based on the MUAC 92.2% were well-nourished, 1.4% had moderate acute malnutrition, whereas 6.4% had severe acute malnutrition (Table 4).

Retention rate

In this study, clients who were active by 2017 and maintained an active follow-up throughout the follow-up period of 48 months were considered as retained. Lost to follow up are those clients who missed their appointments by 90 days and thereafter. The cumulative outcomes were; lost to follow-up, 119(15.43%), and active follow-up was 651(84.57%) with a follow-up duration of 48 months. The corresponding retention rates at 95% CI of participants were 12 months (99.35%), 24 months (94.03%), 36 months (89.88%), and at 48months (84.57%). (Figures2 and 3)

Viral load

In this study, a virally suppressed client was defined as a person whose HIV viral load was < 1000 copies/µl of blood. The cumulative outcomes of viral load were; suppressed 532(69%), non-suppressed 53(6.87%), and those without results 186(24.12%). The corresponding viral load suppression rates at 95% CI of participants were 12 months (57.3%,11.9%,33.8% for suppressed, non-suppressed, and those without results respectively),24 months (70.3%, 8.6%, 21.1% for suppressed, non-suppressed and those without results respectively), 36months (70.3%, 8.3%, 20% for suppressed, non-suppressed and those without results respectively) and at 48months (69%, 6.87%, 24.12% for suppressed, non-suppressed and those without results respectively) (Figures 1 and 4)

Determinants of retention and viral load suppression.

Logistic regression analysis was performed to determine what extent has DSDM and other factors contributed to viral suppression and retention among ART clients in Katakwi district.

After adjustment in multivariate analysis, the significant determinants of retention were; age (OR 1.16, 95% CI: 0.89-1.52) current adherence (OR 0.69, 95% CI: 0.27:1.74) current regimen (OR 4.53, 95% CI: 1.07-19.05) DSD model (OR 0.87, 95% CI: 0.76-1.01) comorbidities (OR 0.89, 95% CI: 0.70-1.12) (Table 5).

Multivariate analysis showed that, the significant determinants for viral load suppression were; age (OR 1.12, 95% CI:0.90-1.39), facility level (OR 0.92, 95% CI:0.70-1.21), sex (OR 1.02, 95% CI:0.73-1.43), marital status (OR 0.98, 95% CI:0.82-1.17), current adherence (OR 0.36, 95% CI:0.17-0.77), current regimen (OR 2.19, 95% CI:0.99-4.83) and type of DSD model (OR 0.96, 95% CI:0.87-1.07) (Table 6).

Analysis of missing data

The missing data were treated and analysed as the rest of the data as shown in the tables 2, 3, and 4

TABLE 2: Demographic characteristics of study participants

Variable		Retention			Viral load suppression			
		Retained(n/%)	Lost (n/%)	(N/%)	Suppressed (n/%)	Non-suppressed (n/%)	Missing	(N/%)
Age	0-19	78(11.62)	5(5.0)	**83(10.77)**	53(9.96)	18(33.96)	12(6.45)	**83(10.77)**
	20-39	244(36.36)	57(57.0)	**301(39.04)**	189(35.53)	15(28.30)	97(52.15)	**301(39.04)**
	40-59	277(41.28)	27(27.0)	**304(39.43)**	226(42.48)	18(33.96)	60(32.260	**304(39.43)**
	60-above 79	72(10.73)	41.28(11.0)	**83(10.77)**	64(12.03)	2(3.77)	17(9.14)	**83(10.77)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**
Sex	male	295(43.96)	34(34)	**329(42.67)**	216(40.6)	35(66.04)	78(41.94)	**329(42.67)**
	female	376(56.04)	66(66)	**442(57.33)**	316(59.4)	18(33.960	108(58.06)	**442(57.33)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**
Marital status	single	136(20.270	17(17)	**153(19.84)**	96(18.05)	22(41.51)	35(18.82)	**153(19.84)**
	married	426(63.49)	59(59)	**485(62.99)**	346(65.04)	27(50.94)	112(60.22)	**485(62.91)**
	widow	28(4.17)	7(7)	**35(4.540**	26(4.89)	0(0)	9(4.54)	**35(4.54)**
	divorced	8(1.19)	2(2)	**10(1.3)**	7(1.37)	0(0)	3(1.61)	**10(1.3)**
	Missing results	73(10.88)	15(15)	**88(11.41)**	57(10.71)	4(7.55)	27(14.52)	**88(11.41)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**
facility level	HC III	276(41.13)	40(40)	**316(40.99)**	210(39.47)	32(60.38)	74(39.788)	**316(40.99)**
	HC IV	36(5.37)	11(11)	**47(6.10)**	30(5.64)	1(1.89)	16(8.6)	**47(6.1)**
	General Hospital	359(53.50)	49(49)	**408(52.92)**	292(54.89)	20(37.74)	96(51.61)	**408(52.92)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**

Retention was highest among clients of 20-59 years of age, females, married, and attending in a general hospital, whereas the percentage of viral load suppression was highest among 40-59 years of age, females, married and clients attending in General hospital.

TABLE 3; Baseline characteristics of the study participants

variable		Retention			Viral load suppression			
		Retained	Lost	(N/%)	Suppressed	Non - suppressed	missing	(N/%)
Initial CD4	1-200	100(14.90)	13(13)	**113(14.66)**	82(15.41)	8(15.09)	23(12.37)	**113(14.66)**
	201-400	139(21.02)	29(29)	**168(21.79)**	120(22.56)	6(11.32)	42(22.58)	**168(21.79)**
	401-600	95(14.16)	11(110)	**106(13.75)**	79(14.85)	8(15.09)	19(10.22)	**106(13.75)**
	601-800	62(9.24)	4(4)	**66(8.56)**	49(9.21)	2(3.77)	15(88.06)	**66(8.56)**
	Above 800	59(8.79)	11(11)	**70(9.08)**	48(9.02)	3(5.66)	19(10.22)	**70(9.08)**
	missing	216(32.19)	32(32)	**248(32.17)**	154(28.95)	26(49.06)	68(36.56)	**248(32.17)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**
Initial WHO stage	1	402(59.91)	56(56)	**458(59.40)**	323(60.71)	30(56.60)	105(56.45)	**458(59.40)**
	2	193(28.76)	31(31.0)	**224(29.05)**	148(27.82)	18(33.96)	58(31.18)	**224(29.05)**
	3	73(10.88)	11(11.0)	**84(10.89)**	58(10.90)	5(9.43)	21(11.29)	**84(10.89)**
	4	3(0.45)	2(2.0)	**5(0.65)**	3(0.56)	0(0)	2(1.08)	**5(0.65)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**
Initial regimen	first	658(98.31)	98(98.0)	**756(9.05)**	526(98.85)	48(90.57)	183(98.39)	**576(98.05)**
	second	12(1.79)	2(2)	**14(1.82)**	6(1.13)	5(9.43)	3(1.61)	**14(1.82)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**
Initial adherence	good	641(95.53)	92(92.0)	**733(955.07)**	513(96.43)	49(92.45)	171(91.94)	**733(98.07)**
	Fair	10(1.49)	1(1.0)	**11(1.43)**	7(1.32)	1(1.89)	3(1.61)	**11(1.43)**
	Poor	20(2.98)	7(7.0)	**27(3.5)**	12(2.26)	3(5.66)	12(6.45)	**27(3.5)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**

The retention and viral load suppression were highest amongst; Clients with initial CD4 201-400, Initial WHO clinical stage 1, good initial adherence, and clients on first-line regimen.

TABLE 4: Other clinical characteristics of the study participants.

variable		retention			Viral load suppression			
DSD models		Retained	Lost	**(N/%)**	Suppressed	Non suppressed	missing	**(N/%)**
	FTDR	306(45.60)	20(20)	**326(42.28)**	264(49.62)	10(18.87)	52(27.96)	**326(42.28)**
	FBG	69(10.28)	7(7)	**76(9.86)**	50(9.4)	15(28.30)	11(5.91)	**76(9.86)**
	FBIM	108(16.01)	64(64)	**172(22.31)**	59(11.09)	26(49.06)	87(46.77)	**172(22.31)**
	CCLAD	163(24.29)	9(9)	**172(22.31)**	136(25.56)	2(3.77)	34(18.28)	**172(22.31)**
	CDDP	25(3.73)	0(0)	**25(3.24)**	23(4.32)	0(0)	2(1.08)	**25(3.24)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**
Duration on ART (years)	0-5	524(78.09)	85(85.0)	**609(78.99)**	407(76.50)	44(83.02)	158(84.95)	**608(78.99)**
	6-10	134(19.97)	14(14)	**148(19.2)**	114(21.43)	8(15.09)	26(13.98)	**148(19.2)**
	11-15	11(1.64)	1(1)	**12(1.56)**	9(1.69)	1(1.89)	2(1.08)	**12(1.56)**
	16 and above	2(0.3)	0(0)	**2(0.26)**	2(0.38)	0(0)	0(0)	**2(0.26)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**
comorbidities	PTB	15(2.24)	4(4)	**19(2.46)**	10(1.88)	5(9.43)	4(2.15)	**19(246)**
	PJP	1(0.15)	0(0)	**1(0.13)**	1(0.19)	0(0)	0(0)	**1(0.13)**
	HTN & DM	1(0.15)	1(1)	**2(0.26)**	1(0.19)	0(0)	1(0.54)	**2(0.26)**
	malnutrition	1(0.15)	2(2)	**3(0.39)**	1(0.19)	0(0)	2(1.08)	**3(0.39)**
	Cry meningitis	1(0.15)	1(1)	**2(0.26)**	0(0)	0(0)	2(1.08)	**2(0.26)**
	fungal infection	3(0.45)	1(1)	**4(0.52)**	3(0.56)	0(0)	1(0.54)	**4(0.52)**
	other	21(3.13)	4(4)	**25(3.24)**	16(3.01)	1(1.89)	8(4.30)	**25(3.24)**
	none	628(93.59)	87(87)	**715(92.74)**	500(93.98)	47(88.68)	168(90.32)	**715(92.74)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**
Current regimen	first	619(92.25)	98(98)	**717(93.0)**	503(94.55)	36(67.92)	178(95.7)	**717(93.0)**
	second	52(7.75)	2(2)	**54(7.0)**	29(5.45)	17(32.08)	8(4.30)	**54(7.0)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**
Current adherence	good	646(96.27)	89(89)	**735(95.33)**	521(97.93)	48(90.57)	166(89.25)	**735(95.33)**
	fair	8(1.19)	4(4)	**12(1.56)**	5(0.94)	2(3.77)	5(2.69)	**12(1.56)**
	poor	17(2.53)	7(7)	**24(3.11)**	6(1.13)	3(5.66)	15(8.06)	**24(3.11)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**
WHO clinical stage	1	596(88.96)	85(85.86)	**681(88.56)**	487(91.71)	38(71.70)	156(84.32)	**681(88.56)**
	2	68(10.15)	12(12.12)	**80(10.40)**	40(7.53)	13(24.53)	27(14.59)	**80(1040)**
	3	6(0.90)	2(2.02)	**8(1.04)**	4(0.75)	2(3.77)	2(1.08)	**8(1.04)**
	Total	**671(87)**	**100(13)**	**771(100)**	**532(69)**	**53(6.87)**	**186(24.13)**	**771(100)**

The majority of the clients were in FTDR however performance in both retention and Viral Load suppression were highest in CDDP. Retention and viral load suppression were highest among the following groups; 0-5 years of age, first-line regimen, good adherence,

and stage 1 WHO staging and PTB was the commonest comorbidity.

TABLE 5: Determinants of retention to care

retention	Odds Ratio	P-value	[95% Conf. Interval]
age	1.163117	0.001	0.888887-1.521949
Current adherence	0.6868554	0.005	0.27021-1.74594
Current regimen	4.528328	0.036	1.076053-19.05645
Type of DSD model	0.875006	0.001	0.758093-1.00995
comorbidities	0.8875778	0.037	0.70142-1.123142

TABLE 6: D**eterminants of viral load suppression.**

Viral load suppression	Odds Ratio	P-value	[95% Conf. Interval]
Age	1.120251	0.001	0.903982-1.388262
Facility level	0.9221916	0.020	0.700178-1.214602
sex	1.022738	0.002	0.729055-1.434725
Marital status	0.9788787	0.007	0.817738-1.171773
Current adherence	0.3587538	0.001	0.166869-0.771289
Current regimen	2.189893	0.001	0.992561-4.831575
Type of DSD model	0.9656563	0.001	0.867439-1.074995

Retention of ART clients was highest in 2017 and reduced overtime was lowest in 2020

Clients in CDDP had the highest percentage of Viral Load suppression whereas FBIM had the lowest.

The percentage of clients having their Viral load suppressed increased over time being highest in 2019.

The percentage of clients with suppressed viral load was highest in CDDP and lowest in FBIM

Discussion

Several studies conducted in rural settings of low and middle-income countries provide estimates of retention and viral load suppression and their determinants; however, most of these studies have not elucidated the Impact differentiated service delivery approach has had on retention and viral load suppression in line with UNAIDS target of eradicating HIV epidemic by 2030.

In this study, we assessed the impact of differentiated service delivery models on retention and viral load suppression among HIV-positive clients attending ART clinics in the North-Eastern Uganda. We reviewed the ART data retrospectively of all clients that were active by 2017 and followed them through 2020.

Generally, retention reduced steadily over time from 99.4% in 2017, 94.3% in 2018, 90.1% in 2019 and 84.8% in 2020 (Fig. 1). Albeit the decreasing trend overtime was expected and similar to most studies done in low and middle-income countries, our results showed higher retention rates (Fig. 1). Similar studies in Jinja-Uganda in 2005–2009 showed retention after 48 months at 69%(13), in Tanzania being at 83.9%, 64%, 53.5% by 12,24 and 36 months respectively(14). In Malawi's option B-plus program study being at 76.8%,70.0%, and 69.7 at 12,24 and 36 months respectively(15), in another study on factors for attrition in Myanmar being at 86%, 82%, 80% and 77% at 12, 24, 36 and 48 months respectively(15). Other studies in Tigray-Ethiopia retention were 85.1% at 12 months and lastly in sub-Saharan Africa at 75% and 61.6 at 12 and 24 months respectively(16). The high retention in our study can be explained partly by the contribution of DSDM and the fact that most other studies were done before DSDM was rolled-out as seen in

one of the studies by Davison Kwarisima et al on Viral load and retention among adults and children using streamlined ART delivery in rural Uganda and Kenya where retention was at 92%(17).

Retention was highest among ART clients in the community-based DSD models with 100% retention in CDDP,94.7% in CCLAD compared to facility-based models in which FBIM performed the worst (61.6%) followed by FBG (90.7%) and FTDR (93.9%) (Fig. 2). This is in line with a similar study by Kagimu D et al in one study on overcoming barriers to access of HIV services among female sex workers in a CCLAD in TASO Entebbe where retention improved from 65–100% in one year and another similar study on streamlined ART(18). This can be explained by good adherence associated with community models due to reduced clinic visits, transport costs, and enhanced psychosocial support as shown by Anna Grimsrud et al in a study of the evidence for scale-up differentiated care research agenda(19), Yibbeltal Asseta et al in a study in Ethiopia who noted community-based care as one of retention promoting activities for clients on ART(20) and by L. Prust et al in 2016 in Malawi who had same observation(21). The high retention rates in FTDR than in the rest of the facility models could be explained by reduced waiting time as noted by Anna Grimsrud et al in evidence for scaling up of differentiated care study(19) and provision of thorough checks as noted by Vicente Adjetey et al in a study of people living with HIV accessing tertiary institutions in Ghana(6).

Other predictors of retention according to the multivariate analysis included; being 40–59 years of age (OR 1.16, 95% CI:0.89–1.52), having good current adherence (OR 0.69, 95% CI:0.27:1.74), being on current first-line regimen (OR 4.53,95% CI:1.07–19.05), and having no comorbidities (OR 0.89, 95% CI:0.70–1.12) albeit pulmonary tuberculosis (PTB) had the highest retention (2.24%) among the comorbidities (Table 3, Table 4). This is in line with a study on retention in Jinja-Uganda by Stephen Okoboi who highlighted female gender as a predictor of better retention(13) and being on TB treatment by Haas et al in Myanmar(15).

Viral load suppression in general improved over time from 57.3% in 2017, 70.3% in 2018, 71.3% in 2019 and 69% in 2020 (Fig. 3). This was partly due to the introduction of differentiated service delivery models which is tailors care to the best individual needs. This was contrary to one of the studies by Jonathan colosanti et al on continuous retention and viral load suppression in the HIV care continuum who noted 64%,48%, and 39% at 12, 24, and 36 months respectively(4) but similar to the result noted by Bijal Shah et al of 63% at 12 months(22). Our results, however, were very low compared to one of the studies that were done by Daltons Kwarisima et al of 93% at 12 months(23).

Viral load suppression was highest amongst the community-based DSD models in which CDDP performed the best (92%) followed CCLAD (79%) compared to the facility-based DSD models in which FBIM performed the worst (34.3%) with the majority of clients having no results, FBG (65%) with FTDR being exceptional (80.9%)(Fig. 4). This is in line with the study by Kagimu et al on overcoming barriers to access of HIV/AIDS services among female sex workers through DSD in CCLAD at TASO Entebbe-Uganda who noted an increase in viral load suppression from 80–100% in 12 months(18). This can be explained partly by the fact that ART patients in the Community based model easily access care at convenience with fewer clinic visits, spending less on transport costs, and good and adherence associated with enhanced psychosocial support as opposed to facility-based model reported L. Prust et al in a study of patients and health workers' experience of DSD model for stable patients in Malawi(21).

Other predictors of viral suppression from the multivariate analysis include; being 40–59 years (OR 1.12, 95% CI:0.90–1.39), receiving care from the general hospital (OR 0.92, 95% CI:0.70–1.21), being married (OR 0.98, 95% CI:0.82–1.17), having good current adherence (OR 0.36, 95% CI:0.17–0.77), being on first line of the current regimen (OR 2.19, 95% CI:0.99–4.83) and being a female (OR 1.02, 95% CI:0.73–1.43) (Table 6). It was also noted by Bijal Chah that first-line ART regimens and good adherence are some of the predictors of viral load suppression(22).

Conclusions

Both facility and community-based DSD models have led to improved retention and viral load suppression through mitigation of barriers to effective HIV/AIDS care of patients on ART albeit community-based DSD models have shown to be more effective than facility-based DSD. Viral load suppression remained low below the UNAIDs target of 90% by 2020 and 95% by 2030 albeit it improved over time.

Recommendations

More resources should be allocated to facilitate community-based models, especially CDDP which were found to have very few clients, and yet evidence shows that they achieve better retention and viral suppression.

The DSD committee should be activated to start a QI project to ensure that all clients due for viral load are done, followed up, and properly documented to reduce cases of no results. On top of this, the non-suppressing clients should be optimized to regimens by doing drug sensitivity testing for those not suppressing.

There is a need to bring the community-based organizations rendering psychosocial support to clients on board to improve compliance as this has been shown to yield good results.

Generalizability

Our findings can be generalized to similar settings in Uganda and other developing countries where these models have been rolled out.

Abbreviations

UNAIDS: United Nations Program on HIV/AIDS; DSD; Differentiated Service Delivery; ART: Anti-Retroviral Therapy; CDDP: Community Drug Distribution Points; CCLAD: Community Client Led ART Delivery; FBIM: Facility Based Individualised Management; FBG: Facility Based Groups; FTDR: Fast track drug refills; HIV: Human Immunodeficiency Virus; AIDS: Acquired Immune Deficiency Syndrome; US: United States; SPEEDI: Standardized Paediatrics Expedited Encounters for drugs; CAD: Community ART Distribution; TB: Tuberculosis; HC: Health Centre; WHO: World Health Organization; MUAC: Mid Upper Arm Circumference; CD4: Cluster of Differentiation 4; CI: Confidence interval; OR; Odds Ratio; PTB: Pulmonary Tuberculosis; TASO: The AIDS Support Organisation; QI: Quality Improvement; MRRHREC: Mbale Regional Referral Research and Ethics Committee.

Declarations

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Availability of data and materials

All data on which the conclusions of this manuscript are drawn is available on request from the corresponding author.

Author Contributions

This work was carried out in collaboration among all authors. Authors JB, SW, JB, RL, and GGN conceived, designed the study, participated in data collection, analysis, and manuscript writing. Author BO was the site preceptor during the research period where he supervised the data collection and analysis. Authors MA and JSI performed the statistical analysis, wrote the protocol and managed the literature searches wrote the first draft of the manuscript, managed the analyses of the study. Author RN was a research mentor and supervisor who participated in the study conception, design, preparation for approval, and proofreading of the final results and manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The research protocol was approved by the Mbale Regional Referral Research and Ethics Committee for approval (MRRHREC) that also granted a waiver of consent since there was no direct involvement with the clients. Permission to undertake the study was obtained from the Chief Administrative Officer (CAO), the District Health Officer (DHO), the Medical Superintendent, and all the health facility In-charges where the study was done.

Participants' data were being handled in a room only accessed by authorized personnel and ART number numbers instead of clients' names or clients' initials to ensure confidentiality. All methods were carried out in accordance with the relevant guidelines and regulations.

Consent for publication

Not applicable

Competing interest

The authors declare that they have no conflict of interest

Author's details

[1]Department of Community and Public Health, Faculty of Health Sciences, Busitema University

[2]Katakwi District Local Government

[3]Department of Paediatrics and Child Health, Soroti University

[4]Department of Microbiology and Immunology, Faculty of Health Sciences, Busitema University

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Figures

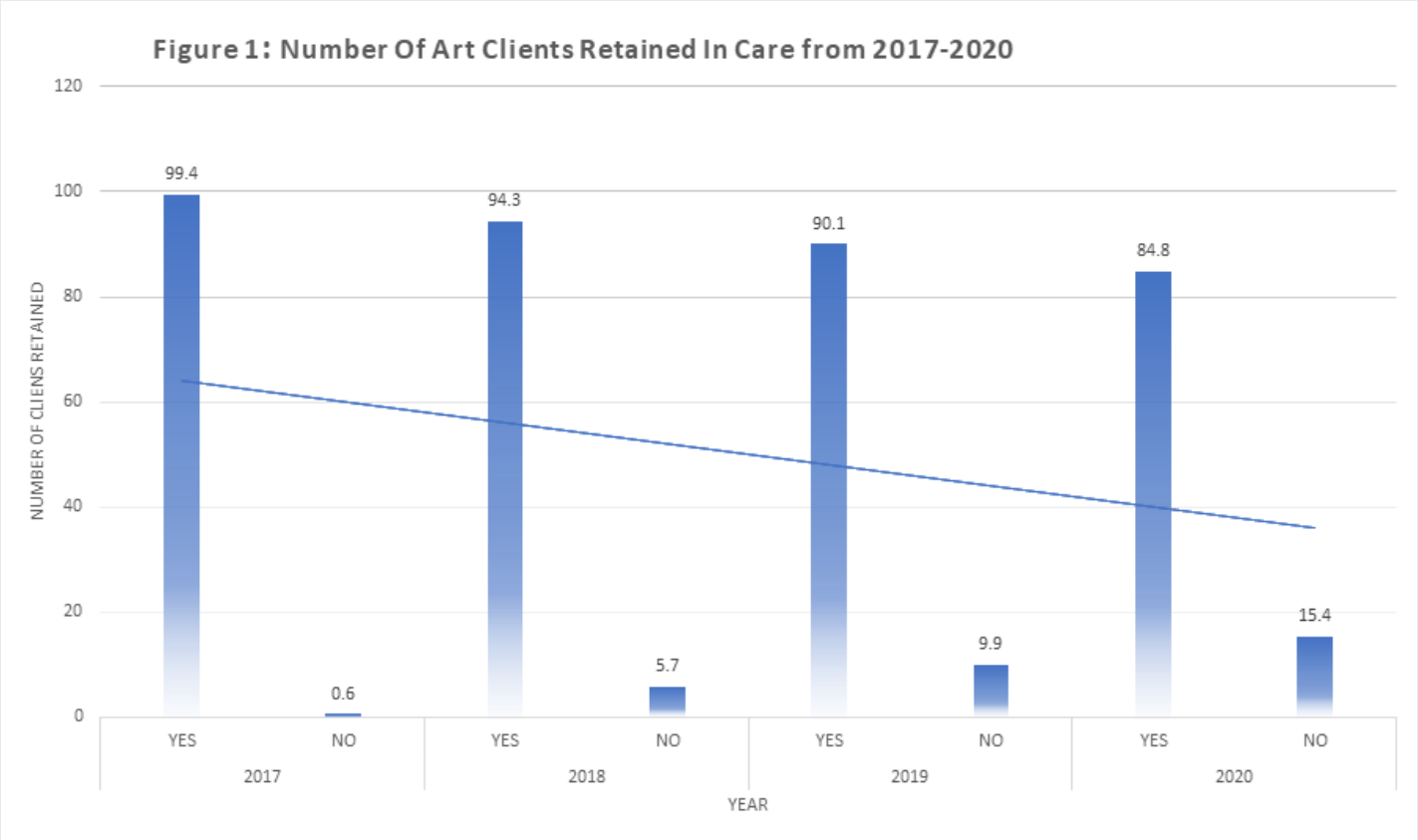

Figure 1

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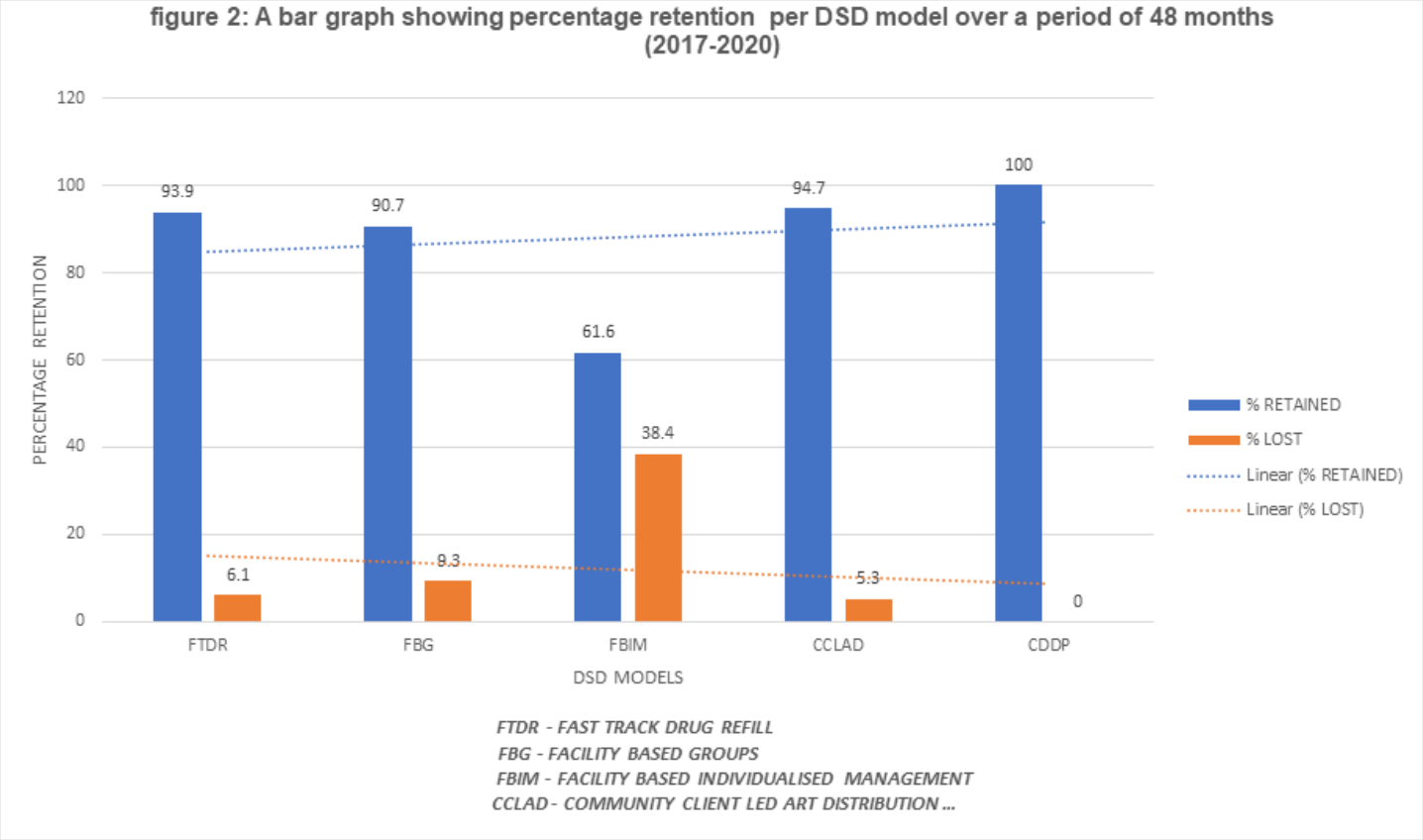

Figure 2

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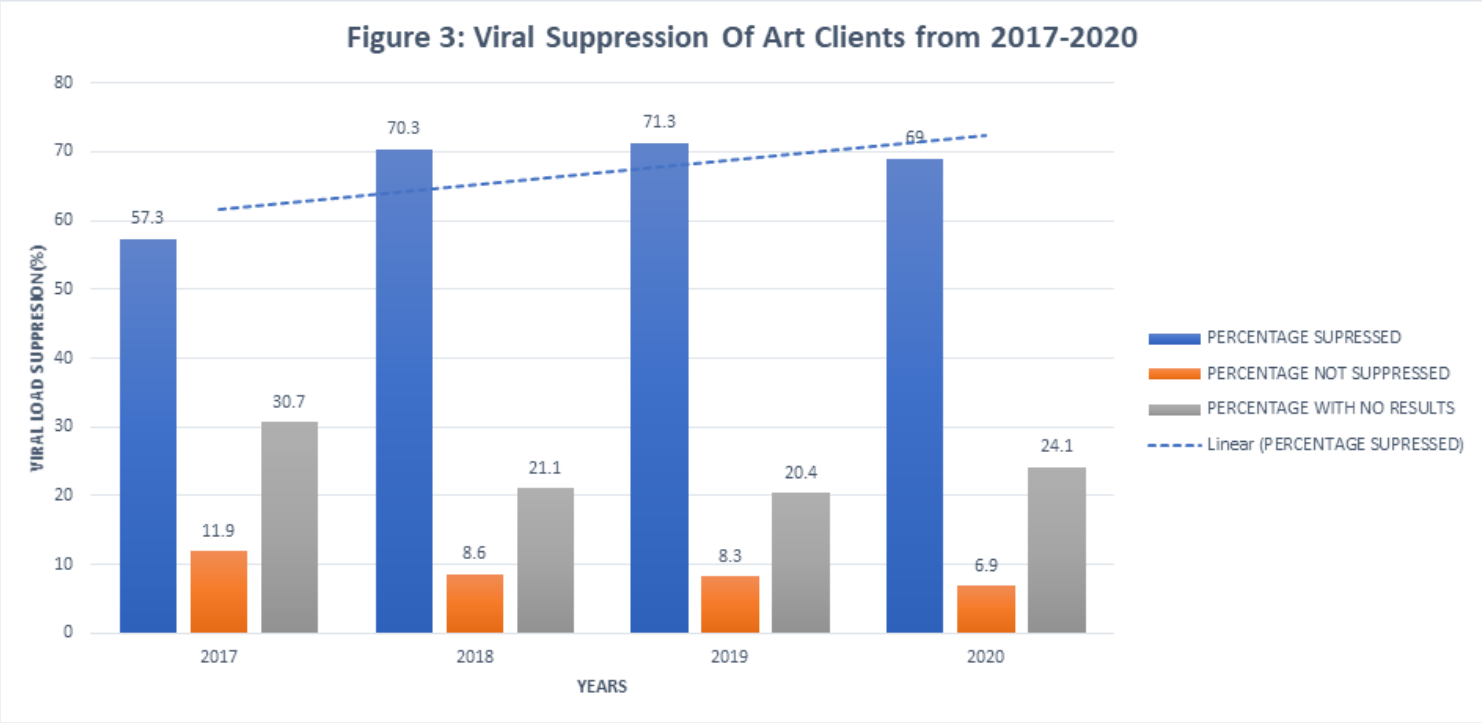

Figure 3

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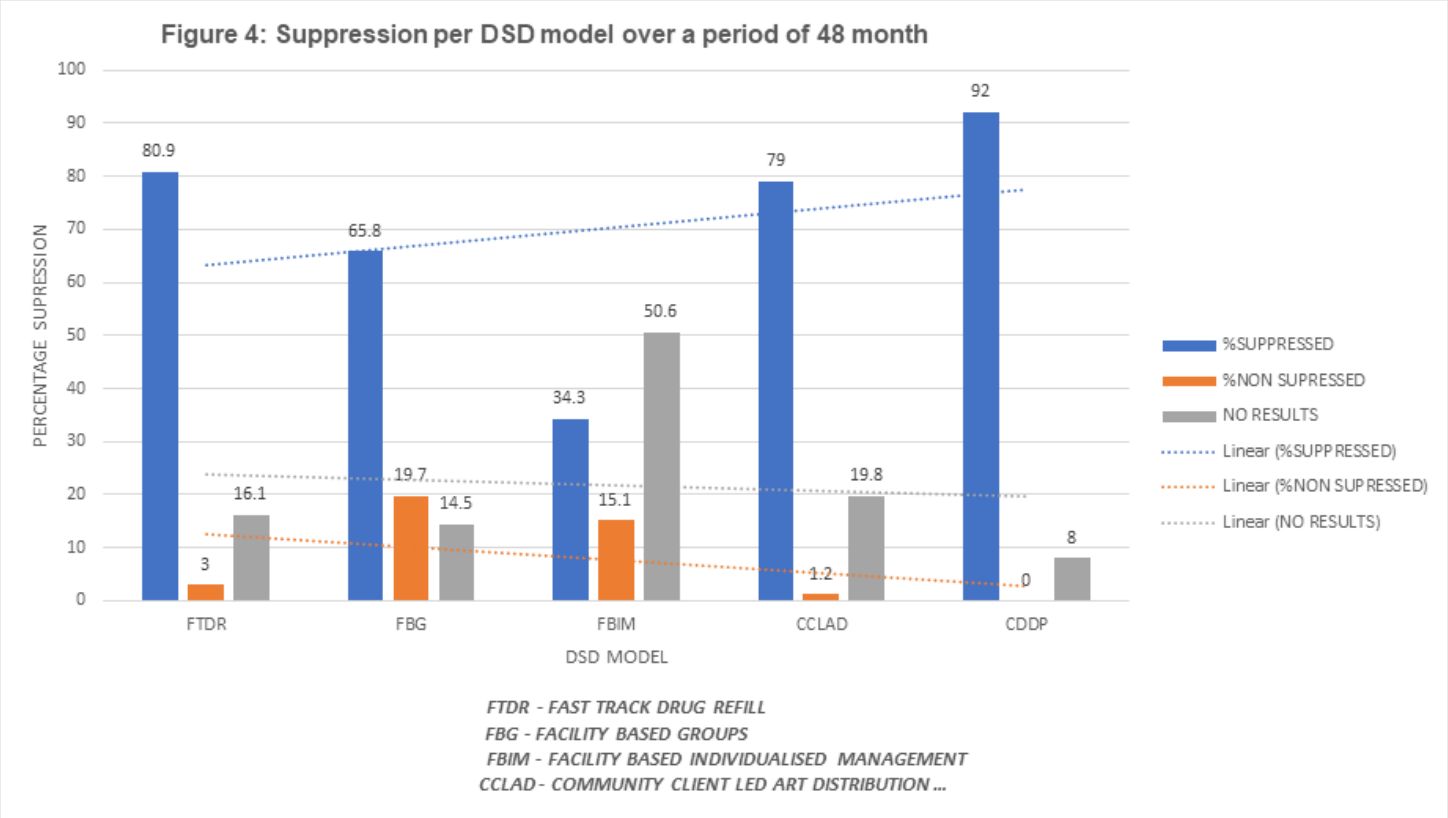

Figure 4

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