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Factors associated with enrollment into differentiated service delivery model among adults with HIV in Kenya

Marie-Claude C. Lavoie[a,b,c], **Emily Koech**[d], **Natalia Blanco**[b,c], **Rebecca Wangusi**[d], **Marline Jumbe**[d], **Francis Kimonye**[d], **Angela Ndaga**[d], **Geofrey Ndichu**[d], **Violet Makokha**[d], **Patrick Awuor**[d], **Emmah Momanyi**[d], **Roseline Oyuga**[d], **Sarah Nzyoka**[d], **Immaculate Mutisya**[e], **Rachel Joseph**[e], **Fredrick Miruka**[e], **Paul Musingila**[e], **Kristen A. Stafford**[a,b,c], **Taylor Lascko**[b,c], **Carol Ngunu**[f], **Elizabeth Owino**[g], **Anthony Kiplangat**[f], **Abuya Kepha**[h], **Caroline Ng'eno**[d]

[a]Division of Global Health Sciences, Department of Epidemiology and Public Health

[b]Institute of Human Virology

[c]Center for International Health, Education, and Biosecurity, University of Maryland School of Medicine, Baltimore, Maryland, USA

[d]Center for International Health, Education, and Biosecurity, MGIC-an affiliate of the University of Maryland Baltimore, Nairobi

[e]Division of Global HIV & TB (DGHT), U.S. Centers for Disease Control and Prevention (CDC), Kisumu

[f]Nairobi Metropolitan Services Health Management Team, Nairobi

[g]Migori County Health Management Team

[h]Kisii County Health Management Team, Western, Kenya.

Abstract

Introduction: Differentiated service delivery (DSD) such as multimonth dispensing (MMD) aims to provide client-centered HIV services, while reducing the workload within health facilities. We assessed individual and facility factors associated with receiving more than three MMD and switching from ≥3MMD back to <3MMD in Kenya.

Methods: We conducted a retrospective cohort study of clients eligible for DSD between July 2017 and December 2019. A random sample of clients eligible for DSD was selected from 32 randomly selected facilities located in Nairobi, Kisii, and Migori counties. We used a multilevel Poisson regression model to assess the factors associated with receiving ≥3MMD, and with switching from ≥3MMD back to <3MMD.

Results: A total of 3501 clients eligible for ≥3MMD were included in our analysis: 1808 (51.6%) were receiving care in Nairobi County and the remaining 1693 (48.4%) in Kisii and

Correspondence to Marie-Claude C. Lavoie, Division of Global Health Sciences, Department of Epidemiology and Public Health, University of Maryland School of Medicine, 725W Lombard Street, Baltimore, MD 21201, USA. mlavoie@ihv.umaryland.edu.

Conflicts of interest
There are no conflicts of interest.

Migori counties. Overall, 65% of clients were enrolled in ≥3MMD at the time of entry into the cohort. In the multivariable model, younger age (20–24; 25–29; 30–34 vs. 50 or more years) and switching ART regimen was significantly associated with a lower likelihood of ≥3MMD uptake. Factors associated with a higher likelihood of enrollment in ≥3MMD included receiving DTG vs. EFV-based ART regimen (aRR: 1.10; 95% confidence interval: 1.05–1.15).

Conclusion: Client-level characteristics are associated with being on ≥3MMD and the likelihood of switching from ≥3MMD to <3MMD. Monitoring DSD enrollment across different populations is critical to successfully implementing these models continually.

Keywords

differentiated service delivery model; HIV; Kenya; multimonth prescription

Introduction

The differentiated service delivery (DSD) model has been widely recognized by the international community, including WHO, as a key strategy to expand access, quality, and efficiency of HIV services while meeting clients' needs [1–3]. This model represents a shift from a "one-size-fits-all" approach to HIV service delivery to one that better serves the needs of individual clients [1]. With the scale-up of antiretroviral therapy (ART) with fewer side effects, many people living with HIV in countries with mature HIV programs are established on treatment and require fewer interactions with the healthcare system. DSD for HIV treatment services may encompass various strategies, including multimonth dispensing (MMD), increased time between clinic visits, fast-track ART refills, task-shifting from physicians to other types of health providers, and community ART distribution [4–7]. For clients, DSD reduces the financial burden of transportation and the time spent traveling to/from the health facility and waiting for appointments. The healthcare system also benefits from DSD as clinics become less congested, and healthcare providers have more time to focus on individuals with advanced HIV or underlying conditions [3,8,9].

Kenya adopted DSD as a key strategy to improve HIV service delivery since 2016 [10]. Under the national guidelines, clients who are established on treatment can elect to receive, among other DSD models, the *facility-based fast-track MMD system* for ART refills (fast-track ART), which includes 3–monthly ART refills and more, refers as ≥3MMD, and clinical reviews every 6 months. In addition, clients receiving fast–track ART can obtain ART refills directly from the pharmacy to reduce waiting time.

A growing body of evidence suggests that outcomes among clients receiving reduced ART refills frequency are comparable to those receiving more frequent ART refills; however, gaps in the literature remain [5,11]. A systematic review found 39 studies on ART refill frequency published between 2018 and 2019 [11]; however, only one of the studies was conducted in Kenya, and this study did not evaluate the facility-based, fast-track model, which includes ≥3MMD. Similarly, a systematic review examining the effect of reduced frequency of clinical encounters and antiretroviral drug refills on retention and viral load included only one study from Kenya, which included a randomized trial [7]. Whereas most DSD research to date has focused on clinical outcomes, little is known about individual and facility-level factors associated with being on at least 3MMD among eligible clients and switching out from ≥3MMD to <3MMD, a better understanding of these factors is essential to improve implementation of DSD as a key model for HIV service delivery. We evaluated individual and facility-level factors associated with receiving ≥3MMD, and with changing service delivery model from ≥3MMD to <3MMD in Kenya.

This project was reviewed in accordance with CDC human research protection procedures and was determined to be research, but CDC investigators did not interact with humans or have access to identifiable data or specimens for research purposes. The protocol was also approved by the Kenyatta National Hospital and University of Nairobi Ethics Review Committee (IRB reference number: KNH-ERC/A/241) and the University of Maryland, Baltimore IRB. The requirements for written informed consent were waived as this evaluation involved no more than minimal risk.

Materials and methods

Study design and setting

We conducted a retrospective cohort study of clinically stable clients referred as established on treatment receiving care in 32 governmental health facilities located in Nairobi ($n = 17$), Kisii ($n = 7$), and Migori ($n = 8$) counties with 500 or more clients currently on ART. Under the leadership of the Ministry of Health (MOH) and County governments, CIHEB at the University of Maryland Baltimore (UMB) provides technical assistance for HIV service delivery at these facilities through the U.S President's Emergency Plan for AIDS Relief (PEPFAR)-Centers for Disease Control and Prevention (CDC) funded Partnership for Advanced Care and Treatment (PACT) Endeleza (Nairobi County), and PACT Timiza (Kisii and Migori counties) programs. Whereas Nairobi County hosts the nation's capital, and an urban population, Kisii and Migori counties host a predominantly rural population in the south-west of Kenya. According to the 2018 Kenya HIV population-based survey, county-level HIV prevalence among adults 15–64 years of ageis 3.8%in Nairobi, 6.1% in Kisii, and 13.0% in Migori [12].

Sampling

A two-stage sampling approach was used to select the cohort for analysis. In the first stage, health facilities were stratified by location (Nairobi, Kisii, and Migori) and facility size based on the number of clients on ART (500–999; 1000–1999; and 2000 and above). In total, 32 supported health facilities were randomly selected from a total of 268 supported health facilities. In the second step, files from clients were randomly selected using probability proportional to size from each of the 44 facilities using a sampling table recommended by the Kenya MOH to achieve 95% representativeness of its population [13]. We excluded supported health facilities with less than 500 clients on ART; therefore, a total of 32 facilities were included as part of this analysis.

Inclusion criteria

Clients were eligible to enter into the cohort between July 2017 and December 2019 when they first met the following MOH criteria for being established on treatment/eligible for enrollment into ≥3MMD: aged 20 years and older; receiving ART for at least 12 months; virally suppressed (<1000 copies/ml); and clinician determined the client's established status at the visit [10]. Only subsequent visits in which the clients were also reported as established on treatment by the clinician were included in the analysis.

Intervention

All clients received a standard package of care recommended by the *2018 Kenya Guidelines on Use of Antiretroviral Drugs for Treating HIV Infection* [14]. The standard of care includes a clinical evaluation at every clinical visit, adherence counseling and support, Cotrimoxazole prophylaxis, baseline $CD4^+$ cell count at enrollment, yearly viral load testing, ART initiation, assessment for drug toxicity, tuberculosis screening and treatment, Isoniazid Presumptive Treatment initiation among eligible clients, sexually transmitted infections screening and treatment, and family planning services. Under the standard of care, clients received clinical consultations and ART refill monthly or every 2 months at the clinic. Clients eligible for DSD could receive ≥3MMD, ART prescriptions were refilled directly at the pharmacy without consulting clinicians. Clients have a clinical appointment every 6 months or as needed.

Outcomes

Our primary outcome of interest was being on ≥ 3MMD, defined as receiving ART multimonth dispensing of ART for 89 days or more. Our secondary outcome was a transition in the client service delivery model from ≥3MMD to <3MMD. Because ART refills of 3 months and more was rolled out starting in 2017, we expected clients to transition from <3MMD to ≥3MMD; therefore, we were interested in examining factors associated with transitioning from ≥3MMD to <3MMD.

Data collection

The evaluation team extracted routine clinical data from the HIV client form and pharmacy records paper files into a District Health Information System (DHIS-2) Tracker platform [15]. Information collected included baseline information (sex, age at a given visit, marital status, type of population (general or key populations defined as female sex workers [FSW] or [MSM]), HIV diagnosis date, ART initiation date, baseline $CD4^+$ cell count, viral load at entry into the cohort, quantity and dates for ART refill, and dates of HIV-related clinical consultations. Data quality assurance (DQA) measures included built-in validation rules and checks in DHIS-2, and the designated supervisor conducted DQA on 10% of the selected samples daily. Data concordance of less than 95% between supervisor and data officers led to further investigation to confirm values and additional training and supervision. Data were collected prospectively as part of routine clinical care and extracted for this study from August 2020 to October 2020.

Statistical analysis

We examined the data using univariate analysis to describe the frequency and distribution of outcomes of interest and covariates. Client characteristics were summarized using means and standard deviations, or medians and interquartile (IQR) ranges for continuous variables and proportions with 95% confidence intervals (95% CIs) for categorical variables. We used Pearson chi-square to compare outcomes between clients 'ART refill frequency' (<3MMD vs. ≥3MMD). Multilevel Poisson regression models with robust "sandwich" standard errors were used to assess client and facility-level characteristics associated with a client type of care delivery model. The models were adjusted for repeated measures and clustering within health facilities. For multivariable Poisson regression model development, variables with a P value < 0.25 in the bivariate analysis and those found to be important confounders based on the scientific literature review (age, sex) were included in the multivariable model. However, only statistically significant variables ($P < 0.05$) and known confounders were retained in the final model. Multicollinearity was assessed through the estimation of the variation inflation factor (VIF). If a VIF was greater than 10, multicollinearity was determined [16]. This methodology was also used to assess individual-and facility-level characteristics associated with switching from ≥3MMD to <3MMD. Data were analyzed using SAS 9.4 (SAS Institute, Cary, North Carolina, USA) and STATA 17 (STATACorp LLC, College Station, Texas, USA). All statistical tests were done at a 5% level of significance.

Results

Description of study population

A total of 3501 clients eligible for ≥3MMD were included in the analysis: 1808 (51.6%) were enrolled in care in Nairobi County, and the remaining 1693 (48.4%) in Kisii and Migori Counties (Table 1). Overall, the cohort population was mostly female (69.0%), aged 30 years or older (85.5%), married or cohabitating (66.2%), and classified as the general population (95.4%).

At the time of entry into the cohort, 815 (64.4%), 1067 (63.0%), and 385 (71.0%) of the included evaluation population were enrolled in ≥3MMD. Atentry, more than half of individuals had been on ART for 1–4years (56.1%) and were receiving an EFV-based ART regimen (59.7%). The client populations in Nairobi and Kisii/Migori counties differed significantly across all characteristics except sex and the year of entry into the cohort. The most notable differences were the proportion of clients who were key populations (FSWs, MSM, IDUs) (8.8% in Nairobi vs. 0.2% in Kisii/Migori; $P < 0.01$) and the proportion with marital status 'single' (24.1% in Nairobivs. 5.6% in Kisii/Migori) (Table 1).

Factors associated with being on ≥3MMD

Overall, 65% of clients established on treatment (71.8% of men and 61.6% of women) were on ≥3MMD at the time of entry into the cohort. Sex, age at the time of entry into cohort, type of population, time on ART, regimen at entry into cohort, and year of entry differed significantly between clients receiving <3MMD vs. those receiving ≥3MMD (Table 2). No significant difference was observed by marital status, line of ART regimen, facility volume, or location type (Table 2).

The 3501 clients had a total of 24204 stable visits (defined as visits in which healthcare providers classified them as established on treatment) during the study period—–11697 (48.3%) among Nairobi-based clients, and 12507 (51.7%) among Kisii/Migori-based clients——which were included in the models. In the multivariable Poisson regression model, younger age (20–24 vs. 50 years and older) was associated with a lower likelihood of being on ≥3MMD (adjusted risk ratio [aRR] 0.79; 95% CI: 0.68–0.92). We observed similar significant findings for age group 25–29 and 30–34 years of age compared with 50 years and over. Clients who switched ART regimen were less likely to be on ≥3MMD (aRR: 0.87; 95% CI: 0.81–0.94). Factors associated with a higher likelihood of being on ≥3MMD included receiving a dolutegravir (DTG) vs. EFV-based ART regimen (aRR: 1.10; 95% CI: 1.05–1.15) and more recent year of entry (2019 vs. 2017) into the cohort (aRR: 1.10; 95% CI: 1.02–1.19). Sex, marital status, type of population, time on ART, and location were not associated with being on ≥3MMD (Table 3). No multicollinearity was observed in the final model (VIF < 2).

Transition from ≥3MMD to <3MMD

Among the 10821 visits, 2385 (22.0%) visits transitioned from ≥3MMD to <3MMD. A similar level of switching occurred across the counties (Nairobi: 23.4%, Kisii and Migori: 20.8%, $P < 0.01$). Among 2991 clients established on treatment, 1670 (56.0%) clients switched from ≥3MMD to <3MMD at least once during the study period. Sex, time on ART, current ART regiments, and year of entry into the cohort differed significantly between individuals who remained on ≥3MMD and those who switched to <3MMD. There was no significant difference in distribution of the outcome by age, marital status, type of population, switching ART regimens, facility volume, and type of location (Table 4). In the multivariable model, men vs. women (aRR 1.19 [95% CI 1.08–1.30]) and clients aged 20–24 vs. 50 years and above (aRR 1.32 [95% CI 1.11–1.57]) had a higher risk of switching from ≥3MMD to <3MMD. Whereas clients who switched ART regimen had 63% higher risk of switching back to <3MMD (aRR 1.63 [95% CI 1.31–2.03]), clients on DTG-based regimens had a 44% lower risk of switching from ≥3MMD to <3MMD (aRR 0.66 [95% CI 0.59–0.74]) (Table 5). No multicollinearity was observed in the final model (VIF < 2).

Discussion

In this cohort of clients established on treatment receiving HIV services in Nairobi, Kisii, and Migori counties, we found that younger age (20–24, 25–29, and 30–34 age categories vs. 50years or more) were associated with a decreased likelihood of being on ≥3MMD. Being male, younger age (20–24years), and switching ART regimen were associated with an increased likelihood of switching from ≥3MMD to <3MMD. In contrast, being on a DTG-based ART regimen and having entered the cohort more recently (2019) was associated with a decreased risk of switching from ≥3MMD to <3MMD.

The finding that younger age was associated with a lower likelihood of being on ≥3MMD and higher risk of switching from ≥3MMD to <3MMD may reflect differences in client's preferences or bias/perceptions from healthcare workers. Previous research has found that some adult clients may prefer standard clinical care rather than MMD due to the ongoing support and counseling and fear of HIV stigma and discrimination due to the challenges to safely and privately storing MMD [17] or due to misunderstanding about MMD or mistrust in the health system. While this is plausible, young adults may also face stigma and discrimination while accessing HIV services [18], which could have impacted access and continuation of MMD. Evidence from qualitative studies suggest healthcare workers may have hesitancy to prescribe MMD to clients due to different concerns such as that clients may change their health-seeking behaviors and be more hesitant to visit a healthcare facility to seek care when needed [19,20]. Further research may consider examining clients' and clinicians' preferences and apprehensions on the type of service delivery to different populations and address them early.

Individuals on DTG-based ART regimens were more likely to receive ≥3MMD than other regimens and less likely to experience a transition from >3MMD to ≤3MMD. DTG-based ART regimens have been shown to have superior tolerance compared to other ART regimens, which may explain why clients on DTG have fewer interactions with the health system [21]. This finding aligns with evidence that individuals on DTG-based ART regimens have a lower discontinuation rate than non-DTG-based ART regimens due to high tolerability [22]. Under the 2018 Kenya HIV guidelines, Kenya has recommended that all people living with HIV transition to DTG-based ART regimens [14]. By December 2019, approximately 43% of people living with HIV on ART were taking DTG-based regimen [23]. Our findings suggest that scaling-up DTG-based regimens will also assist in enrolling and maintaining clients on MMD.

Clients switching ART regimens were less likely to be on ≥3MMD and more likely to switch from ≥3MMD to <3MMD. Clinical guidelines recommend close monitoring after switching ART regimen in order to assess tolerability and safety of the new regimen [24]. This clinical practice is aligned with our findings. We also observed that enrolling in this cohort in 2019 was associated with increased likelihood of being on >3MMD and decreased risk of switching from ≥3MMD to <3MMD the previous years. We suspect that this improvement over time is due to several factors, including training of healthcare workers on DSD guidelines; community engagement to inform clients about the option and benefits of DSD such as MMD which led to increased demand for MMD; and ongoing data review related to ≥3MMD to guide program implementation and rapid course corrections.

The strengths of the study include a representative sample of health facilities and clients across three counties in Kenya. Longitudinal data of clients provided information about the type and change of services delivered across time. Limitations include the use of clinical programmatic data rather than research cohort data, which are collected in a more structured environment. We also did not collect qualitative data to contextualize our quantitative findings. There is potential misclassification for the client's status (established on treatment or not on treatment), which would have impacted their eligibility for being on ≥3MMDand transition between types of services. Missing data on the ≥3MMD eligibility criteria, including opportunistic infections (e.g. tuberculosis), pregnancy, and BMI status, limited our ability to confirm the client's eligibility. However, these variables are part of the criteria used by the healthcare providers to classify clients as established on treatment, which is captured under the field variable 'client type' in the clinical form and was used in this analysis. We did not disaggregate our exposure (MMD) into multiple categories (e.g. 3–5MMD, 6MMD); however, 86% of the included sample received 3–5MMD.

Conclusion

In our cohort, most eligible clients received ≥3MMD. Individual factors were associated with being on ≥3MMD and being switched from ≥3MMD to <3MMD. Monitoring frequency of ART refills across different populations is critical to identifying and remedying gaps to providing access to multimonth dispensing and continually improving the implementation of these service delivery models. Healthcare systems may provide adaptations to offer flexibility to the clients to vary services delivery models based on evolving preferences and needs.

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Table 1.

Characteristics of adults established on treatment accessing HIV care and treatment services at UMB-supported sites in Kenya at the time of eligibility between July 2017 and December 2019 by county.

Characteristics	Overall population (*N* = 3501)	Nairobi county *n* (%) *n* = 1808	Kisii and Migori counties *n* (%) *n* = 1693	*P* *
Sex				0.39
Male	1086 (31.0)	549 (30.4)	537 (31.7)	
Female	2415 (69.0)	1259 (69.6)	1156 (68.3)	
Age at time of entry into cohort (years)				**<0.01**
20–24	161 (4.6)	83 (4.6)	78 (4.6)	
25–29	346 (9.9)	214 (11.8)	132 (7.8)	
30–34	636 (18.2)	375 (20.7)	261 (15.4)	
35–39	589 (16.8)	326 (18.1)	263 (15.5)	
40–44	620 (17.7)	317 (17.5)	303 (17.9)	
45 –49	447 (12.8)	228 (12.6)	219 (13.0)	
50+	702 (20.0)	265 (14.7)	437 (25.8)	
Marital status				**<0.01**
Single	528 (15.1)	433 (24.1)	95 (5.6)	
Married/Cohabitating	2308 (66.2)	1041 (58.0)	1267 (74.8)	
Separated/Divorced/Widows	651 (18.7)	320 (17.9)	331 (19.6)	
Type of population				**<0.01**
General population	3329 (95.4)	1639 (91.2)	1690.8)	
KPs[a]	162 (4.6)	159 (8.8)	3 (0.2)	
Time on ART (years)				**<0.01**
1–4	1965 (56.1)	1158 (64.0)	807 (47.7)	
5 –9	1312 (37.5)	562 (30.1)	750 (44.3)	
10 or more	224 (6.4)	88 (4.9)	136 (8.0)	
Current regimen at time of entry to cohort				**<0.01**
DTG-based	350 (10.0)	188 (10.3)	162 (9.6)	
EFV-based	2089 (59.7)	1259 (69.4)	835 (49.3)	
Nevirapine (NVP)-based	838 (23.9)	260 (14.3)	578 (34.1)	
Other	224 (6.4)	107 (5.9)	118 (7.0)	

Characteristics	Overall population (*N* = 3501)	Nairobi county *n* (%) *n* = 1808	Kisii and Migori counties *n* (%) *n* = 1693	*P* *
Line of current regimen at time of entry to cohort				**<0.01**
First-line	3353 (95.8)	1757 (97.2)	1596 (94.3)	
Second-line	148 (4.2)	51 (2.8)	97 (5.7)	
Facility volume				**<0.01**
500–999	2058 (58.8)	1010 (55.9)	1048 (61.9)	
≥1000	1443 (41.2)	798 (44.1)	645 (38.1)	
Location type				-
Urban	1808 (51.6)	1808 (100)	-	
Rural	1693 (48.4)	-	1693 (100)	
Year of entry into cohort				
2017	1266 (36.2)	626 (34.6)	640 (37.8)	**0.11**
2018	1693 (48.3)	903 (50.0)	790 (46.7)	
2019	542 (15.5)	279 (15.4)	263 (15.5)	

[a] Key population is composed female sex workers, MSM, and people who inject drugs.

P values <0.05 are bolded.

* *P* values obtained using Pearson Chi-square.

Table 2.

Characteristics of adults established on treatment accessing HIV care and treatment services at UMB-supported sites in Kenya at the time of eligibility between July 2017 and December 2019 by antiretroviral therapy refill frequency.

Characteristics	**<3MMD *n* (%) *n* = 1234**	**≥3MMD *n* (%) *n* = 2267**	***P*** *
Sex			
Male	306 (28.2)	780 (71.8)	**<0.01**
Female	928 (38.4)	1487 (61.6)	
Age at time of entry into cohort (years)			**<0.01**
20–24	75 (46.6)	86 (53.4)	
25–29	150 (43.4)	196 (56.6)	
30–34	244 (38.4)	392 (61.6)	
35–39	211 (35.8)	378 (64.2)	
40–44	195 (31.5)	425 (68.5)	
45 –49	148 (33.1)	299 (66.9)	
50+	211 (30.1)	491 (69.9)	
Marital status			0.09
Single	182 (34.5)	346 (65.5)	
Married/Cohabitating	795 (34.5)	1513 (65.5)	
Separated/Divorced/Widows	254 (39.0)	397 (61.0)	
Type of population			**<0.01**
General population	1151 (34.6)	2178 (65.4)	
KPs[a]	83 (48.3)	89 (51.7)	
Time on ART (years)			**<0.01**
1–4	743 (37.8)	1222 (62.2)	
5 –9	414 (31.6)	898 (68.4)	
10 or more	77 (34.4)	147 (65.6)	
Current regimen at time of entry to cohort			**<0.01**
DTG-based	83 (23.7)	267 (76.3)	
EFV-based	756 (36.2)	1333 (63.8)	
Nevirapine (NVP)-based	308 (36.7)	530 (63.3)	
Other	87 (38.8)	137 (61.2)	

Characteristics	<3MMD n (%) n = 1234	≥3MMD n (%) n = 2267	P *
Line of current regimen at time of entry to cohort			0.75
First-line	1180 (35.2)	2173 (64.8)	
Second-line	54 (36.5)	94 (63.5)	
Facility volume			0.34
500–999	712 (34.6)	1346 (65.4)	
≥1000	522 (36.2)	921 (63.8)	
Location type			0.74
Urban	642 (35.5)	1166 (64.5)	
Rural	592 (35.0)	11.01 (65.0)	
Year of entry into cohort			**<0.01**
2017	451 (35.6)	815 (64.4)	
2018	626 (37.0)	1067 (63.0)	
2019	157 (29.0)	385 (71.0)	

[a] Key population is composed female sex workers, MSM, and people who inject drugs.

P values <0.05 are bolded.

* *P* values obtained using Pearson Chi-square.

Table 3.

Factors associated with being on ≥3MMD among visits of clients eligible to enter the cohort.

Covariates	Unadjusted RR (95% CI)	*P*	Adjusted RR (95% CI)[a]
Sex		0.03	
Male	1.04 (1.00–1.08)		0.98 (0.94–1.04)
Female	Ref.		Ref.
Marital status		0.01	
Single	Ref.		
Married/Cohabitating	1.02 (0.96–1.08)		
Separated/Divorce/Widow	1.08 (1.02–1.14)		
Age at visit (years)		<0.01	
20–24	0.77 (0.67–0.90)		0.79 (0.68–0.92)
25–29	0.78 (0.70–0.87)		0.80 (0.72 –0.89)
30–34	0.87 (0.81–0.94)		0.89 (0.83 –0.96)
35–39	0.96 (0.91–1.02)		0.98 (0.92–1.03)
40–44	0.98 (0.93–1.03)		0.99 (0.94–1.05)
45 –49	1.00 (0.95–1.07)		1.02 (0.96–1.07)
50 or more	Ref.		Ref.
Type of population		0.33	
General population	Ref.		
KPs	0.86 (0.62–1.17)		
Time on ART (years)		0.02	
1–4	0.87 (0.78–0.98)		
5 –9	0.93 (0.86–1.02)		
10 or more	Ref.		
Current ART regimen		<0.01	
DTG-based	1.12 (1.07–1.18)		1.10 (1.05–1.15)
EFV-based	Ref.		Ref.
NVP-based	0.99 (0.96–1.09)		1.00 (0.94–1.05)
Other	0.96 (0.87–1.06)		0.96 (0.87–1.06)
Line of current regimen		0.83	

Covariates	Unadjusted RR (95% CI)	*P*	Adjusted RR (95% CI)[a]
First	Ref.		
Second	0.99 (0.89–1.10)		
Switching ART regimen		0.06	
No	Ref.		Ref.
Yes	0.93 (0.86–1.00)		0.87 (0.81 –0.94)
Facility volume		0.63	
500–999	Ref.		
≥1000	1.05 (0.85–1.30)		
Location type		0.95	
Urban	1.01 (0.81–1.26)		
Rural	Ref.		
Year of entry into the cohort		0.04	
2017	Ref.		Ref.
2018	1.01 (0.98–1.06)		1.01 (0.97–1.04)
2019	1.10 (1.02–1.18)		1.10 (1.02–1.19)

[a]Variables with a $P < 0.25$ in the bivariate model or known confounders were included in the multivariable model;however, only variables with a P value <0.05 and known confounders (age, sex) remained in the final multivariable model and were included in the adjusted RR column.

Table 4.

Characteristics of clients established on treatment who switched from ≥3MMD to <3MMD.

	Switch back from ≥3MMD to <3MMD[a] (*N* = 1670)	**Remaining on ≥3MMD[b] (*N* = 1311)**	***P***
Sex			**0.01**
Male	501 (51.7)	469 (48.3)	
Female	1169 (58.1)	842 (41.9)	
Marital status			0.64
Single	238 (56.9)	180 (43.1)	
Married /Cohabitating	1100 (55.5)	883 (44.5)	
Separated/Divorce/Widow	326 (57.5)	241 (42.5)	
Age at visit (years)			0.05
20–24	82 (64.6)	45 (35.4)	
25–29	170 (62.5)	102 (37.5)	
30–34	297 (56.3)	231 (43.7)	
35–39	285 (57.1)	214 (42.9)	
40–44	294 (54.1)	249 (45.9)	
45 –49	212 (54.8)	175 (45.2)	
50 or more	330 (52.8)	295 (47.2)	
Type of population			0.62
General population	1599 (55.9)	1260 (44.1)	
Key population	71 (58.2)	51 (41.8)	
Time on ART			**<0.01**
1–4	1011 (60.1)	672 (39.9)	
5 –9	565 (50.9)	546 (49.1)	
10+	94 (50.3)	93 (49.7)	
Current ART regimen at first visit on >3MMD[c]			**<0.01**
DTG-based	67 (27.6)	176 (72.4)	
EFV-based	1083 (59.9)	724 (40.1)	
NVP-based	436 (59.9)	330 (43.1)	
Other	84 (50.9)	81 (49.1)	
Line of current regimen at first visit on >3MMD[c]			0.63

	Switch back from ≥3MMD to <3MMD[a] (N = 1670)	Remaining on ≥3MMD[b] (N = 1311)	P
First	1607 (56.1)	1257 (43.9)	
Second	63 (53.9)	54 (46.1)	
Switching ART regimen[d]			0.25
No	737 (57.2)	551 (42.8)	
Yes	933 (55.1)	760 (44.9)	
Facility volume			0.40
500–999	951 (55.3)	768 (44.7)	
≥1000	719 (57.0)	543 (43.0)	
Location type			0.52
Urban	859 (56.6)	659 (43.4)	
Rural	811 (55.4)	652 (44.6)	
Year of entry into the cohort			**<0.01**
2017	827 (69.5)	362 (30.5)	
2018	796 (52.9)	710 (47.1)	
2019	47 (16.4)	239 (83.6)	

[a] Switch from ≥3MMD to <3MMD at least once.

[b] Clients remaining on ≥3MMD.

[c] Among the visits included in this analysis.

[d] Clients switched regimens at least once.

P values <0.05 are bolded.

Table 5.

Factors associated with switching from ≥3MMD to <3MMD.

	Unadjusted RR (95% CI)	*P*	Adjusted RR (95% CI)[a]
Sex		0.68	
Male	1.02 (0.93–1.11)		1.19 (1.08–1.30)
Female	Ref.		Ref.
Marital status		0.03	
Single	Ref.		
Married/Cohabitating	0.90 (0.80–1.01)		
Separated/Divorce/Widow	0.85 (0.75–0.96)		
Age at visit (years)		<0.01	
20–24	1.37 (1.15–1.64)		1.32 (1.11–1.57)
25–29	1.26 (1.06–1.50)		1.18 (0.99–1.42)
30–34	1.16 (1.06–1.28)		1.09 (0.98–1.21)
35–39	1.03 (0.94–1.14)		0.97 (0.87–1.07)
40–44	1.12 (1.01–1.24)		1.07 (0.96–1.19)
45 –49	1.00 (0.90–1.11)		0.98 (0.88–1.10)
50 or more	Ref.		Ref.
Type of population		0.82	
General population	Ref.		
Key population	0.95 (0.62–1.46)		
Time on ART		0.03	
1–4	1.27 (1.06–1.53)		
5 –9	1.19 (1.02–1.38)		
10+	Ref.		
Current ART regimen		<0.01	
DTG-based	0.72 (0.66–0.79)		0.66 (0.59–0.74)
EFV-based	Ref.		Ref.
NVP-based	1.02 (0.90–1.17)		1.02 (0.90–1.16)
Other	0.89 (0.73–1.07)		0.90 (0.74–1.10)
Line of current regimen		0.18	

	Unadjusted RR (95% CI)	*P*	Adjusted RR (95% CI)[a]
First	Ref.		
Second	0.86 (0.70–1.07)		
Switching ART regimen		<0.01	
No	Ref.		Ref.
Yes	1.37 (1.11–1.70)		1.63 (1.31 –2.03)
Facility volume		0.53	
500–999	Ref.		
≥1000	1.20 (0.68–2.11)		
Location type		0.98	
Urban	0.99 (0.55–1.77)		
Rural	Ref.		
Year of entry into the cohort		<0.01	
2017	Ref.		Ref.
2018	0.91 (0.82–1.01)		0.94 (0.85–1.04)
2019	0.52 (0.40–0.70)		0.58 (0.45–0.75)

[a]Variables with a $P < 0.25$ in the bivariate model or known confounders were included in the multivariable model;however, only variables with a *P* value <0.05 and known confounders (age and sex) remained in the final multivariable model and were included in the adjusted RR column.