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Earlier first viral load testing and differentiated service delivery enrolment after revised antiretroviral therapy guidelines in four South African districts

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Background: In April 2023, South Africa revised antiretroviral therapy (ART) guidelines, moving the first viral load (VL) from 6 months to 3 months post-initiation. Clients with VL < 50 copies/mL became eligible for differentiated service delivery (DSD) at their 4-month review.

Objectives: We assessed early implementation of this strategy in four South African districts.

Method: We conducted a retrospective descriptive analysis of TIER.Net data from 664 523 people initiating ART between 2017 and 2023 in Johannesburg, Sedibeng, Capricorn, and Mopani. Primary analyses compared 2022 and January – April 2023 (pre-implementation) with May – December 2023 (early implementation). Outcomes included VL timing, coverage, suppression (<50 copies/mL and <200 copies/mL), and DSD enrolment timing and coverage among those with VL < 50 copies/mL. Follow-up was defined as 6 months from recommended first VL timing. Trends from 2017 to 2023 were described.

Results: Among 91 723 ART initiators pre-implementation and 39 084 early implementation, the proportion without a recorded VL declined from 41.1% to 33.5%, and median time to first VL decreased from 175 to 105 days. VL testing within 3 months increased from 13.5% to 51.8%. Among those with VL results, suppression remained stable (64.5% vs 64.6% for VL < 50 copies/mL; 85.5% vs 84.9% for VL < 200 copies/mL). DSD enrolment within 6 months of VL < 50 copies/mL rose from 26.9% to 33.5%, while median time to enrolment decreased from 367 to 186 days.

Conclusion: Early implementation was associated with earlier VL testing and DSD enrolment, with stable suppression. Sustaining gains requires improved VL coverage, timely action at the 4-month review. Longer follow-up is needed to assess effects on retention.

Keywords: HIV; viral load; viral suppression; viral load coverage; ART guidelines; low-level viraemia; differentiated service delivery.

What this study adds: This large routine data analysis provides early evidence that advancing first viral load testing to 3 months enables substantially earlier treatment monitoring and faster enrolment into differentiated service delivery, without compromising viral suppression. It also highlights benefits from introducing linked clinical and service delivery changes within a single policy package.

Introduction

South Africa has the largest HIV burden in the world, with an estimated HIV prevalence of 12.4%, 7.8 million people living with HIV, and 6.1 million on antiretroviral therapy (ART) in 2024.[1] In April 2023, South Africa updated its national ART guidelines to move the first viral load (VL) test from 6 months to 3 months post-ART initiation.[2] Clients achieving viral suppression (< 50 copies/mL) at this earlier VL became eligible for less-intensive differentiated service delivery (DSD) models at their 4-month review, without any additional minimum time on ART requirement. An earlier first VL may also support quicker identification of

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unsuppressed clients, facilitating timely adherence support and repeat VL testing during the early months on ART when retention is particularly challenging.[3,4]

This policy change built on evidence of the rapid virological response associated with dolutegravir, the current first-line agent, which achieves faster suppression and has improved tolerability compared with previous regimens.[5,6] The 2021 WHO HIV consolidated guidelines had already recommended bringing the first VL forward so that results are reviewed by 6 months, and defined eligibility for less-intensive DSD as at least 6 months on ART with evidence of treatment success, ideally one suppressed VL.[7] South Africa's 2023 ART guideline went further by removing the time on ART requirement and linking DSD eligibility directly to the earlier VL result, thereby enabling clinically virologically suppressed clients to transition to less-intensive DSD models earlier in care. For the first time, the guidelines aligned clinical and service delivery guidance within a single integrated policy.

DSD models reduce the intensity of care for clinically stable individuals by decreasing clinical review frequency and extending prescription and refill length through multi-month scripting (MMS) and multi-month dispensing (MMD). In South Africa these include quick 'one-stop' treatment collection points within or outside of health facilities (called facility and external pick-up points) and adherence support groups (called ART adherence clubs). DSD models have demonstrated outcomes comparable to conventional care and with added benefits of lower costs and higher satisfaction.[8,9,10,11,12]

Prior to the 2023 guideline update, clinically stable clients were only eligible for DSD model enrolment after (1) 6 months on ART, and (2) a suppressed VL result, with the first VL test performed at 6 months on ART. This meant DSD enrolment only occurred from 7 months on ART, or later, once results were reviewed and actioned. This resulted in frequent clinic visits during the first year of treatment. The revised guideline reduced the intensity of care during early ART by decreasing the number of required clinic visits in the first year. Table 1 summarises key differences in VL timing, DSD eligibility, and clinic visit frequency after the revised guideline.[2,13]

In this study, we describe early changes to VL timing, coverage and suppression, and DSD enrolment following the guideline revision, using routine programme data.

Research methods and design

Setting

This study focuses on four South African districts: the City of Johannesburg and Sedibeng in Gauteng province, and Capricorn and Mopani districts in Limpopo province, which together accounted for an estimated 864 000 people living with HIV on ART in 2023.[14] Johannesburg is South Africa's largest city by population and economic activity.

TABLE 1: Key differences in viral load timing, differentiated service delivery eligibility and clinic visit frequency before and after the 2023 South African antiretroviral therapy guideline revision.

Guideline recommendation	Pre-May 2023	May 2023 onward
Timing of first VL after treatment initiation	Month six	Month three
Earliest DSD enrolment timing	Month seven	Month four
Minimum number of clinical consultation visits in first year (incl. ART initiation visit)	8 (M0, M1, M2, M3, M4, M5, M6, M7)† *Plus 1 ART refill collection at M10*	5 (M0, M1, M3, M4, M10)†
Earliest targeted adherence support possible	Month seven	Month four

Note: Study location: four South African districts, Capricorn, Mopani, Johannesburg, Sedibeng, Study data includes people initiating ART 01 January 2017 – 31 December 2023.
VL, viral load; DSD, differentiated service delivery; ART, antiretroviral therapy.
†, M = Month (28- or 30-day dispensing period).

Sedibeng and Capricorn comprise a mix of urban, semi-urban and rural areas, while Mopani is predominantly rural. Anova Health Institute, as the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) and United States Agency for International Development (USAID) district support partner, provided implementation support in all four districts until January 2025, when USAID grants were terminated.

2023 ART guideline implementation timing

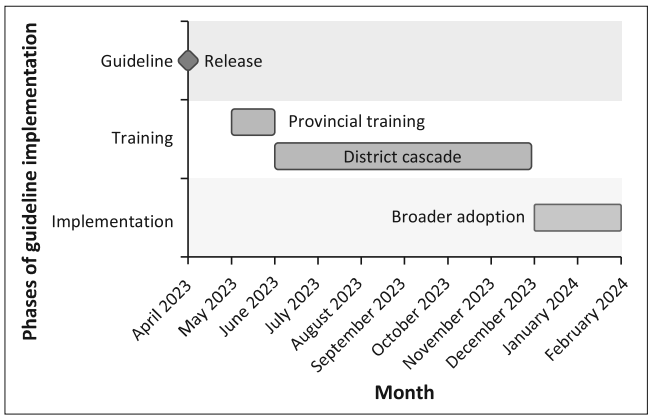
The first version of the 2023 ART guidelines was released in April 2023. In May 2023, the National Department of Health conducted train-the-trainer sessions for provincial departments of health and PEPFAR-supported implementing partners. Provincial Departments of Health and implementing partners then began cascading training across districts. The National Department of Health also made guideline training available through the Knowledge Hub online platform as a series of webinars, both live and recorded. In the four study districts, cascade training was completed by the end of October 2023 (Figure 1). As with previous national ART guideline revisions, PEPFAR-supported facilities received routine facility-level implementation and monitoring support from implementing partners. No additional support was provided specifically for implementation of the revised VL timing or earlier DSD eligibility provisions.

Following publication of the guidelines, some healthcare providers likely began implementing the revised VL timings immediately, while others may only have adopted the changes after formal training, mentoring, or implementing partner support. Implementation therefore did not occur at a single fixed point in time but increased progressively across districts following guideline release.

We therefore consider May – December 2023 as the early implementation period.

Study design

This was a retrospective descriptive analysis of routine programme data extracted from TIER.Net, South Africa's national ART monitoring database system. The primary



Note: Study data include people initiating ART 01 January 2017 – 31 December 2023.
ART, antiretroviral therapy.

FIGURE 1: Timeline of 2023 ART guideline release, training rollout and early implementation of revised first viral load timing guidance in four South African districts (Capricorn, Mopani, Johannesburg, Sedibeng).

objective was to describe early changes following the 2023 ART guideline revision, which advanced the first VL test from 6 months to 3 months after ART initiation and enabled clients with viral suppression (VL <50 copies/mL) to become eligible for DSD models at their 4-month review. Primary implementation analyses focused on 2022, January – April 2023, and May – December 2023, corresponding to pre-implementation and early implementation periods of the revised VL timing guidance, while monthly trends during 2023 were used to describe uptake during the year of guideline release and implementation. Outcomes assessed included VL timing, coverage and suppression (<50 copies/mL and <200 copies/mL), and among clients with a VL < 50 copies/mL, DSD enrolment timing and coverage within 6 months of potential eligibility across four districts. Trends across 2017–2023 were additionally described to provide historical context and assess changes over time.

Study population

We included all individuals who initiated ART between 01 January 2017 and 31 December 2023 at facilities supported by Anova Health Institute in the City of Johannesburg and Sedibeng (Gauteng province), and Capricorn and Mopani (Limpopo province). Clients were excluded if they had a recorded outcome of death or transfer-out prior to the end of their follow-up period. Clients without a VL result or DSD enrolment during follow-up were retained in the analysis, as they may reflect programmatic disengagement or delays in service delivery.

Data sources and follow-up

TIER.Net, South Africa's public sector HIV programme monitoring database,[15] tracks individuals longitudinally within facilities but does not link records across sites. It is used across most of the country, including the study districts. Similar to other routine data sources, there are risks of incomplete data and delayed capturing of laboratory results or misassigned outcomes,[16] which may underestimate recorded VL coverage and DSD enrolment. TIER.Net does not link records across facilities, so silent transfers may also appear as missing outcomes.

Data were extracted between August and September 2024. Analyses were limited to individuals initiating ART up to 31 December 2023 to allow sufficient follow-up time for assessment of early VL and DSD enrolment outcomes before programme support and data access disruptions following termination of USAID-funded district support in January 2025.

Follow-up time was defined as the guideline-mandated timing of the first VL plus an additional 6-month leeway period to allow for delayed testing and recording:

- ART initiators before May 2023: first VL due at 6 months + 6-month leeway = 360 days follow-up.
- ART initiators from May 2023 onwards: first VL due at 3 months + 6-month leeway = 270 days follow-up.

Variables and definitions

Extracted variables included age, gender, district, ART initiation date, first VL date and result, DSD enrolment date. Age was grouped into the following categories: <15, 15–24, 25–49, 50+ years.

First VL timing was calculated as days from ART initiation to first VL test. VLs taken within 0–28 days were considered baseline VLs and excluded from analysis, as they are not part of standard monitoring and are more likely associated with re-engagement. Remaining VLs were categorised as follows: Early: 29–77 days; 3-month window: 78–112 days; Between 3 and 6 months: 113–161 days; 6-month window: 162–196 days; Late: > 196 days (within follow-up period).

VL outcomes were analysed both at the <50 copies/mL suppression threshold (in line with 2023 guidelines) and <200 copies/mL because of test reliability uncertainty below this threshold[17] and the high proportion of VLs in the 50–199 copies/mL range. Results between 200–399 copies/mL and 400–999 copies/mL were reported separately to preserve the distribution of low-level viraemia (LLV) below 1000 copies/mL.

As part of data cleaning, VL results recorded as 124 copies/mL were recoded to 49 copies/mL, as this value had historically been used in TIER.Net to capture results below the detectable limit of some assays.

DSD enrolment outcomes were restricted to clients with a first VL < 50 copies/mL and assessed relative to the earliest time at which clients could reasonably be enrolled into DSD under the applicable national ART guidelines. Before April 2020, clients became eligible for DSD 12 months after ART initiation following two consecutive VL results < 50 copies/mL. From April 2020, eligibility was reduced to 6 months after ART initiation following a single

VL < 50 copies/mL. From May 2023, the minimum time on ART requirement was removed, and eligibility depended on a single VL < 50 copies/mL with the test scheduled at 3 months post-initiation. As DSD enrolment could only occur after a qualifying VL result was available and reviewed, eligibility for DSD enrolment was assessed from the eligible VL timepoint to improve comparability across changing guideline periods.

Statistical analysis

Descriptive statistics were used to describe trends in VL timing, coverage and suppression rates, and DSD enrolment timing and coverage across the study period. All analyses were conducted using Stata v18 (StataCorp LLC, College Station, Texas, United States).

Ethical considerations

Ethical clearance to conduct this study was obtained from the he Human Sciences Research Council (HSRC) Human Research Ethics Committee (No. REC 3/22/08/18) and the Johannesburg, Sedibeng and Limpopo Research Committees. No informed consent was obtained for this secondary analysis of programme data. Data management followed organisational and legislative standards (*Protection of Personal Information Act*) to ensure appropriate use.

Results

Characteristics of people initiating antiretroviral therapy

We included 664523 individuals initiating ART between 2017 and 2023 across four South African districts, of whom 64.8% (430823) were women and 67.5% (448639) were from Johannesburg district. Primary pre- and early implementation period comparisons included 91723 ART initiators during the pre-implementation period (January 2022–April 2023), and 39084 during the early implementation period (May – December 2023). Additional characteristics are presented in Appendix 1 Table 1-A1.

Early implementation of revised first viral load timing guidance during 2023

The proportion of ART initiators with a recorded first VL during follow-up increased from 58.9% (54055/91723) during the pre-implementation period to 66.5% (25973/39084) during May – December 2023. Median time to first VL declined from 175 days (interquartile range [IQR] 146–196) during the pre-implementation period to 105 days (IQR 84–150) during May – December 2023.

The proportion of first VLs performed within the 3-month window increased from 13.5% (7302/54055) during the pre-implementation period to 51.8% (13462/25973) during May – December 2023, while the proportion performed within the 6-month window declined from 45.9% (24816/54055) to 14.3% (3704/25973) during May – December 2023. Trends in first VL completion, timing and suppression, and DSD enrolment outcomes are summarised in Table 2.

Monthly trends during 2023 are shown in Figure 2. Among ART initiators with a recorded VL during follow-up (N = 40877), the proportion of first VLs performed within the 3-month window increased from 12.6% among January ART initiators to 60.1% among December ART initiators.

TABLE 2: Trends in first viral load completion, timing and suppression, and differentiated service delivery enrolment outcomes among antiretroviral therapy initiators in four South African districts (Capricorn, Mopani, Johannesburg, Sedibeng) in the pre-implementation and early implementation (May – December) periods.

Category	Pre-implementation												Early implementation (May – December 2023)			
	2022				January – April 2023				Total							
	n	%	Days	IQR	*n*	%	Days	IQR	*n*	%	Days	IQR	*n*	%	Days	IQR
Total ART initiations	69 653	-	-	-	22 070	-	-	-	91 723	-	-	-	39 084	-	-	-
First VL recorded within follow-up period	39 151	56.2	-	-	14 904	67.5	-	-	54 055	58.9	-	-	25 973	66.5	-	-
Median time to first VL	-	-	176	154–196	-	-	173	130–196	-	-	175	146–196	-	-	105	84–150
VL timing categories among ART initiators with a recorded VL																
Early: 29–77 days	1636	4.2	-	-	637	4.3	-	-	2273	4.2	-	-	2087	8.0	-	-
3 months: 78–112 days	4825	12.3	-	-	2477	16.6	-	-	7302	13.5	-	-	13 462	51.8	-	-
3–6 months: 113–161 days	4495	11.5	-	-	2131	14.3	-	-	6626	12.3	-	-	4577	17.6	-	-
6 months: 162–196 days	18 818	48.1	-	-	5998	40.2	-	-	24 816	45.9	-	-	370	14.3	-	-
Late: > 196 days	9377	24.0	-	-	3661	24.6	-	-	13 038	24.1	-	-	2143	8.3	-	-
First VL result																
< 50 copies/mL	25 109	64.1	-	-	9802	65.8	-	-	34 911	64.6	-	-	16 742	64.5	-	-
< 200 copies/mL	33 076	84.5	-	-	12 838	86.1	-	-	45 914	84.9	-	-	22 215	85.5	-	-
200 copies/mL – 399 copies/mL	1692	4.3	-	-	515	3.5	-	-	2207	4.1	-	-	1159	4.5	-	-
400 copies/mL – 999 copies/mL	1071	2.7	-	-	353	2.4	-	-	1424	2.6	-	-	683	2.6	-	-
> 1000 copies/mL	3312	8.5	-	-	1198	8.0	-	-	4510	8.3	-	-	1916	7.4	-	-
DSD enrolment restricted to suppressed first VL < 50 copies/mL																
Enrolled in DSD within 6 months of potential eligibility	6147	24.5	-	-	3252	33.2	-	-	9399	26.9	-	-	5606	33.5	-	-
Median time to DSD enrolment	-	-	386	252–504	-	-	278	210–399	-	-	367	231–472	-	-	186	138–254

Note: Study data include people initiating ART 01 January 2017 – 31 December 2023.

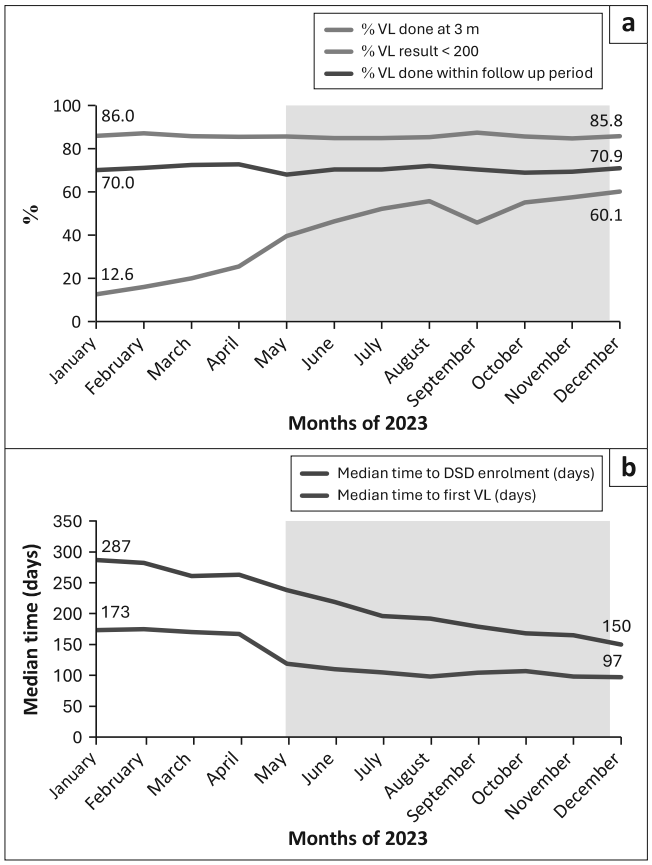
ART, antiretroviral therapy; VL, viral load; IQR, interquartile range; DSD, differentiated service delivery.

Median time to first VL declined during the year, reaching 97 days (IQR 84–120) among December ART initiators.

The proportion with VL < 50 copies/mL remained stable before and during early implementation of the revised guideline, at 64.6% during the pre-implementation period and 64.5% during May – December 2023. Similarly, the proportion with VL < 200 copies/mL remained stable at 84.9% and 85.5%, respectively. Monthly trends during 2023 also remained stable (Figure 2). Among May – December 2023 ART initiators with a recorded first VL, suppression was similar whether the first VL was performed within the 3-month or 6-month window (<200 copies/mL: 87.8% vs 86.2%; <50 copies/mL: 65.1% vs 66.9%) (Appendix 1 Table 2-A1).

Among clients with a first VL < 50 copies/mL, enrolment into DSD within 6 months of potential eligibility was 26.9% (9399/34911) during the pre-implementation period and 33.5% (5606/16742) during May – December 2023. Median time to DSD enrolment was 367 (IQR 231–472) during the pre-implementation period and 186 days (IQR 138–254) during May – December 2023.

Monthly trends showed median time to DSD enrolment declining during 2023, from 287 days among January ART initiators to 150 days among December ART initiators. Among May – December 2023 ART initiators, DSD enrolment within 6 months of eligibility was 42.3% among those with first VLs performed within the 3-month window and 21.3% among those with first VLs performed within the 6-month window; median time to DSD enrolment was 162 and 252 days from ART initiation, respectively (Appendix 1 Table 2-A1).



Note: Study location: four South African districts, Capricorn, Mopani, Johannesburg, Sedibeng, Study data includes people initiating ART 01 January 2017 – 31 December 2023.
VL, viral load; DSD, differentiated service delivery; 3 m, 3 months; < 200, < 200 copies/mL.

FIGURE 2: a) Monthly trends in first viral load timing and suppression among 2023 antiretroviral therapy initiators with a recorded viral load result during follow up (N = 40 877) and b) median time to differentiated service delivery enrolment among clients enrolled into differentiated service delivery.

Historical context: Trends in first viral load completion, timing and suppression, and differentiated service delivery enrolment (2017–2023)

As shown in Table 3, between 2017 and 2022, the proportion of ART initiators without a recorded VL result during follow-up declined from 50.1% (65592/131006) to 43.8% (30502/69653) in 2022, and further to 33.2% (20277/61154) in 2023. Among those with a recorded VL, median time to first VL remained relatively stable between 2017 and 2022, ranging from 176 to 178 days, before declining to 120 days (IQR 87–179) in 2023.

The proportion of first VLs performed within the 3-month window remained relatively stable between 2017 and 2022, ranging from 11.7% to 13.5%, before increasing to 39.0% (15939/40877) in 2023. The proportion performed within the 6-month window or later declined from 72.2% (47218/65414) in 2017 and 72.1% (28195/39151) in 2022 to 37.9% (15506/40877) in 2023.

Among ART initiators with a recorded VL, suppression improved gradually over time. The proportion with VL < 50 copies/mL increased from 54.7% (35758/65414) in 2017 to 64.1% (25109/39151) in 2022 and 64.9% (26544/40877) in 2023. At the <200 copies/mL threshold, suppression increased from 76.7% (50190/65414) in 2017 to 84.5% (33076/39151) in 2022 and 85.8% (35053/40877) in 2023. As shown in Table 3, the proportion of VL results within the 50 copies/mL – 199 copies/mL range remained similar throughout the study period, ranging from 18.3% to 23.0%.

Among clients with a first VL < 50 copies/mL, enrolment into DSD within 6 months of potential eligibility increased from 10.2% (3633/35758) in 2017 to 24.5% (6147/25109) in 2022 and 33.4% (8858/26544) in 2023. Median time to DSD enrolment declined from 937 days (IQR 680–1343) in 2017 to 386 days (IQR 252–504) in 2022 and 219 days (IQR 166–336) in 2023.

Discussion

Our retrospective analysis evaluated early implementation of revised guidance moving the first VL test from 6 months to 3 months post-ART initiation and linking DSD eligibility to this earlier suppressed VL result. During the first year of implementation, a greater proportion of ART initiators had a recorded VL during follow-up, first VL completion occurred earlier, and DSD enrolment occurred sooner, while

TABLE 3: Trends in first viral load completion, timing and suppression, and differentiated service delivery enrolment outcomes among antiretroviral therapy initiators in four South African districts, (Capricorn, Mopani, Johannesburg, Sedibeng); includes people initiating ART 01 January 2017–31 December 2023.

Category	2017				2018				2019				2020				2021				2022				2023			
	n	%	Days	IQR	*n*	%	Days	IQR	*n*	%	Days	IQR	*n*	%	Days	IQR	*n*	%	Days	IQR	*n*	%	Days	IQR	*n*	%	Days	IQR
Total ART initiations	131 006	-	-	-	110 573	-	-	-	123 876	-	-	-	91 798	-	-	-	76 463	-	-	-	69 653	-	-	-	61 154	-	-	-
First VL recorded within follow-up period	65 414	49.9	-	-	54 875	49.6	-	-	61 025	49.3	-	-	46 146	50.3	-	-	40 773	53.3	-	-	39 151	56.2	-	-	40 877	66.8	-	-
Median time to first VL	-	-	177	154–210	-	-	177	147–210	-	-	178	156–196	-	-	178	151–211	-	-	176	147–196	-	-	176	154–196	-	-	120	87–179
VL timing categories among ART initiators with a recorded VL																												
Early: 29–77 days	2666	4.1	-	-	2350	4.3	-	-	2436	4.0	-	-	1946	4.2	-	-	1697	4.2	-	-	1636	4.2	-	-	2724	6.7	-	-
3 months: 78–112 days	7760	11.9	-	-	7190	13.1	-	-	7163	11.7	-	-	5802	12.6	-	-	5490	13.5	-	-	4825	12.3	-	-	15 939	39.0	-	-
3–6 months: 113–161 days	7770	11.9	-	-	6538	11.9	-	-	7117	11.7	-	-	5591	12.1	-	-	4822	11.8	-	-	4495	11.5	-	-	6708	16.4	-	-
6 months: 162–196 days	30 161	46.1	-	-	24 626	44.9	-	-	29 264	48.0	-	-	20 592	44.6	-	-	18 860	46.3	-	-	18 818	48.1	-	-	9702	23.7	-	-
Late: > 196 days	17 057	26.1	-	-	14 171	25.8	-	-	15 045	24.7	-	-	12 215	26.5	-	-	9904	24.3	-	-	9377	24.0	-	-	5804	14.2	-	-
First VL result																												
< 50 copies/mL	35 758	54.7	-	-	30 366	55.3	-	-	35 160	57.6	-	-	28 969	62.8	-	-	26 592	65.2	-	-	25 109	64.1	-	-	26 544	64.9	-	-
< 200 copies/mL	50 190	76.7	-	-	42 972	78.3	-	-	47 641	78.1	-	-	37 611	81.5	-	-	34 057	83.5	-	-	33 076	84.5	-	-	35 053	85.8	-	-
200–399 copies/mL	4403	6.7	-	-	3291	6.0	-	-	3588	5.9	-	-	2188	4.7	-	-	1730	4.2	-	-	1692	4.3	-	-	1674	4.1	-	-
400–999 copies/mL	3433	5.3	-	-	2229	4.1	-	-	2516	4.1	-	-	1719	3.7	-	-	1368	3.4	-	-	1071	2.7	-	-	1036	2.5	-	-
> 1000 copies/mL	7388	11.3	-	-	6383	11.6	-	-	7280	11.9	-	-	4628	10.0	-	-	3618	8.9	-	-	3312	8.5	-	-	3114	7.6	-	-
DSD enrolment restricted to suppressed first VL < 50 copies/mL																												
Enrolled in DSD within 6 months of potential eligibility	3633	10.2	-	-	5009	16.5	-	-	9620	27.4	-	-	6263	21.6	-	-	4340	16.3	-	-	6147	24.5	-	-	8858	33.4	-	-
Median time to DSD enrolment	-	-	937	680–1343	-	-	771	532–1150	-	-	595	426–973	-	-	517	370–847	-	-	455	350–729	-	-	386	252–504	-	-	219	166–336

ART, antiretroviral therapy; VL, viral load; IQR, interquartile range; DSD, differentiated service delivery.

VL suppression remained stable. These findings suggest that the April 2023 guideline revisions were rapidly adopted across the four study districts.

Earlier first VL testing was accompanied by earlier transition to less-intensive care within their first year on ART. Compared with the April 2020 ART guideline revision, which was associated with an approximately 13% reduction in median time to DSD enrolment during the first year of implementation, the 2023 guideline revision was associated with a substantially larger reduction of approximately 43%, suggesting potential benefits of aligning clinical and service delivery guidance within a single integrated policy package.

Low-level viraemia (LLV, 50–199 copies/mL) remained stable at about one-fifth of clients across years. Interpretation is complicated by the reliability of VL results at these low levels, as assay performance and pre-analytical conditions (such as sample handling, transport conditions and collection or processing delays) can affect accuracy near the lower limit of quantification.[17] Some results may reflect measurement error, while others represent transient blips or delayed but improving suppression. Current guidelines exclude clients with a VL > 50 copies/mL from DSD eligibility, increasing health system burden and cost through additional clinical reviews, adherence counselling, and repeat testing, even for adherent clients. Pragmatic algorithms are needed to balance safety and efficiency. LLV in the public sector warrants further study to clarify causes and inform guideline updates.

An earlier VL may also help mitigate the risk of disengagement in the first 6–12 months, when interruptions are common.[3,4] By shortening the time to confirmed suppression, more clients may remain engaged long enough to receive their first VL result and experience the associated feedback and recognition of treatment success. This, in turn, facilitates earlier access to DSD models that reduce visit frequency and cost and increase convenience – factors known to support ongoing retention.[18,19] Although our analysis did not measure retention, these results suggest earlier VL could strengthen early outcomes. Reported national program data reinforce this: following the 2023 guideline update, VL coverage rose from 72% to 78% and 6-month suppression from 68% to 73%,[20] consistent with our findings. Earlier VL testing may also enable earlier identification of unsuppressed clients for adherence support and repeat testing, although this was not specifically assessed in the current analysis.

A study from Zambia found that patients entering DSD before 6 months had at least equivalent 18-month retention compared with later enrollers,[21] suggesting safety of earlier DSD enrolment. Most countries in the region still schedule the first VL at 6 months[22] and allow only 2–3-monthly dispensing before then, commonly delaying DSD eligibility and enrolment until around 9 months post ART initiation, once VL results are reviewed. South Africa remains unique in linking DSD eligibility directly to the 3-month VL with no additional time-on-ART requirement, providing important evidence to inform shifts in WHO and regional guidance.

From a policy perspective, these findings support full implementation of the earlier first VL timing guidance. Despite substantial improvements during 2023, one-third of ART initiators still had no recorded VL within 6 months after the recommended first VL timepoint. While a proportion of these clients may already have disengaged or unofficially transferred, this gap also highlights the need to strengthen VL completion, result capturing and availability at the 4-month review visit, and timely clinical response to results. In the broader context of constrained public-sector HIV funding, earlier VL monitoring is operationally attractive because it does not increase the number of VL tests performed, while potentially supporting earlier transition to less-intensive care. Our findings may be relevant to other high-burden, resource-constrained HIV programmes in East and Southern Africa. Many countries in the region already define DSD eligibility using higher VL thresholds (<200 copies/mL or <1000 copies/mL), which may provide additional opportunities to improve efficiencies.

This study draws on a large routine dataset covering 7 years of ART initiations across four diverse South African districts, including both urban and rural settings. The large sample size and longitudinal programme data provide an important real-world description of early implementation of revised first VL timing guidance within routine public-sector HIV care.

Limitations

Several limitations should be noted. First, missing VL data remained substantial: even in 2023, one-third of ART initiators had no recorded first VL result. Suppression estimates may therefore be overestimated if clients without recorded VLs were more likely to be unsuppressed or disengaged from care. Second, because TIER.Net does not link clients across facilities, silent transfers may appear as missing outcomes despite ongoing care elsewhere. Third, implementation occurred progressively during 2023 following national and district-level training, and implementation exposure could not be measured directly at facility level. Fourth, follow-up after guideline release was limited to the early implementation period and did not allow assessment of longer-term retention or virological outcomes. The analysis was restricted to ART initiators up to December 2023 to allow sufficient follow-up time for first VL and DSD outcomes before loss of USAID-funded district support in January 2025, which disrupted programme support and access to updated routine programme data. Finally, as an observational analysis using routine programme data, findings are subject to potential data quality limitations, incomplete reporting, and residual bias.

Future research should repeat this evaluation among clients initiating ART after the first year of implementation to assess whether outcomes continue to improve as guideline implementation strengthens, including further reductions in missing first VLs. It should also examine whether earlier identification of unsuppressed clients leads to more timely adherence support and improved longer-term outcomes.

Follow-up should be extended to 12–24 months to assess longer-term retention and viral suppression outcomes following earlier DSD enrolment. Cost-effectiveness analyses will also be important to assess potential programme efficiencies associated with earlier VL testing and earlier transition to less-intensive care. The clinical significance of LLV (50–199 copies/mL) must also be clarified to guide algorithms for counselling, repeat VL testing, and DSD eligibility. Comparative analyses across countries will be important to inform national and global recommendations on optimal VL timing and DSD entry.

Conclusion

Following implementation of revised guidance moving the first VL from 6 months to 3 months post-ART initiation and linking DSD eligibility to this earlier suppressed VL result, first VL testing and DSD enrolment occurred earlier in care, while viral suppression rates remained stable, during the early implementation period. These findings are consistent with early uptake of revised first VL timing guidance within routine programme settings. They also suggest benefits from introducing linked clinical and service delivery changes within a single policy package. Sustaining these gains will require further improvements in VL coverage, result availability and clinical action at the 4-month review visit, including timely adherence support and repeat testing for clients with elevated VLs. Further evaluations with longer follow-up are needed to assess programme efficiencies, retention and longer-term virological outcomes.

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This article is based on data from a larger study for which findings were previously presented in a published abstract and unpublished poster at the13th IAS Conference on HIV Science held in Kigali, Rwanda on 14-17 July 2025. The conference poster can be found here: https://plus.iasociety.org/sites/default/files/2025-08/e-poster_325.pdf, and the abstract here: https://onlinelibrary.wiley.com/doi/epdf/10.1002/jia2.26518. While the outputs draw on the same dataset, the present article adds seven years of historical trend data (2017-2023), monthly implementation trends during 2023, subgroup analyses linking viral load timing to DSD uptake, and a fuller interpretation of findings within the context of WHO guidance, South African policy, and regional HIV service delivery.

Competing interests

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CRediT authorship contribution

Kate Rees: Conceptualisation, Formal analysis, Project administration, Writing – original draft. Natasha Davies: Methodology, Writing – review & editing. Cara O'Connor: Project administration, Writing – review & editing. Barry Mutasa: Data curation, Writing – review & editing. Prince Dulaze: Data curation, Writing – review & editing. Lynne S. Wilkinson: Conceptualisation, Formal analysis, Writing – review & editing. All authors reviewed the article, contributed to the discussion of results, approved the final version for submission and publication, and take responsibility for the integrity of its findings.

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Data availability

The data that supports the findings of this study are available from the corresponding author, Kate Rees, upon reasonable request.

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Appendix 1

TABLE 1-A1: Characteristics of ART initiators included in the analysis across four South African districts, 2017–2023.

Category		2017		2018		2019		2020		2021		2022 & Jan – Apr 2023 (Pre-implementation)		May – Dec 2023 (Early implementation)		Total	
		n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Total ART initiations, *n*		131 006	-	110 573	-	123 876	-	91 798	-	76 463	-	91 723	-	39 084	-	664 523	-
Gender	Female	87 383	66.7	72 257	65.4	80 152	64.7	59 537	64.9	49 552	64.8	57 895	63.1	24 047	61.5	430 823	64.8
	Male	43 623	33.3	38 316	34.7	43 724	35.3	32 261	35.1	26 911	35.2	33 828	36.9	15 037	38.5	233 700	35.2
Age	< 15 years old	1 801	1.4	1 657	1.5	1 600	1.3	1 276	1.4	1 099	1.4	1 536	1.7	713	1.8	9 682	1.5
	15-24 years old	2 601	2.0	2 720	2.5	4 117	3.3	4 160	4.5	4 879	6.4	7 894	8.6	4 317	11.1	30 688	4.6
	25-49 years old	97 169	74.2	84 572	76.5	96 872	78.2	72 539	79.0	59 768	78.2	69 498	75.8	28 847	73.8	509 265	76.6
	50+ years old	29 435	22.5	21 624	19.6	21 287	17.2	13 823	15.1	10 717	14.0	12 795	13.9	5 207	13.3	114 888	17.3
District	Capricorn	16 161	12.3	11 894	10.8	11 470	9.3	8 553	9.3	8 236	10.8	9 870	10.8	4 362	11.2	70 546	10.6
	Mopani	15 479	11.8	12 600	11.4	11 573	9.3	9 062	9.9	8 055	10.5	9 305	10.1	4 173	10.7	70 247	10.6
	Johannesburg	82 872	63.3	72 577	65.6	87 620	70.7	64 678	70.5	51 889	67.9	62 786	68.5	26 217	67.1	448 639	67.5
	Sedibeng	16 494	12.6	13 502	12.2	13 213	10.7	9 505	10.4	8 283	10.8	9 762	10.6	4 332	11.1	75 091	10.6

TABLE 2-A1: Viral load suppression and DSD enrolment outcomes by first viral load timing category among May–December 2023 ART initiators with a recorded first viral load.

VL timing	Early			Three months			Between			Six months			Late			Total		
	n	%	Days	*n*	%	Days	*n*	%	Days	*n*	%	Days	*n*	%	Days	*n*	%	Days
Days	-	-	29-77	-	-	78-112	-	-	113-161	-	-	162-196	-	-	> 196	-	-	-
ART initiators with a recorded first VL	2 087	-	-	13 462	-	-	4 577	-	-	3 704	-	-	2 143	-	-	25 973	-	-
First VL < 200 copies/ml	1 671	80.1	-	11 813	87.8	-	3 814	83.3	-	3 194	86.2	-	1 723	80.4	-	22 215	85.5	-
First VL < 50 copies/ml	1 191	57.1	-	8 758	65.1	-	2 946	64.4	-	2 476	66.9	-	1 371	64.0	-	16 742	64.5	-
Enrolled in DSD within 6 months of eligibility	403	33.8	-	3 701	42.3	-	844	28.7	-	528	21.3	-	130	9.5	-	5 606	33.5	-
Median time to DSD enrolment	143	-	105-200	162	-	119-210	196	-	167-262	252	-	211-337	295	-	257-366	186	-	138-254