AIDS CARE
2026, VOL. 38, NO. 1, 61–71
https://doi.org/10.1080/09540121.2025.2564196

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Progress toward the second and third UNAIDS 95-95-95 targets among adolescents and young adults in the Ekurhuleni district, South Africa

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ABSTRACT

We investigated the progress towards the second and third 95-95-95 UNAIDS targets among adolescents and young adults (AYA) living with HIV in the Ekurhuleni district, South Africa. A total of 39,038 AYA were tested for HIV in 2018, 17.0% (95% CI: 16.6%-17.4%) tested positive, 79.5% (95% CI: 78.5%-80.5%) were aged 20-24, and the majority were females 86.8% (95% CI: 86.0%-87.6%) and of these females 33.8% (95% CI: 32.6%-35.1%) were pregnant. Antiretroviral therapy (ART) initiation rate was 81.9% (95% CI: 81.0%-82.9%) and 63% were initiated on the same day. Viral load suppression had an upward trajectory of 63%, 66%, 71%, 73%, 81%, while retention rate regressed from 67%, 63%, 62%, 60%, 56% over 12, 24, 36, 48 and 60 months. Compared to males, females achieved greater proportions while when comparing the three-age bands, AYA aged 20-24 achieved better outcomes than AYA aged 10-14 and 15-19. These findings underscore the importance of interventions focused on targeted testing and diagnosis, linkage to treatment, retention to care and viral load suppression of younger adolescents (10-14 years) and male AYA and implementation of age and gender disaggregated HIV cascade indicators tracking for this subpopulation.

ARTICLE HISTORY
Received 21 March 2025
Accepted 10 September 2025

KEYWORDS
ART; HIV diagnosis; viral load suppression

SUSTAINABLE DEVELOPMENT GOALS
SDG 3: Good Health and Well Being

Introduction

The Sustainable Development Goals (SDGs) 3 and Joint United Nations Programme on HIV and AIDS (UNAIDS) 2025 aim to enhance the health and wellness of global populations by ending AIDS as a public health threat by 2030 (Kelly et al., 2003; United Nations, 2024). In 2014, the UNAIDS introduced a fast-track strategy to reach the 2020 targets and surpass the 90-90-90 targets, aiming for 95-95-95 by 2030 (Marsh et al., 2019; Joint United Nations Programme on HIV/AIDS (UNAIDS), 2024a; Joint United Nations Programme on HIV/AIDS (UNAIDS), 2024b; UNAIDS, 2023). The UNAIDS target aims for 95% of the people living with HIV (PLHIV) to know their status, those diagnose receive antiretroviral treatment (ART), and those receiving ART to achieve be viral load suppression (Joint United Nations Programme on HIV/AIDS (UNAIDS), 2024a; Joint United Nations Programme on HIV/AIDS (UNAIDS), 2024c). Modeling studies suggest that reaching these objectives may reduce the incidence of new infections to a point where the HIV/AIDS epidemic could be managed by 2030 (Marinda et al., 2020).

In South Africa, the progress toward the targets for people aged 15 years and older was 90%-91%-94%, that for females was 92%-91%-83%, and that for males was 85%-90%-70% (Human Sciences Research Council, 2024). Furthermore, the progress in Gauteng Province is lower than that of the rest of South Africa, at 89%-61%-87% (Low, 2020). Unfortunately, these estimates are not stratified by age groups, which is problematic for tracking progress for populations like adolescents and young adults (AYA) living with HIV. Younger adolescents aged 10–14 are included in children's reports, which is 0–14 years age band, and older adolescents and young adults 15–24 years old are included in the adult population, which is defined as 15 years and older (Human Sciences Research Council, 2024). AYA require special consideration as they struggle across the HIV care cascade (Chapman et al., 2019). As we approach 2030, monitoring gaps in 95-95-95 progress is essential (Ali & Yirtaw, 2019; Jonnalagadda et al., 2021; Van Wyk et al., 2020),

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particularly in South Africa, where HIV burden is high (Stover et al., 2021). This study investigates progress toward achieving the second and third UNAIDS 95-95-95 targets in the Ekurhuleni district, South Africa. We further compute the evaluation of retention in care and viral load suppression of AYA five years after ART initiation.

Methods

Design and population

We conducted a secondary data analysis of AYA living with HIV who received HIV care and treatment between January and December 2018 in the Ekurhuleni district, South Africa.

Study population

Adolescents and young adults aged 10–24 years residing in the Ekurhuleni health district, Gauteng Province, South Africa.

Study setting

Records of all AYA living with HIV aged 10–24 years who were tested and diagnosed with HIV in Ekurhuleni clinics and hospitals from January to December 2018 were included. The Ekurhuleni district is the second largest of Gauteng Province's five districts in terms of the ART program. The district has 93 primary healthcare facilities, of which 11 are 24-hour service facilities. In addition, one district, four regional and one tertiary hospital and 21 chronic medication pick-up points are located within communities (Department of Corporative Governance and Traditional Affairs, 2024a). A data extraction tool was designed to solicit data from Tier.net (Three Interlinked Electronic Registers) through the district's Health Management Information Systems department. Tier.net is an electronic patient management system used for monitoring and evaluating HIV care and treatment programs in government health facilities throughout South Africa (Osler & Boulle, 2024). The system was designed as part of a 3-tier approach to implement a complete electronic medical record system. Tier.net forms the second tier, whereby patients' paper clinical records are entered into a non-network computer at the health facility and transferred periodically to a subdistrict, district, provincial and, ultimately, national databases according to requirements (Osler & Boulle, 2024). The variables included demographic baseline data, baseline and outcome measures. To determine the proportion of AYA retained at each step of the cohort.

Statistical analysis

Descriptive analysis was used to summarize cohort characteristics and basic demographics, such as sex, age groups (Ali & Yirtaw, 2019; Chapman et al., 2019; Department of Corporative Governance and Traditional Affairs, 2024a; Department of Corporative Governance and Traditional Affairs, 2024b; Farley et al., 2022; Gona et al., 2020; Haghighat et al., 2021; Jonnalagadda et al., 2021; Levi et al., 2016; Low, 2020; NDOH South Africa, 2024; Osler & Boulle, 2024; Shah et al., 2022; Stover et al., 2021; Van Wyk et al., 2020), established HIV testing, HIV positivity, ART initiation, retention in care, and viral load suppression rates. Categorical variables are summarized using frequencies and proportions. We determined the percentage of individuals who advanced through specific stages of the cascade by dividing the number of participants who experienced relevant outcomes by the number who had completed the previous step. The ratio of individuals starting ART was determined by dividing the number of people reaching event two by the number reaching event one. We computed the results for the entire cohort and age and sex disaggregated category. The traits examined were the ART regimen, CD4 cell count, viral load, and World Health Organization (WHO) stage of HIV disease. Retention and viral load suppression rates were calculated over five years. The viral load suppression was defined as the proportion of ART users who achieved HIV-1 RNA <1000 copies/ml. All analyses were conducted via Stata 18 Statistical Software: STATA/SE 18.1 (Stata Corp, College Station, TX).

Results

Cohort characteristics

In 2018, a total of 39,038 AYA were tested for HIV, of whom 6,627 (17.0%) tested positive (95% CI: 16.6%–17.4%). The age distribution of HIV-positive AYA skewed toward older youth, the mean age of the AYA was 20.8 years, with 79.5% (95% CI: 78.5%–80.5%) aged 20–24 years and most 86.8% (95% CI: 86.0%–87.6%) were adolescent girls and young women (AGYW). Among those that were diagnosed with HIV, 81.9% (95% CI: 81.0%–82.9%) had initiated antiretroviral therapy (ART). At ART initiation, 83.3% (95% CI: 82.6%–84.4%) of HIV-positive AYA were classified as WHO clinical Stage I. Baseline CD4 counts among HIV-positive AYA showed that 31.6% had ≥500 cells/mm^3, 24.7% had 200–349 cells/mm^{3}and 23.9% had 350–499 cells/mm^3 and the median CD4 count was 380 cells/mm^3 Among HIV-positive females, 33.8% (95% CI: 32.6%–35.1%) were pregnant at ART initiation and of these (83%) were 20–24 years old (Table 1).

Initiation of ART

Among the 6627 diagnosed AYA, 81.9% (95 CI: 81.0%–82.9%) were initiated on ART. Of all AYA who were initiated, 3,421 (63%) were initiated on the same day, whereas 1,325 (20%) were initiated within 7 days of diagnosis (Figure 1).

Retention in care

Only 67% of the AYA who were initiated on ART remained in care after the first year of ART initiation while by the end of 2023 56% AYA remained in care. This retention rate was reported at 12, 24-, 36-, 48- and 60-months post-initiation on ART and the rate proportion declined year-on-year (Figure 2).

Viral load suppression

Six months after initiating ART, the viral load of 3 614 (86%) AYA was monitored. Of these patients, 2 059 (57%) were virally suppressed. The viral load suppression rates were 63%, 66%, 71%, 73%, and 81% at 12, 24, 36, 48, and 60 months, respectively. The viral load suppression rates improved over the 5-year period but the 95% target was not reached. The viral suppression was defined as HIV-1 RNA <1000 copies/ml (Figure 3).

Progress toward the second and third 95 targets

Among the 6627 AYA who were HIV positive, 81.9% were initiated on ART in 2018, and 81% had a suppressed viral load in 2023. The progress across the second and third targets differed based on sex and age.

Table 1. Descriptive summary of key variables of AYA living with HIV in Ekurhuleni district, South Africa.

Variable	Category	Frequency (n)	%	95% CI
Total tested	–	39,038	100%	–
HIV positive	–	6,627	17.0%	16.6%–17.4%
Sex	Female	5,754	86.8%	86.0%–87.6%
	Male	873	13.2%	12.4%–14.0%
Age group (years)	10–14	212	3.2%	2.8%–3.7%
	15–19	1,144	17.3%	16.4%–18.2%
	20–24	5,271	79.5%	78.5%–80.5%
ART initiation	Yes	5,430	81.9%	81.0%–82.9%
	No	1,197	18.1%	17.1%–19.0%
WHO Stage at ART initiation	Stage I	4,457	83.3%	82.5%–84.4%
	Stage II	617	11.5%	10.8%–12.2%
	Stage III	210	3.9%	3.5%–4.0%
	Stage IV	67	1.3%	1.1%–1.6%
Baseline CD4 (cells/mm^3)	< 200	848	19.8%	18.6%–21.0%
	200–349	1,056	24.7%	23.4%–26.0%
	350–499	1,024	23.9%	22.6%–25.2%
	≥ 500	1,355	31.6%	30.2%–33.1%
Pregnant at ART start (female)	Yes	1,946	33.8%	32.6%–35.1%

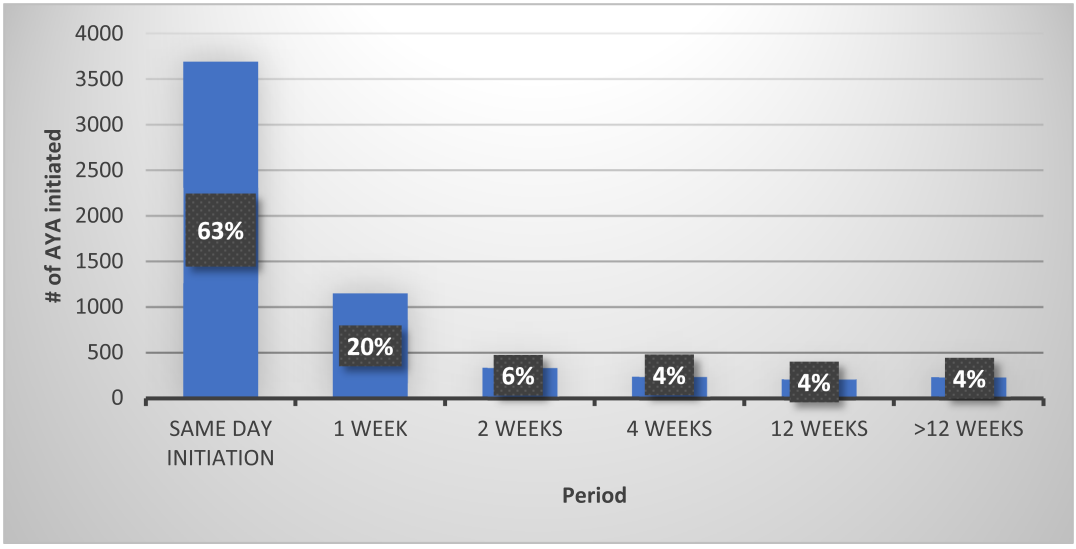

Figure 1. Time interval between HIV diagnosis and antiretroviral treatment (ART) initiation of AYA diagnosed with HIV in 2018 in the Ekurhuleni district, South Africa.

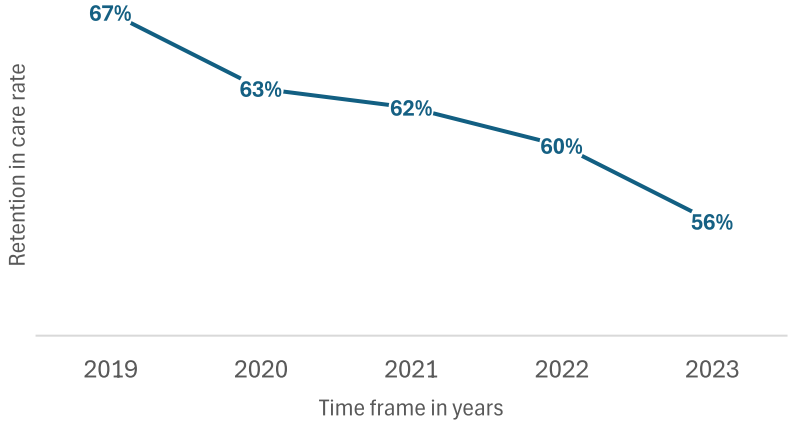

Figure 2. Retention in care rate between 2018 and 2023 of AYA initiated on ART in 2018 in the Ekurhuleni district, South Africa.

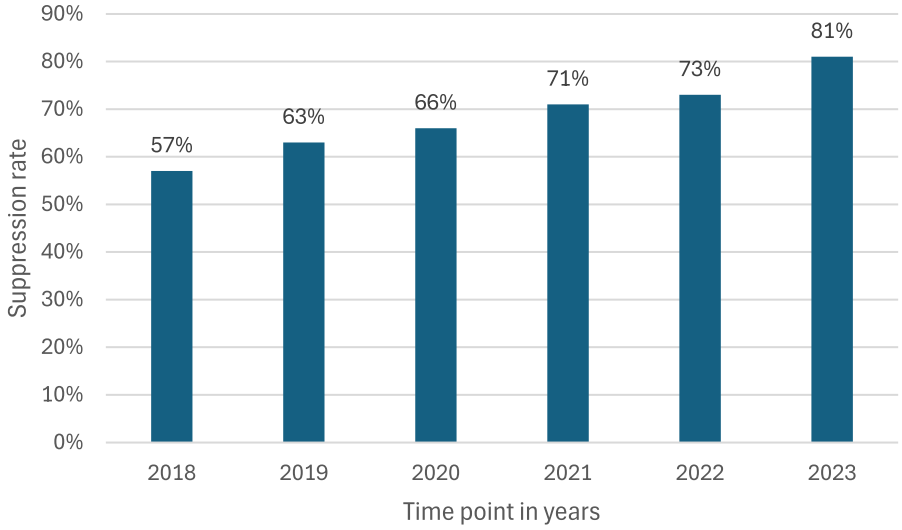

Figure 3. Viral load suppression rate over five years of AYA initiated on ART in 2018 in the Ekurhuleni district, South Africa.

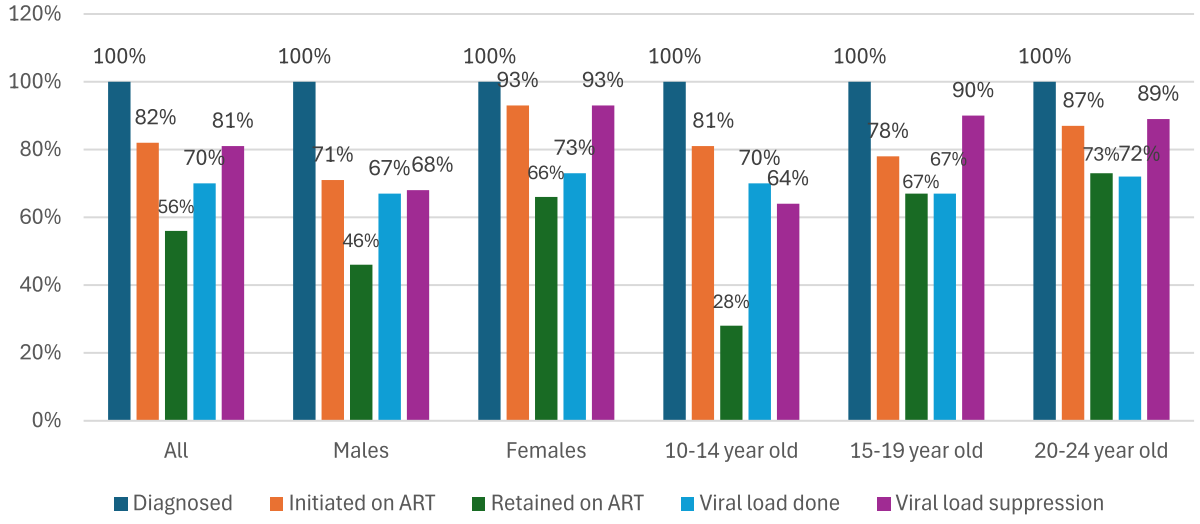

Figure 4. Progress toward the second and third UNAIDS 95-95-95 targets by age and gender, using the 2018 cohort data of AYA in the Ekurhuleni district, South Africa.

Compared to males, females accounted for greater proportions of the sample; this trend was seen across the second and third 95: 71% vs 93% initiated, 46% vs 66% retained and 68% vs 93% virally suppressed. When comparing the three-age bands, the young adults (Department of Corporative Governance and Traditional Affairs, 2024b; Farley et al., 2022; Gona et al., 2020; NDOH South Africa, 2024; Shah et al., 2022) seemed to have better outcomes, and the progress improved with age. Progress towards the second 95 by age was 81% vs 78% vs 87%, retention in care was 28% vs 67% vs 73%, while progress towards the third 95 did not differ between the 15–19 and 20–24-year-old, 64% vs 90% vs 89% (Figure 4).

Discussion

The UNAIDS 95-95-95 HIV care and treatment cascade has been widely used to monitor patients' health among various populations to identify progress, subgroups at greater risk and key gaps in care at critical stages of care, from HIV testing to ART initiation and viral suppression (Haghighat et al., 2021; Levi et al., 2016). These UNAIDS 95-95-95 targets are ambitious but feasible. They have already been achieved in seven SSA countries and some population groups (Farley et al., 2022). The Ekurhuleni district has progressed towards attaining the UNAIDS HIV treatment cascade targets.

In the present study, 39 038 AYA were tested for HIV, and 6627 were diagnosed with HIV. Among those who were diagnosed with HIV, 81.9% were initiated on ART, 56% remained in care, and 81% were virally suppressed 60 months after initiation. Many AYA remain undiagnosed, diagnosed but not receiving ART or receiving ART but not achieving viral load suppression. The WHO defines advanced HIV disease as a CD4 cell count <200 cells/mm^3 or WHO stage 3 or 4 disease in adults and adolescents (Gona et al., 2020). In this study, the proportion of AYA with advanced HIV disease was relatively low, and they were all initiated on ART. This finding suggests that these AYA accessed care very late, with significant risk of morbidity and mortality especially in a setting where HIV/AIDS- and TB-related conditions were recorded as the greatest causes of death among AYA aged 15–24 years (Department of Corporative Governance and Traditional Affairs, 2024b).

We found that most of the AGYW entered the HIV care and treatment through the prevention of mother-to-child transmission program, now known as vertical transmission prevention, which might explain a substantially higher proportion of AGYW than ABYM. Over one-third (35%) of the AGYW were pregnant when they were diagnosed with HIV and initiated on ART. This likely affected the behavior of this cohort regarding linkage, retention, and viral load suppression. In the South African public health-care setting, for instance, pregnant women should be tested at every visit, and those who test HIV positive are initiated on ART and have their viral loads monitored more frequently than the general population (NDOH South Africa, 2024). This might have played a positive role in the initiation of ART; however,

negatively affected retention and viral load suppression over time, and this was consistent with existing studies (Nuwagaba-Biribonwoha et al., 2018; Ross et al., 2018; Shah et al., 2022) and in particular the study conducted in Democratic Republic of Congo showed that pregnant women were twice as likely to be lost to follow-up (Ross et al., 2018).

We observed that 82% of AYA with known status were on treatment, consistent with a previous Sub-Saharan Africa study reporting 84% ART initiation (Gerber et al., 2024), but lower than that reported by Payne et al. (96.2%), and higher than the 70% and 55% reported by Grobler et al. and Marinda et al. (Grobler et al., 2017; Marinda et al., 2020; Payne et al., 2023). These discrepancies are likely due to the variations in AYA age bands analyzed in each study; for example, Payne et al. analyzed data of AYA aged 15–24 years only. These findings show that AYA are yet to achieve their second 95 target. Among AYA that were diagnosed 34% delayed initiation by up to more than 12 weeks although the 2015 WHO guidelines recommend that patients be initiated on ART regardless of CD4 count and clinical stage and where possible, starting ART on the same day the positive HIV result is obtained (Filiatreau et al., 2023; Gerber et al., 2024; Republic of South Africa National Department of Health & World Health Organisation, 2024). Although in our study the factors that are associated with ART start delays are not clear due to limitations in data, literature has recorded that presence of contra-indication, patients with high CD4 cell count were more likely to delay ART initiation than those with low CD4 cell count (Tao et al., 2023), presence of opportunistic infections and having other chronic diseases (Berihun et al., 2023; Kesselring et al., 2019), lack of family support and involvement in the AYA's healthcare, and AYA that does not have other HIV-positive family member (Berihun et al., 2023).

Notably, this cohort had a worryingly low retention rate of 67%, 63%, 62%, 60%, 56% over 12, 24, 36, 48 and 60 months, respectively. On the 60th month, the retention was worse for younger adolescents (10–14 years) 28% and male AYA 46%. Natural attrition is expected over time in HIV care and treatment cascades how in our case the attrition is extremely exaggerated. These gaps depict a leaky cascade as AYA subpopulation continues to face challenges with retention in care after treatment initiation (Hallett & Eaton, 2013). Retention in care overtime reported in a South African study was 68.6%, 50.5% and 36.4% at 4, 12 and 24 months, respectively (Van Wyk et al., 2020), while the Namibian study reported 97.7%, 94.1%, 92.4%, 90.2%, and 84.6% at 6, 12, 18, 24 and 36 months respectively (Munyayi & van Wyk, 2023). Although these studies reported varied rates with one reporting much lower rates over 24 months and the other much higher rates over 36 months, the downward trajectory is still noted. The lack of knowledge on ART benefits and the importance of medication adherence, younger age, insufficient support from biological parents/caregivers and family support may lead to subsequent poor retention in care (Evans et al., 2013; Munyayi & van Wyk, 2023; Okonji et al., 2023). Interestingly, van Wyk and colleagues reported results contrary to ours. They found that younger adolescents (10–14 years) demonstrated better retention in care, because they depend on their caregivers to handle their treatment journey and clinic visits (Van Wyk et al., 2020).

Viral load suppression was defined as viral load <1000 copies/ml. The findings of the study were 57%, 63%, 66%, 71%, 73%, 81% at 6, 12, 24, 36, 48, 60 months which are a cause for concern. In another study, the viral load suppression levels were 84.1%, 77.4% and 68.8% at 4, 12 and 24 months, respectively (Van Wyk et al., 2020), and seemed to regress over time while the current study trend is progressive (Hlophe et al., 2025; Mushy et al., 2024). These findings indicate an upward positive trajectory, and this seems to be consistent with the previous studies that reported that AYA who had been on ART for longer period were more likely to achieve viral load suppression than those that have been on treatment for a shorter duration (Elashi & van Wyk, 2022; Giordano et al., 2007; Yehia et al., 2014). This suggests that the longer the AYA remains in care the higher the chance of achieving viral load which might mean they have dealt with barriers that affect adherence to treatment, have a better understanding of treatment literacy and benefits of ART and have acquired better self-management skills (Rakhmanina et al., 2024). However, our results contradicted those of Nglazi and colleagues who found that it is the young adults (20-24 years) who had worse virological outcomes when compared to those in younger adolescents (10-19 years) and adults (≥ 25 years) (Nglazi et al., 2012).

Our findings highlight that male AYA and younger adolescents (10–14 years) experience worse HIV outcomes than female AYA and older adolescents (Anglemyer et al., 2020; Fox et al., 2010; Haber et al., 2016; Mills et al., 2014; Slogrove & Sohn, 2018). They were the least diagnosed, they have lower ART initiation,

retention in care and even lower viral load suppression rates. These factors are a threat to the progress toward the UNAIDS targets and SDGs to end the HIV pandemic by 2030 (Gleeson et al., 2018). To prevent onward transmission to partners and children, starting and remaining on treatment and achieving viral load suppression becomes essential as AYA grow and develop into adults and enter child-bearing age (Hallett et al., 2011; A. B. Kharsany et al., 2012; Tarantino et al., 2020). New initiatives must specifically be designed to reach these subpopulations by being tailor-made and targeted so that AYA are diagnosed before they develop advanced HIV disease, are initiated on ART promptly, achieve retention and viral load suppression (Cornell et al., 2017; Staveteig et al., 2017; Takuva et al., 2017). The strategies should include community-based services, in-facility AYA-friendly services, and psychosocial support for retention in care, which should be provided in collaboration with parents/guardians, peers and importantly, the AYA should be involved in developing and implementing these strategies. It is also recommended that more attention should be given to monitoring and analyzing the HIV cascade of this priority population (Beima-Sofie et al., 2023; Gleeson et al., 2018; Kay et al., 2016; A. B. M. Kharsany et al., 2012).

Limitations

Several limitations should be considered when interpreting these findings. The analysis relied on secondary routinely collected electronic health record data, which may be subject to missingness and data quality issues due to inadequate clinical documentation of the source documents. Notably, baseline CD4 cell count data were missing for a substantial proportion of AYA. The study was conducted in a single district, and findings may not be generalizable to other settings with different healthcare access, service delivery models, or sociocultural dynamics. While the data were collected prior to the COVID-19 pandemic, which introduced notable shifts in HIV care service delivery, the findings remain valuable for understanding the progress made. Despite these limitations, the study leverages a large cohort of AYA living with HIV and provides valuable evidence on the progress toward the second and third 95, which can inform programmatic responses and policy development in similar high-burden settings.

Conclusion

Our analysis revealed that the Ekurhuleni district, South Africa, has made progress toward achieving the UNAIDS 95–95–95 targets. However, there is still a long way to go before reaching these targets, particularly among AYA. This cohort of AYA did not meet the second and third targets. Achieving these targets is feasible but requires custom interventions to meet the unique requirements of AYA. Monitoring and analyzing the HIV treatment cascade framework is essential. It involves age-disaggregated tracking services from HIV diagnosis, ART initiation, and retention in care to viral suppression of this subpopulation. Targeted HIV testing, diagnosis and linkage to treatment strategies for ABYM and the younger adolescents aged 10–14 years are required.

Abbreviations

ABYM, Adolescent boys and young women; AGYW, Adolescent girls and young women; AHD, Advanced HIV disease; ART, Antiretroviral therapy; AYA, Adolescent and young adults; CD4, Cluster of Differentiation 4; SABSSM VI, Sixth South African National HIV Prevalence, Incidence, and Behavior survey; SDG, Sustainable Development Goals; Tier.net, Three Interlinked Electronic Registers; UNAIDS, Joint United Nations Programme on HIV/AIDS; WHO, World Health Organization.

Acknowledgements

PS was involved in conceptualization, collected and analyzed data of the study and wrote the initial draft manuscript. AM and CY conceptualized the study, verified the data analysis, critically reviewed and revised the manuscript and final approval for publication. All authors contributed to the interpretation of the results and critically reviewed and edited the manuscript. PS revised the manuscript and took responsibility for its submission for publication.

Author contributions

CRediT: **Patricia Silinda:** Conceptualization, Formal analysis, Methodology, Visualization, Writing – original draft, Writing – review & editing; **Clarence Yah:** Supervision, Writing – review & editing; **Alfred Musekiwa:** Conceptualization, Supervision, Validation, Writing – review & editing.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

The author(s) reported there is no funding associated with the work featured in this article.

Ethics approval and consent to participate

Data collection commenced after full ethical clearance from the University of Pretoria Faculty of Health Sciences Research Ethics Committee (HREC), Ethics reference no. 505/2023 dated 12 September 2024 approved the protocol, and the Ekurhuleni Health District Research Committee, reference no. NHRD GP No. 202311_015 dated 27/11/2023, granted approval for the study to be conducted. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki**.** The participants were aged 18 years or older and were briefed about the purpose of the study, confidentiality of their information and written informed consent prior to participation. All study participants signed informed consent before participating in the study.

Data availability statement

The data that support the findings of this study are available from the Ekurhuleni district Health Management Information Systems (HMIS). Restrictions apply to the availability of this data and require relevant channels, as enacted by HMIS. The first author can be contacted to assist with the contact details of the head of HMIS.

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