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Timing and Predictors of Initiation on Antiretroviral Therapy Among Newly–Diagnosed HIV–Infected Persons in South Africa

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Abstract

Despite a decade of advancing HIV/AIDS treatment policy in South Africa, 20% of people living with HIV (PLHIV) eligible for antiretroviral treatment (ART) remain untreated. To inform universal test and treat (UTT) implementation in South Africa, this analysis describes the rate, timeliness and determinants of ART initiation among newly diagnosed PLHIV. This analysis used routine data from 35 purposively selected primary clinics in three high HIV-burden districts of South Africa from June 1, 2014 to March 31, 2015. Kaplan–Meier survival curves estimated the rate of ART initiation. We identified predictors of ART initiation rate and timely initiation (within 14 days of eligibility determination) using Cox proportional hazards and multivariable logistic regression models in Stata 14.1. Based on national guidelines, 6826 patients were eligible for ART initiation. Under half of men and non-pregnant women were initiated on ART within 14 days (men: 39.7.0%, 95% CI 37.7–41.9; women: 39.9%, 95% CI 38.1–41.7). Pregnant women initiated at a faster rate (within 14 days: 87.6%, 86.1–89.0). ART initiation and timeliness varied significantly by district, facility location, and age, with little to no variation by World Health Organization stage, or CD4 count. Men and non-pregnant women newly diagnosed with HIV who are eligible for ART in South Africa show suboptimal timeliness of ART initiation. If treatment initiation performance is not improved, UTT implementation will be challenging among men and non-pregnant women. UTT programming should be tailored to district and location categories to address contextual differences influencing treatment initiation.

Keywords

South Africa; Universal test and treat; HIV/AIDS; Antiretroviral therapy; Time to initiation

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Conflict of interest All authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

Introduction

Over the last decade, South Africa has made great strides in HIV/AIDS treatment policy that have resulted in encouraging gains in management of HIV/AIDS burden. After introducing HIV antiretroviral therapy (ART) in 2004, South Africa achieved a rapid increase in the number of people living with HIV (PLHIV) on ART from just over 48,000 in 2004 to 3.5 million by 2015 with aggressive adoption of increasingly-inclusive guidelines for eligibility to ART [1, 2]. These efforts were rewarded with reductions in HIV incidence and mortality, as well as leveling of HIV prevalence at about 18% in the general adult population [1, 3]. Despite these gains, over half of the 6.4 million PLHIV [4] remain uninitiated on vital treatment [5]. South Africa remains the country with the highest number of PLHIV and accounts for 18% of the global HIV/AIDS burden [5].

To address the persisting HIV/AIDS epidemic in South Africa and beyond, the Joint United Nations Program on HIV/AIDS (UNAIDS) set the “90:90:90” global target in 2014 aiming to ensure that by 2020, 90% of all PLHIV know their HIV status, 90% of those diagnosed with HIV infection receive sustained ART, and 90% of all people receiving ART are virally suppressed [6]. Following the establishment of this target, the World Health Organization (WHO) released updated ART treatment guidelines in June 2016. These guidelines encourage the adoption of Universal Test and Treat (UTT), thus offering ART to all PLHIV regardless of clinical stage or CD4 count [7].

Before September 2016, South African national ART guidelines mandated that PLHIV with CD4 count below 500, WHO stage 3 or 4, tuberculosis (TB) co-infection, or Hepatitis B Virus (HBV) co-infection start ART [8]. Under WHO recommended Option B+ for prevention of maternal-to-child transmission (PMTCT), all pregnant and breastfeeding women in South Africa were mandated to start ART beginning in December 2014 [9, 10]. In accordance with WHO ART guidelines for Universal Test and Treat and in moving toward achievement of the UNAIDS 90:90:90 target, the South African government adopted UTT beginning in September 2016 [11].

With the implementation of UTT in South Africa, it is necessary to understand the current status and timing of ART initiation among those eligible to inform targeted programming. An understanding of ART initiation timing and factors associated with timeliness under the pre-UTT care guidelines can be used to illuminate areas for improvement when implementing UTT. As such, we sought to identify factors associated with timeliness among a cohort of eligible South Africans newly diagnosed with HIV.

Numerous factors contribute to timing of engagement with the health system in Sub-Saharan Africa. Factors regarding access to the health facility such as distance from the health facility or type of health facility often predict timing of care in Sub-Saharan African settings, with those living farther from health facilities presenting later to care than those living closer to health facilities [12–15]. Further, factors concerning the health system affect timing of care. For instance awareness of drug and supply stock outs, perceived low quality of care, and high cost of services relative to a patient’s income influence delays in seeking and receiving care from the health system [14, 16]. Finally, characteristics of the patients

themselves are often highly predictive of timely initiation. Across Sub-Saharan Africa, women are more likely to initiate care in a timely manner than men, adolescents and young adults have been shown to seek timely care more than older adults, and individuals with higher income levels are more likely to seek care with timeliness than those with lower income levels [13–15, 17–20]. Studies similar to ours regarding timing of ART initiation in Sub-Saharan African (SSA) countries identified factors such as gender, age, location of residence, location of care facility, CD4 count, WHO stage, and TB co-infection as associated with timing of ART initiation. In these examples, women, adolescents and young adults, those living closer to a facility, those with a lower CD4 count, a lower WHO stage, and those uninfected with TB were more likely than their counterparts who were male, older adults, living farther from a health facility, with a higher CD4 count, a higher WHO stage, and co-infected with TB to initiate ART [13, 15, 19–24].

The present analysis describes the rate of ART initiation and prevalence of timely initiation from the point of ART eligibility determination among newly diagnosed PLHIV in three districts of South Africa. We utilize data regarding facility and individual-level factors to describe influencers on timing of ART initiation. This information can be used to inform improved implementation of UTT programming within South Africa to achieve 90:90:90 targets.

Methods

Population and Setting

The present analysis utilized routine program data collected within 35 purposively selected primary health care clinics selected from three high HIV burden districts of South Africa. These districts—Gert Sibande, uThukela, and the City of Johannesburg—were selected based on prevalence of HIV, HIV positivity rate, and quality of clinical data available for extraction during the data collection period. Selection was performed in consultation with the national, provincial, and district health authorities. We extracted data from the clinical registers and medical records of all patients aged 15 years and above (in accordance with HIV counseling and testing (HCT) guidelines) newly-diagnosed as HIV-positive between June 1, 2014 and March 31, 2015.

Patients were determined to be eligible for initiation on ART based on pregnancy status, TB co-infection status, designation as WHO stage 3 or 4, or a qualifying CD4 result (350 cells/μL or below in 2014 and 500 cells/μL or below in 2015) [8]. The present analysis included those who were at least 15 years or older, were eligible for initiation on ART during the clinical assessment period, had gender information available, and had relevant date information for eligibility determination.

Data Collection

Researchers collected socio-demographic and clinical information such as age, gender, pregnancy status, clinical screening, and laboratory monitoring services, as well as relevant dates for clinical assessment using a standardized case record form. The earliest available dates of eligibility determination and ART initiation were used to measure rate of ART

initiation and prevalence of timely ART initiation. For those who qualified due to their CD4 result we used the date that CD4 results were provided to the clinic from the laboratory as indicated in the patient file. For those who qualified due to TB co-infection we used the date TB treatment was initiated. South African national guidelines indicate that TB co-infected patients should be started on TB treatment prior to initiation on ART, thus date of TB treatment initiation describes entry into ART care [8]. For this analysis we defined the date of ART care initiation as the date of TB treatment initiation among TB co-infected persons. For those who qualified due to a determination of WHO stage 3 or 4 we used the date that WHO staging was determined. For pregnant women, date of diagnosis was used to measure timely initiation of ART. If any of these dates were unavailable due to incompleteness of patient records or clinical registers, the earliest available date indicating eligibility was used. We defined date of ART initiation as the date the first dose of ART was collected. If this was not available, we used the earliest date indicating the patient had begun ART care, such as date of completing ART readiness assessment.

Timely initiation on ART was defined in accordance with South African ART guidelines entitling eligible patients to initiate ART within 14 days of eligibility determination. Based on South African ART guidelines, timely initiation on ART was defined more specifically for those qualifying for “fast-tracking” (CD4 count ≤ 350 cells/μL (if diagnosed in 2014) or CD4 count ≤ 500 cells/μL (if diagnosed in 2015), WHO stage 4, pregnant, TB co-infected or CD4 count < 50 cells/μL) as initiation within 7 days of eligibility determination per national guidelines [8].

Data Analysis

For this analysis we selected independent factors a priori that we suspected would influence rate and timeliness of initiation on ART based on examination of the literature from similar studies conducted in SSA [21–23]. These studies described differences in timing of ART initiation by gender, age, location of residence, location of care facility, CD4 count, WHO stage, and TB co-infection. Studies describing other aspects of HIV care and treatment within South Africa also highlight differences in achieving care and treatment measures across these factors [25–27]. To describe the study population, we calculated frequencies of patient characteristics.

The present analysis focused on assessing three aspects of ART initiation. First, we used Cox Proportional Hazards analysis to assess time to ART initiation overall and stratified by gender and pregnancy status. Second, we estimated cumulative probability of ART initiation by 60 days post-eligibility determination, both overall and stratified by key indicators, using Kaplan–Meier survival curves. Finally, we identified predictors of ART initiation rate and predictors of timely ART initiation using a Cox proportional hazards model and multivariable logistic regression model, respectively.

Variables that were significant at 5% based on log-rank tests were included in the Cox proportional hazards model. Similarly, variables significant at 5% in bivariate analysis were included in the multivariable logistic regression model. We performed tests and plotted graphs based on the Schoenfeld Residuals to test the proportional hazards assumption. Covariates upheld the proportional hazards assumption except age, CD4 level, WHO stage,

and TB co-infection, thus these were treated as time-varying covariates. We pooled data for men and women after models fitted separately by gender and pregnancy status revealed very similar results across all variables. All analyses were performed in Stata 14.1.

Ethical Consideration

The protocol for the surveillance project from which this analysis emanated was approved by the Associate Director for Science at the United States Centers for Disease Control and Prevention, Division of Global HIV/AIDS and Tuberculosis and by the Research Ethics Committee at the School of Health Sciences and Public Health at the University of Pretoria. Howard University also obtained relevant permissions from the national and the respective provincial departments of health of South Africa.

Results

Study Population Characteristics

From 12,413 newly-diagnosed HIV-positive persons identified in the selected facilities, 6826 (54.9%) were included in this analysis because they were deemed eligible for ART initiation during the clinical assessment period and had information on gender and date of eligibility determination. Most of the study population (N = 6826) were women (n = 4757, 69.7%) and about 40% of women were pregnant at the time of HIV testing (n = 1969, 41.4%). About 22% of the population was between 15 and 24 years old, with about 42.7% within the 25–34 age group. Cases were evenly distributed across the three study districts with Gert Sibande representing the highest proportion (39.6%). About 60% of the study population were diagnosed in facilities located in Urban Townships (63.6%) (Table 1).

Most of the population was determined to be eligible for ART based on CD4 result (58.0%). Over three quarters (76.3%) of eligible men were eligible based on CD4 result, while CD4 result and pregnancy status were seen at almost equal proportions among women (CD4 result: 48.6%, pregnancy status: 41.4%). TB co-infection was the qualifier for a small proportion of the population (5.0%), and was a more common qualifier among men (9.0%) than women (3.2%).

Time to ART Initiation and Timeliness of ART Initiation

Among the overall study population, half were initiated on ART within 14 days after eligibility was determined (53.6%, 95% confidence interval (CI) 52.4–54.8%) and three quarters were initiated within 60 days after eligibility was determined (75.5%, 95% CI 74.5–76.5). Overall, almost all of those eligible (98.1%) were eventually initiated on ART. The median time to ART initiation was 12 days (Interquartile range 1, 59 days) (Table 2).

When stratified by gender, women displayed a higher rate of ART initiation than men (Fig. 1). When women were further stratified by pregnancy status, however, the results indicate that pregnancy accounts for this differential in ART initiation rate such that non-pregnant women and men show very similar patterns in ART initiation rates (Fig. 2).

About 40% of men and non-pregnant women were initiated on ART within 14 days of eligibility determination (men: 39.7.0%, 95% CI 37.7–41.9; women: 39.9%, 95% CI 38.1–

41.7) and nearly 70 percent within 60 days (men: 69.7%, 95% CI 67.8–71.7; women: 68.3%, 95% CI 66.6–70.1). The median time to ART initiation was 22 days (range 7–60) among eligible men and non-pregnant women. Pregnant women were initiated at a much faster rate, with 82.1% (95% CI 80.4–83.8) initiated on the date of HIV diagnosis, 87.6% (95% CI 86.1–89.0) initiated within 14 days, and 91.7% (95% CI 90.4–92.8) initiated within 60 days of HIV diagnosis. The median time to ART initiation among pregnant women was 1 day (IQR 1–1) (Table 2).

Predictors of ART Initiation and Timely ART Initiation

No difference was detected in ART initiation or timeliness between men and non-pregnant women. Pregnancy among women was the strongest predictor of ART initiation and of timely ART initiation. Pregnant women were three times more likely than non-pregnant women to be initiated on ART (hazard ratio (HR) 3.1, 95% CI 2.9–3.4) and had over ten times the odds of being initiated within 14 days of eligibility determination (odds ratio (OR) 11.9, 95% CI 9.8–14.5) (Table 3). Those co-infected with TB had 60% lower odds of timely ART care initiation (OR 0.37, 95% CI 0.28–0.50).

Compared with patients in other groups those aged 15–24 had greater likelihood of ART initiation (age 25–34 years, HR 0.90, 95% CI 0.83–0.97; age 35–44 years, HR 0.80, 95% CI 0.72–0.88; age 45 years and over, HR 0.67, 95% CI 0.58–0.77), but no significant difference in timely ART initiation.

Variation in ART initiation and timely ART initiation was detected by facility location with those diagnosed in facilities in rural and urban suburbs less likely to initiate ART (rural, HR 0.76, 95% CI 0.69–0.84; urban suburbs, HR 0.89, 95% CI 0.82–0.97) and with even lower odds of timely ART initiation (rural, OR 0.55, 95% CI 0.44–0.67; urban suburbs, OR 0.80, 0.68–0.94) than their counterparts diagnosed in facilities in urban townships. Results also revealed variation in achievement of ART initiation and timely ART initiation by facility district. Those diagnosed in facilities in Johannesburg were less likely to initiate ART and had lower odds of timely initiation than those in uThukela (HR 0.72, 95% CI 0.65–0.78; OR 0.32, 95% CI 0.26–0.39). Those diagnosed in Gert Sibande versus uThukela also had lower ART initiation in both measurements (HR 0.85, 95% CI 0.78–0.92; OR 0.63, 95% CI 0.53–0.75).

Patients who presented with illness at eligibility determination and were deemed WHO stage 3 had higher ART initiation compared to those deemed WHO stage 1 (HR 1.17, 95% CI 1.05–1.30), while those deemed WHO stage 4 showed lower odds of timely initiation than WHO stage 1 patients (OR 0.57. 95% CI 0.39–0.82).

Higher achievement of ART initiation was seen among patients with extremely low CD4 count (< 50 cells/μL) compared to those with CD4 results above 500 cells/μL (HR 1.22, 95% CI 1.04–1.43), yet we did not detect difference in ART initiation rate by other CD4 level.

Discussion

Study Population Characteristics

Results concerning the characteristics of our study population were consistent with expectations based on other analyses of routine program data in South Africa. As seen in South Africa as well as Kenya and Rwanda, a higher proportion of HIV-positive women than men were eligible for ART initiation at presentation to care based on national guidelines [4, 21, 22]. The age distribution with a large proportion of the study population falling in adolescent and young adult age category (ages 15–24) also follows the age distribution of those seeking HCT in South Africa as well as the bulge in this age category within the general population of South Africa [4, 28]. Our finding that among those eligible for ART initiation a higher proportion of men than women were TB co-infected is similar to other studies that found a gender differential with higher TB and HIV co-infection in men than women [29].

Time to ART Initiation and Timeliness of ART Initiation

The current analysis shows that half of those eligible for ART initiation at presentation to care were initiated on ART within 14 days of eligibility determination, indicating a need for improvement. By 60 days post eligibility determination, three quarters of those eligible for ART initiation were initiated. In similar studies conducted in sub-Saharan African settings, similar proportions of newly-diagnosed HIV-positive persons were initiated within 60–90 days of eligibility [21–23].

The onset of UTT, which entitles all HIV-positive persons to ART initiation upon receipt of a positive result, may cause an increase in the proportion of HIV-positive persons initiated on ART within 14 days. Conversely, UTT policy will increase the proportion of HIV-positive persons requiring ART initiation which, in turn, may increase the burden on health care facilities and thus decrease the proportion of those eligible that the health system is able to initiate in a timely manner [30]. The current status of time to ART initiation must be considered as South Africa anticipates the effects of UTT on timely initiation and on 90:90:90 targets.

Current literature and analyses focus on gender differentials in health seeking behavior and linkage and retentionin the HIV care cascade in Southern Africa as a threat to achieving UNAIDS 90:90:90 targets [25, 26, 31]. Our findings further display the gender differential among newly-diagnosed PLHIV and ART initiation seen in similar studies [15, 20, 32]. Apart from differences explained by the underlying higher HIV prevalence in women versus men [4], gender differences in health seeking behavior for HIV care are likely influenced by targeted PMTCT programs for pregnant women. When we stratified time to ART initiation by pregnancy status in addition to gender, we were able to isolate the contributions of pregnancy on timeliness among female PLHIV. Examined alone, pregnant women initiate ART at a much higher rate than the rest of the population, while men and non-pregnant women initiate at the same low rate.

These stratified results have three important interpretations. First, results from the general population without the effects of pregnant women highlight the magnitude of low and non-

ideal timing of ART initiation in South Africa. We observed that men and non-pregnant women determined to be eligible for ART were initiated at very low rates. If South Africa is to achieve 90% of diagnosed PLHIV receiving sustained ART by 2020 as targeted by UNAIDS, implementation of UTT programming must specifically address barriers to ART initiation experienced by men and non-pregnant women. By nature of the present study which collected data through chart review, we were unable to specifically assess such barriers without further information beyond clinical data. However other studies conducted in Sub-Saharan Africa indicate low levels of health literacy, stigma associated with HIV, low quality of care, and geographical and transportation barriers as deterrents to timely ART initiation [14, 16].

Second, we clearly observe that pregnant women initiate ART at a much greater proportion and timeliness to the general population. As such, gender differentials in ART initiation and timeliness are likely explained by both the desire to protect the infant from HIV transmission as well as effective messaging of targeted Option B+ programming encourage ART initiation for PMTCT. In studies describing attitudes and behaviors of pregnant women participating in PMTCT programs, women indicate their positive feelings about initiating ART to ensure the health of their child [33, 34]. Successful linkage to treatment among pregnant women has been attributed to Option B+ programming by other studies [13, 35]. A study conducted in Cameroon found that late initiation to ART was significantly higher in hospitals without PMTCT programs [13], highlighting the role of PMTCT in encouraging timely initiation. The HIV care and treatment community in South Africa should carefully examine the messages and implementation methods that contribute to the success of the PMTCT program to identify replicable modalities to increase timely ART initiation among men and non-pregnant women [36].

Finally, our findings suggest that achievement and time-liness of ART initiation is similar among non-pregnant women and men populations, despite the fact that other behaviors regarding HIV care and treatment such as attendance to HIV testing [37] and overall ART enrollment [35, 38] differ markedly between men and women. Based on this observation, we suggest that further research should be done to identify whether UTT could be messaged and promoted to men and non-pregnant women using a unified approach. While efforts to encourage uptake of HIV testing and care enrollment have been proposed and implemented in a gendered approach [37], this study identifies that potentially for timely ART initiation one overall approach may be successful if the underlying causes of these essentially identical low and untimely ART initiation rates are similar across men and non-pregnant women.

Predictors of ART Initiation and Timely ART Initiation

Examination of predictors of ART initiation and timeliness also revealed important implications for UTT programming in South Africa. As expected based on the differential in ART initiation timeliness among pregnant women versus other groups, pregnancy had the strongest effect on achievement and timeliness of ART initiation likely due to the targeted programming of Option B+ which operates as UTT for pregnant PLHIV [36, 39]. While not affecting timeliness of ART initiation, age influenced rate of ART initiation with adolescents

initiating at a faster rate than adults of all ages. Similar studies in sub-Saharan Africa saw no variation in timeliness of ART initiation by age [21, 22]. While the present analysis is limited in scope to explain the differences in timeliness by age, this is likely partially explained by the high proportion of pregnant women falling in the 15–24 age category. Further, HIV programming in South Africa is increasingly focused on engaging adolescents and young adults in care and treatment [40].

Those described as WHO stage 4 showed lower odds of timely initiation than those with WHO stage 1. This is in line with expectations as WHO stage 4 indicates poor health, thus delays in initiation may be due to individuals being too ill to reach a health facility to initiate ART. However little variation was seen in ART initiation among patients by CD4 level or WHO staging. Similar results were seen in studies conducted in Kenya and Rwanda which found little or no variation in ART initiation WHO staging, however these studies saw variation by CD4 count category [21, 22]. It appears that prioritization for treatment initiation among HIV-positive persons is not currently occurring at a significantly different rate based on CD4 level within the selected facilities we studied in South Africa.

Differentials in ART initiation and timeliness were evident by district and facility location. Data regarding location and context is limited to factors captured from patient records, therefore our ability to explain these geographical and contextual differences with the present data is limited. However, district level analyses of routine data conducted in South Africa indicate similar trends in health care access within other health services and delineated by these districts and location categories [41]. UTT programming must be tailored by district and location category to address geographical and contextual differences influencing achievement and timeliness of treatment initiation.

Patients co-infected with TB and HIV had lower odds of timely initiation, which was similarly found in another study from South Africa [24]. According to national ART guidelines, TB co-infected patients should be initiated on ART as soon as possible within 2–8 weeks after initiation of TB treatment—thus the lag time to ART initiation is likely per this recommendation. UTT programming should specifically target patients co-infected with TB and HIV to ensure that these extremely ill patients are initiated on treatment as soon as it is clinically appropriate to do so to ensure optimal health outcomes [42]. Findings from this analysis have implications for implementation of UTT in South Africa. Consideration of these results emanating from routine program data may strengthen the planning, implementation, and ongoing performance monitoring of the UTT program.

Limitations

The results of this study are not generalizable across South Africa, as the facilities analyzed were selected purposively and intra-site clustering was not accounted for in the analysis. The representativeness of our findings, therefore, is limited to the facilities from which data were collected and may not represent patterns of ART initiation in other contexts across South Africa. Data were extracted from routine patient data, thus completeness and quality are limited by the data completeness and quality maintained in each facility. Patients who may have died or were lost to follow up were assumed to have contributed time for the duration

of the survival analysis since we did not have event or date information for death or defaulting.

Conclusions

Many South Africans newly-diagnosed as HIV-positive and eligible for initiation on ART are failing to be initiated per national guidelines, indicating that the change in policy toward UTT is not enough to ensure timely ART initiation on a population level. Results suggest that South Africa must optimize implementation of UTT specifically in male and non-pregnant female populations. Programming should be tailored to district and location categories to address contextual differences influencing treatment initiation. Overall, our findings indicate that much work remains in implementing UTT in South Africa to ensure that those in the greatest need for ART receive timely treatment.

With continued efforts to improve data quality and completeness, utilization of existing routinely collected program data can inform UTT guidelines, programming, and implementation in order to improve achievement and timeliness of treatment initiation among HIV-positive persons in South Africa.

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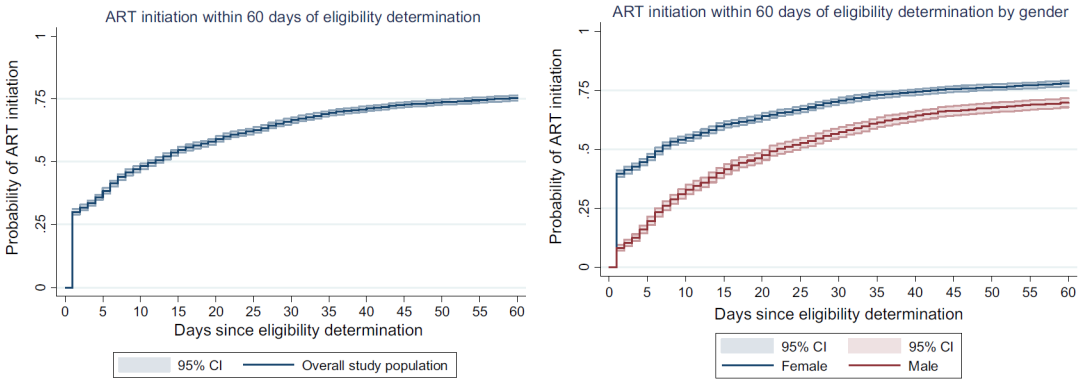

Fig. 1.

Cumulative probability of ART initiation among newly-diagnosed PLHIV from day of eligibility determination by gender

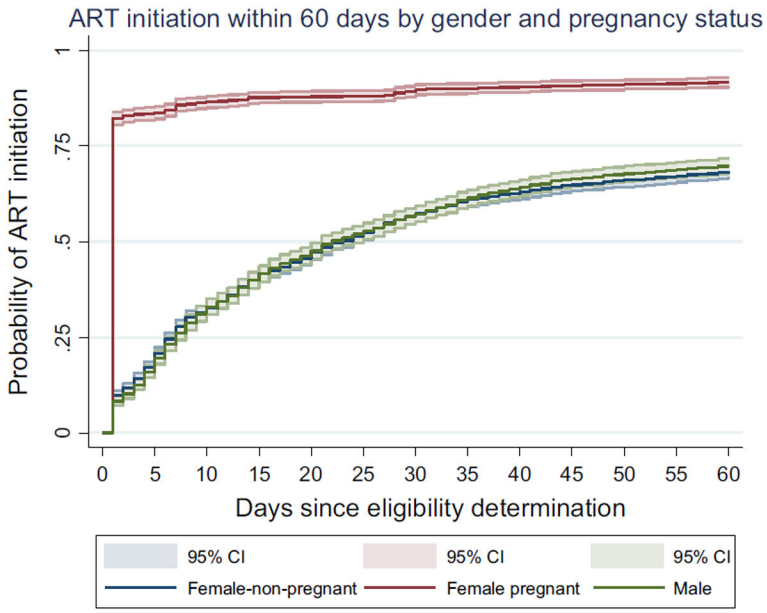

Fig. 2.

Cumulative probability of ART initiation among newly-diagnosed PLHIV from day of eligibility determination by gender and pregnancy status

Table 1

Baseline characteristics of the study population of newly-diagnosed PLHIV eligible for ART enrollment (N = 6866)

Characteristic	Study population N = 6826		Women n = 4757		Men n = 2069	
	n	%	n	%	n	%
Gender						
Women	4757	69.69				
Men	2069	30.31				
Age category						
15–24	1520	22.27	1350	28.38	170	8.22
25–34	2915	42.70	2090	43.94	825	39.87
35–4	1554	22.77	880	18.50	674	32.58
> 45	837	12.26	437	9.19	400	19.33
Median age	30	IQR 25–38	29	IQR 24–35	35	IQR 29–2
District						
uThukela	2157	31.60	1454	30.57	703	33.98
Johannesburg	1967	28.82	1433	30.12	534	25.81
Gert Sibande	2702	39.58	1870	39.31	832	40.21
Facility location						
Urban township	4340	63.58	3118	65.22	1240	59.47
Rural	1091	15.98	724	15.14	379	18.18
Urban inner city	197	2.89	149	3.12	48	2.30
Urban suburb	1198	17.55	790	16.52	418	20.05
Qualified for fast tracking per national guidelines[a]						
No	2470	36.19	1558	32.75	912	44.08
Yes	4356	63.81	3199	67.25	1157	55.92
CD4 result (cells/jiL)						
> 500	611	8.95	561	11.79	50	2.42
351–500	1147	16.80	908	19.09	239	11.55
201–350	2107	30.87	1469	30.88	638	30.84
50–200	2037	29.84	1185	24.91	852	41.18
< 50	557	8.16	282	5.93	275	13.29
Not applicable (NA)/do not know (DK)	367	5.38	352	7.40	15	0.72
WHO stage						
WHO stage 1	3187	46.69	2497	52.49	690	33.35
WHO stage 2	1231	18.03	764	16.06	467	22.57
WHO stage 3	736	10.78	374	7.86	362	17.50
WHO stage 4	153	2.24	82	1.72	71	3.43
NA/DK	1519	22.25	1040	21.86	479	23.15
TB Co-infection						
No	5562	81.48	3966	83.37	1596	77.14

Characteristic	Study population		Women		Men	
	N = 6826		n = 4757		n = 2069	
	n	%	n	%	n	%
Yes	346	5.07	161	3.38	185	8.94
NA/DK	918	13.45	630	13.24	288	13.92
Pregnant (among women only)						
No			2469	51.90		
Yes			1949	40.97		
NA/DK			339	7.13		
Eligibility determination qualifier						
CD4 result	3889	56.97	2311	48.58	1578	76.27
Pregnant	1969	28.85	1969	41.39	0	0
WHO stage	630	9.23	324	6.81	306	14.79
TB coinfected	338	4.95	153	3.22	185	8.94

[a]The National Consolidated Guidelines for the Prevention of Mother-to-Child Transmission of HIV and the Management of HIV in Children, Adolescents, and Adults of South Africa (2015) indicated that PLHIV who were pregnant, had a CD4 count below 500, were WHO stage 3 or 4, had tuberculosis (TB) co-infection, or had Hepatitis B Virus (HBV) co-infection qualified for “fast-tracking” to ART initiation

Table 2

ART initiation among those determined eligible upon presentation to care

	Total (N = 6826)			Women (pregnant) (n = 1949)			Women (not pregnant) (n = 2808)			Men (n = 2069)		
	Number (n)	**%**	**95% confidence interval (CI)**	**n**	**%**	**95% CI**	**n**	**%**	**95% CI**	**n**	**%**	**95% CI**
Cumulative probability of ART initiation (all)												
Day 1	2058	30.15	29.08–31.25	1598	81.99	80.25–83.66	292	10.40	9.33–11.59	168	8.12	7.02–9.38
Day 7	2997	43.91	42.74–5.09	1668	85.58	83.98–87.10	791	28.17	26.54–29.87	538	26.00	24.17–27.95
Day 14	3658	53.59	52.41–54.78	1706	87.53	86.02–88.95	1130	40.24	38.45–42.08	822	39.73	37.66–1.87
Day 30	4543	66.55	65.43–67.67	1747	89.64	88.23–90.94	1615	57.51	55.69–59.35	1181	57.08	54.96–59.22
Day 60	5152	75.48	74.45–76.49	1786	91.64	90.35–92.81	1923	68.48	66.76–70.19	1443	69.74	67.76–71.71
Average time to ART initiation [Median, (IQR or range)]	12 (IQR 1–59)			1 (IQR 1–1)			22 (range 6–60)			22 (range 7–60)		
	Total (n = 4375)			Women (pregnant) (n = 1949)			Women (not pregnant) (n = 1258)			Men(n = 1164)		
Cumulative probability of ART initiation (qualified for fast tracking per national guidelines, n = 4356)												
Day 1	1817	41.71	40.26–43.19	1598	81.99	80.25–83.66	125	10.00	8.46–11.80	94	8.12	6.69–9.85
Day 7	2317	53.19	51.72–54.68	1668	85.58	83.98–87.10	340	27.20	24.82–29.76	309	26.71	24.26–29.36
Day 14	2676	61.43	59.99–62.88	1706	87.53	86.02–88.95	493	39.44	36.79–42.21	477	41.23	38.45–4.12
Day 30	3143	72.15	70.82–73.48	1747	89.64	88.23–90.94	708	56.64	53.91–59.40	688	59.46	56.65–62.30
Day 60	3461	79.45	78.24–80.64	1786	91.64	90.35–92.81	852	68.16	65.57–70.73	823	71.13	68.50–73.72
Average time to ART initiation (Median, (IQR))	6 (IQR 1–37)			1 (IQR 1–1)			24 (range 7–60)			21 (range 7–60)		

Table 3

Determinants of time to ART initiation and timely ART initiation within two weeks post-eligibility N = 6866)

Characteristic	ART initiation study population			Timely ART initiation logistic regression model		
	Adjusted hazard ratio	95% confidence interval (CI)	p value	Adjusted odds ratio	95% CI	p value
Gender						
Women, non-pregnant	1.00			1.00		
Women, pregnant	3.12	2.87–3.38	< 0.0001	11.92	9.81–14.52	< 0.0001
Men	0.98	0.91–1.05	0.511	0.97	0.85–1.10	0.636
Age category						
	1.00			1.00		
25–34	0.89	0.83–0.97	0.005	0.93	0.79–1.09	0.351
35–44	0.79	0.72–0.88	< 0.0001	0.94	0.79–1.13	0.519
> 45	0.67	0.58–0.77	< 0.0001	0.91	0.74–1.12	0.372
District						
uThukela	1.00			1.00		
Johannesburg	0.72	0.65–0.79	< 0.0001	0.32	0.26–0.39	< 0.0001
Gert Sibande	0.85	0.78–0.92	< 0.0001	0.63	0.53–0.75	< 0.0001
Facility location						
Urban township	1.00					
Rural	0.76	0.69–0.84	< 0.0001	0.55	0.44–0.67	< 0.0001
Urban inner city	1.02	0.86–1.21	0.874	0.93	0.65–1.33	0.697
Urban suburb	0.89	0.82–0.97	0.008	0.80	0.68–0.94	0.006
CD4 result						
> 500	1.00			1.00		
351–500	1.10	0.99–1.23	0.124	1.15	0.87–1.52	0.332
201–350	1.11	0.99–1.24	0.088	1.17	0.89–1.52	0.255
51–200	1.02	0.91–1.15	0.95	1 22	0.93–1.60	0.143
< 50	1 22	1.04–1.43	0.026	1.84	1.34–2.52	< 0.0001
Not applicable (NA)/do not know (DK)	1.04	0.88–1.24	0.785	1.24	0.86–1.79	0.240
WHO stage						
WHO stage 1	1.00			1.00		
WHO stage 2	1.07	0.99–1.16	0.109	0.97	0.84–1.13	0.712
WHO stage 3	1.17	1.05–1.30	0.007	0.86	0.71–1.05	0.141
WHO stage 4	0.99	0.80–1.21	0.907	0.57	0.39–0.82	0.003
NA/DK	0.38	0.33–0.44	< 0.0001	0.23	0.19–0.27	< 0.0001
TB co-infection						
No	1.00			1.00		
Yes	0.92	0.79–1.06	0.282	0.37	0.28–0.50	< 0.0001
NA/DK	0.89	0.77–1.04	0.163	0.75	0.61–0.91	0.004