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Evaluation of rapid antiretroviral initiation strategy in a cohort of newly diagnosed people living with HIV in Panama, 2018–2019

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Authors contribution

JPAE, AAR and REM conceived the research idea and study design. JPAE, AAR and XMSS analyzed the data, and wrote this manuscript. DRD, FD, AM, REM, LRC, NV, GAM, ABA provided a critical revision of this studýs results and participated in the preparation for this manuscript draft.

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No potential conflict of interest was reported by the author(s).

Disclaimer

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Abstract

Antiretroviral therapy (ART) has been adopted as a form of HIV treatment and prevention. This study assesses rapid ART initiation using clinical outcomes such as viral load (VL) and CD4+ T lymphocytes count. Over the course of one year, the progress of newly diagnosed people living with HIV who started ART early in a hospital in Panama City was followed. The evaluation of early initiation of ART in achieving viral suppression (VL <200 copies/ml) was analyzed using descriptive statistics. Additionally, the cost difference between early (first 7 days) and late initiation of ART was evaluated from the perspective of the service provider. In total, 209 people were followed up during the study; 85% were male, 70% started ART on same day from hospital arrival, 80% had suppressed viral load at 6 months, and the median count of CD4 increased from 285 (IQR: 166–429) to 509 (IQR: 373–696) over 12 months. Starting ART early led to a 42% increase for the provider in terms of staffing costs; however, the clients had the opportunity to decrease absenteeism in daily activities. The results reveal that early initiation of ART generates clinical and economic benefits for the person in treatment.

Keywords

Healthcare and well-being; antiretroviral therapy; HIV; early initiation; partnerships for the goals; reduced inequalities

Introduction

The Human Immunodeficiency Virus (HIV) is a major public health problem throughout the world. In response, the Joint United Nations Programme on HIV and AIDS (UNAIDS) set the 95-95-95 targets to achieve a 95% reduction in new HIV infections by 2030 (UNAIDS, 2015). According to the most recent Latin American HIV cascade data from 2022, 85% of all people living with HIV know their status, 72% of these are on antiretroviral therapy (ART), and 66% are virally suppressed (VL < 1000 copies/ml), respectively (UNAIDS, 2024). Despite continued efforts, the inability to achieve the set targets is due to factors such as insufficient linkage of newly diagnosed cases to care and treatment clinics and low ART initiation rates (Crabtree-Ramírez et al., 2020; Piñeirúa et al., 2015).

Based on 2022 data from UNAIDS, it was estimated that in Panama there are 29,000 people living with HIV, of which approximately 24,000 (82.8%) know their diagnosis, and of these, around 19,000 (79.2%) are on ART. Furthermore, of those receiving treatment, 17,000 (89.5%) people are on viral suppression. In addition, Panama registered a HIV prevalence rate in adults between 15 and 49 years of 1.0 (0.9–1.1). Added to this, in that year, it was estimated that there were around 1400 (1200–1600) new infections (UNAIDS, 2024).

The World Health Organization (WHO) guidelines recommend universal ART initiation for all newly diagnosed people living with HIV regardless of CD4 count and rapid initiation of ART (Rapid ART model) within the first 7 days of diagnosis (WHO, 2017). However, gaps

persist in Latin American countries that delay early initiation of ART (Belaunzarán-Zamudio et al., 2020; Rodrigues et al., 2021).

Early initiation of ART is important not only to achieve the goals proposed by UNAIDS, but also to improve the life expectancy of people living with HIV (Katz & Maughan-Brown, 2017; Nakagawa et al., 2012). Delaying ART initiation can have psychosocial consequences, as newly diagnosed individuals often experience prolonged periods of depression or anxiety (Remien et al., 2019); thus, the challenge of early initiation of ART is not only limited to expediting the care process.

It is well known that HIV imposes a significant economic burden on society (Ortblad et al., 2013). This has led to efforts in developing new treatments and in the way in which they are applied to reduce the potential costs of caring for people in treatment, reduce transmission, reduce the number of clinical visits and improve morbidity and mortality indicators (Koenig et al., 2017; Labhardt et al., 2018; Lebelonyane et al., 2018; Rosen et al., 2016). In this order, it is important to evaluate treatment start alternatives that lead to potential benefits.

At the Santo Tomás Hospital, prior to implementing the Rapid ART model, the main service provision model related treatment initiation was the Universal or standard care model, which required that the person diagnosed with HIV visits the clinic multiple times (3–5 appointments), attend multiple counseling sessions /advice, and undergoes laboratory tests. Once all these activities have been carried out, ART is finally started. This whole process can take between 1 and 3 months. On the other hand, the rapid treatment initiation model executes the aforementioned activities in the first 7 days (WHO, 2017).

This study presents an evaluation of the Rapid model and a comparison of the personnel costs between executing the Universal model and implementing the Rapid model to initiate ART in newly diagnosed people living with HIV in Panama.

Materials and methods

Study design, population, and setting

The present study carried out the follow-up of a cohort of newly diagnosed people living with HIV (persons who did not know their HIV status and were diagnosed with HIV) who started ART under the Rapid model (initiation of first-line ART within 7 days of HIV diagnosis) independent of disease stage during the period 1 February 2018 to 31 January 2019. The study population consisted of newly diagnosed residents living with HIV of Panama aged 18 years or older who registered for care at Hospital Santo Tomás in Panama City, Panama. Many of these individuals in this study were referred from other outpatient services diagnosing HIV to Hospital Santo Tomás, which is the largest public reference center for Ministry of Health with 4387 HIV patients to 2018. National HIV guidelines of 2016, described the initiation of ART independently of VL or CD4 count, nevertheless, rapid initiation of ART is defined as within 7 days of HIV diagnosis (WHO, 2017).

Variables

The data used for this study was collected from the hospital's electronic medical records that contain information on the visits that people made to the site. Within the information obtained, sociodemographic data, laboratory tests and antiretroviral treatments used were extracted. Regarding the laboratory data, participants who initiated antiretroviral therapy (ART) had their viral load measured at baseline, and then at 1, 6, and 12 months after starting ART. Similarly, their CD4+ T-lymphocyte counts were assessed at the initiation of ART, and then again at 6 and 12 months. In addition, information on staff salaries was collected through the Hospital's transparency portal and financial data from the Universidad del Valle de Guatemala, which supported the recruitment of some staff.

Analysis of the evaluation of the rapid model

To assess the impact that the Rapid model had on the cohort, we analyzed the outcomes including time to initiate ART, viral load and CD4 count, and viral suppression status (VL < 200 copies/ml). People receiving treatment under the Rapid ART model had their initial viral load and CD4 measurements taken at the Hospital. Subsequent measurements were conducted months later as part of the clinical indicator follow-up. Specifically, the follow-up viral load measurements were taken at 1, 6, and 12 months; However, the follow-up measurements of CD4+ T lymphocytes were only conducted at 6 and 12 months.

Using follow-up measurements of VL and CD4 counts, we examined the progression of the percentage of individuals receiving ART who achieved viral suppression. Additionally, using other descriptive statistics such as measures of central tendency and dispersion, the progression of viral load and CD4 values was evaluated to analyze patterns in these measurements.

Analysis of costs

A description and comparison of the personnel costs incurred to initiate ART under the Universal and Rapid models were carried out. For this, a retrospective cost analysis was executed from the perspective of the service provider to estimate the costs of both models.

For the analysis, the care algorithms of both the Universal and Rapid models were considered. Figure 1 shows the number of visits required for a person to initiate ART: under the Universal model, a person would initiate ART by the third visit, while under the Rapid model, a person would do so on the first or second visit (7 days later). The Rapid model expanded certain services such as social work, mental health, and specimen delivery to improve the quality and efficiency of the provided service. As a result, processes such as pharmacy (dispensing of antiretrovirals) and laboratory sample collection and processing were performed at the first medical visit. Therefore, the differences between the models for initiating ART included a reduction in the number of visits required to start ART, the time between visits, the expansion of personnel to provide additional services, and the redistribution of medical services throughout the visits.

Hospital Santo Tomás did not substantially change the services provided when moving from the Universal to the Rapid model. Services such as medical or nursing care, collection and

processing of samples for VL and CD4, payment for services at the cashier, and the total quantity of antiretrovirals dispensed in the pharmacy remained the same. Thus, this analysis focuses on the human resources that needed to be added or removed to provide services such as social work, mental health, and sample shipping.

To estimate personnel costs, the salaries of positions such as nurses (nursing assistant and mental health nurse), cashiers, doctors, laboratorians (medical technologist and laboratory assistant), messengers, social workers, pharmacists and receptionists that were involved in the Universal and Rapid care models, were taken into account (see Figure 1). Furthermore, it was assumed that personnel worked full-time for 21 days per month and were fully dedicated to the initiation of treatment, and the times for services provided in both algorithms did not vary, i.e., times for sample collection and processing, times to pay the cashier for care, times to provide a medical consultation, times to deliver medications, and times for other services were the same between the care models. Based on these assumptions, the operating cost in both models was calculated as follows: the daily operating cost was calculated by dividing the total monthly cost by the number of working days and the annual cost was calculated multiplying the total monthly cost by 12 months.

Additionally, the patient's potential savings were expressed through the opportunity costs (potential lost income) that implied starting ART early. For this, we considered the number of visits required to initiate ART according to the care algorithm (see Figure 1), the country's 2019 legal minimum salary, assumed 21 full-time working days per month, and considered the fact that client spends a whole day missing from work. By dividing the minimum salary by the working days and multiplying it by the required visits to initiate ART, the opportunity cost was obtained. Finally, the comparison of opportunity costs between care models was conducted in a similar manner as the costs of initiating ART.

The costs shown in this work represent the number of human resources employed during a given month. All costs are recorded in the local currency, which will be reported later in US dollars using an average of the 2020 exchange rate, which was 1 USD = 1 PAB.

Ethical considerations

This study was approved by the Research Bioethics Committee of the Gorgas Commemorative Institute for Health Studies on 24 July 2019. Because de-identified data extracted from medical records were used, the Bioethics Committee determined that the use of anonymized data posed minimal risk to the participants and that the scientific and social value of the study outweighed any potential risk, and therefore approved the conduct of the research without the need to obtain informed consent.

Results

Sociodemographic characteristics

In total, 204 people received ART at the Santo Tomás Hospital from 1 February 2018 to 31 January 2019 under the Rapid ART model. This number represents about 11.3% of the 1800 new infections reported in 2018 nationwide (UNAIDS, 2024). Most of the people

who received care were men (85.3%); 48.0% self-identified as heterosexual; approximately 89.2% were of mixed race and had at least a primary or secondary education degree; and around 57.4% declared having a formal job. In addition, the median age was 28 years (IQR: 23–25 years). More details are found in Table 1.

Rapid model analysis

During the follow-up period, measurements were not available for all patients. However, the observed trend in viral suppression within the first 6 months showed a significant increase, rising from 0 to 80.4% (Table 2).

People on treatment started ART regardless of CD4+ T cell count. Overall, people followed up improved their CD4 count from baseline to 12 months, with average CD4 counts of 319 and 534 cells/ml (Table 2, Figure 2).

Data on the start time of ART and the administered ARV scheme is shown in Table 3. Most of the cases (71.1%, 145/204) complied with the period established in the Rapid model, starting ART on same day from hospital arrival. In general, the most prescribed ARV treatment regimen for patients was the first line for 2018 (Tenofovir/Emtricitabine/Efavirenz), which was prescribed (99.0%, 202/204) of the time.

Analysis of costs

In general, the annual cost of providing services to initiate ART was higher in the Rapid ART model in comparison with the Universal model, with total costs of US$279,284 and US$196,740, respectively (Table 4). This increase of costs (42%) was due to the increase in care capacity (new hires) at the clinic, which is understood as an increase in clinical services. Specifically, mental health and social work services were included in the Rapid mode ART, which led to addressing social issues related to HIV acquisition. On the side of the person in treatment, there were also savings in opportunity costs. Indeed, the productivity loss was reduced due to opting for the Rapid ART model. This was because the user only needed 1–2 visits to start ART. In monetary terms, assuming a legal minimum salary per month of USD$300 for the patient (Presidencia de la República de Panamá, 2019), who works 21 days a month and who misses the whole day due to medical appointments, the opportunity cost of starting ART with the Rapid model was USD$14–USD$29 versus USD$43 for the Universal model. Using the Rapid model in a person in treatment meant a reduction of 33–67% of the opportunity cost if the Universal model was used (Table 4).

Discussion

HIV/AIDS is in the top 20 leading causes of death in Panama (Institute for Health Metrics and Evaluation, 2023). Ensuring that diagnosed people receive treatment would reduce mortality and would aim to meet one of the pillars of the UNAIDS 95-95-95 programmatic goals for the year 2030.

In late 2015, the WHO recommended that all people living with HIV should start ART regardless of their disease status and CD4+ T cell count (Eholié et al., 2016). For 2017, the

WHO recommended starting ART within the first 7 days after confirmed HIV diagnosis, and even recommended starting ART on the same day if possible (World Health Organization, 2021). These recommendations have caused HIV treatment policies to change in many countries.

Given the aforementioned recommendations, this paper studied the clinical and economic consequences of implementing for the first time a care model to provide early ART to newly diagnosed people living with HIV in Panama. Logistical changes were made in the activities of the Universal care model to carry out the transition to the Rapid model. The main change consisted of bringing together more services to be offered in the first visit that the patient would make.

As in other studies (Pilcher et al., 2017), one of the main characteristics to be analyzed was the tendency to achieve viral suppression (Koenig et al., 2017; Labhardt et al., 2018; Lebelonyane et al., 2018; Rosen et al., 2016). Their findings revealed that more than three-quarters of people had achieved viral suppression by month six. In addition, 71.1% of the population under study was able to start treatment on same day from hospital arrival. This is consistent with results indicating that early initiation of ART is associated with reductions in treatment initiation time and time to achieve viral suppression. It is also consistent with evaluations of rapid initiation of ART in sub-Saharan African settings and the United States, which found that providers and patients found offering ART at the time of diagnosis acceptable and possible (Amanyire et al., 2016).

Estimates related to the personnel costs of initiating treatment indicated that it was 42% more expensive to opt for Rapid model; nevertheless, this occurred because services such as metal health were added to improve user care. The results showed that adopting the Rapid model generates benefits for the patient, since they will save at least one clinical visit to start ART. This adds to the evidence that treating a person living with HIV can have important economic benefits such as job recovery, job performance, and reduced absenteeism (Beard et al., 2009; Bor et al., 2012).

One of the limitations of the study was the incomplete clinical data, particularly viral load measurements. This made it impossible to know if people receiving treatment achieved viral suppression or not at 6 or 12 months of follow-up. Specifically, at 12 months of treatment, no viral load reports were found in a significant number of patients (97 people). This could be explained both by factors related to the patient and to the health service (tests shortage or loss of patient follow-up), which were not investigated and may influence the viral load suppression results reported in this study. This important limitation reveals that there are still challenges and obstacles to achieving sustained viral suppression over time, even when ART is initiated early.

In addition, this study did not analyze the adverse effects of therapy among people who started ART quickly. Additionally, it was also not possible to identify the barriers people face when it comes to accessing health care in the follow-up months.

It was also not possible to know the mental health status of those who started ART early. However, the Rapid model considered mental health services, which are key to improving

the quality of life of newly diagnosed individuals and have implications for ART adherence and sustaining health outcomes (e.g., viral suppression) over the long term (Aggarwal et al., 2019; Haas et al., 2023).

Another limitation inherent to the study design was the impossibility of comparing clinical results between the Universal and Rapid ART care models due to the inability to provide the same population characteristics to the subjects who received ART in both care models. It was not possible to contrast the times in which people in treatment reached viral suppression, nor was it possible to carry out a similar exercise to study adherence to ART and retention of services.

On the economic side, the limitations centered on the exclusive use of the personnel category to estimate the difference in costs between the care models. This is because the transition from the Universal to Rapid model primarily required the reorganization of services or activities. In addition, the analysis considered the human capital method to estimate the opportunity cost, so it is possible that the loss of productivity of individuals initiating ART was overestimated due to inaccurate lost work hours and because about 43% of individuals in this study were unemployed.

Despite the limitations mentioned, one of the main strengths of this work was its ability to contrast the costs associated with the transition from the Universal model to the Rapid model of ART initiation. The findings of this study show that it is economically efficient to adopt the Rapid model by adjusting or reorganizing the services offered under the Universal model.

Future research examining the factors influencing ART adherence and retention of services when starting ART early will help improve the model. Studies on the social acceptability – on the patient's side – of rapid start are also recommended. In addition, studying the transition from the Universal to Rapid model at the national level under an ad-hoc design will allow evaluating the impact of the HIV treatment policy in the country.

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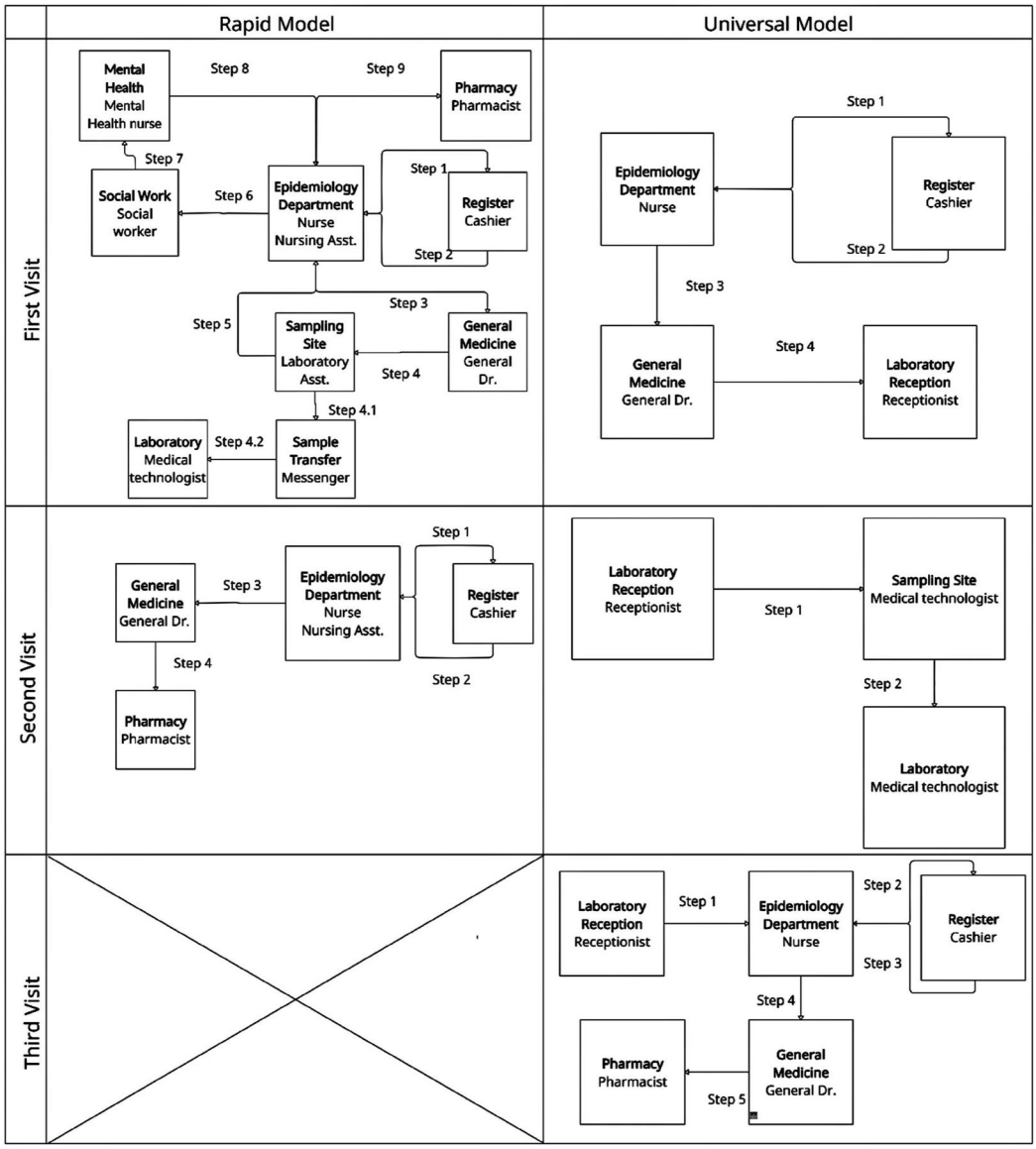

Figure 1.
Rapid and Universal model care algorithm.

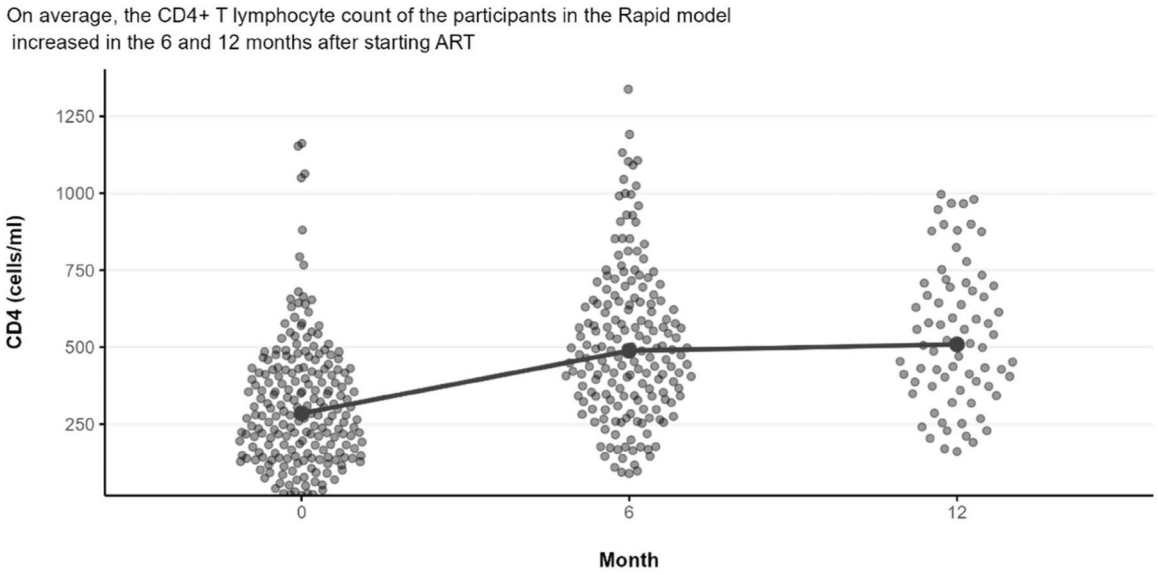

Figure 2.
Distribution of CD4+ T lymphocytes of people in the study period.

Table 1.

Sociodemographic characteristics of people under Rapid Model.

Characteristic	*n* (%) *N* = 204
Sex	
Male	174 (85.3%)
Female	30 (14.7%)
Sexual Preference, *n* (%)	
Heterosexual	98 (48.0%)
Men who have sex with men	92 (45.1%)
Bisexual	14 (6.9%)
Race/Ethnicity*, *n* (%)	
Mestizo	182 (89.2%)
Indigenous	20 (9.8%)
Black	2 (1.0%)
Education, *n* (%)	
Literate	1 (0.5%)
Elementary	51 (25.0%)
High School	135 (66.2%)
University	17 (8.3%)
Type of job, *n* (%)	
Formal Job	117 (57.4%)
Unemployed	87 (42.6%)
Age (years)	
Median (IQR)	28 (23–35)

* Race/ethnicity refers to a social and cultural categorization of people based on shared physical, cultural, historical, and geographic characteristics.

Table 2.

VL levels and CD4+ T lymphocyte count of people under the Rapid model, $N = 204$.

Indicator	Month 0	Month 1	Month 6	Month 12
Viral load suppression, *n* (%)				
VL < 200 copies/ml	0 (0.0%)	105 (51.5%)	164 (80.4%)	104 (51.0%)
VL ≥ 200 copies/ml	204 (100.0%)	97 (47.5%)	11 (5.4%)	3 (1.5%)
Missing	0 (0.0%)	2 (1.0%)	29 (14.2%)	97 (47.5%)
Viral load (copies/ml) *				
Mean (SD)	172,417 (734,639)	109,484 (1,015,183)	12,682 (16,981)	12,616 (12,253)
Median (IQR)	37,918 (10,518–113,584)	616 (408–1028)	5,088 (1254–16,102)	11,159 (6,158–18,346)
Min. – Max.	248–10,000,000	209–10,000,000	306–52,027	1,157–25,533
CD4+ T lymphocytes (cells/ml) **				
Mean (SD)	318 (205)	–	512 (246)	534 (228)
Median (IQR)	280 (158–429)	–	488 (341–648)	506 (373–689)
Min.–Max.	18–1162	–	90–1338	161–996
Missing	0	–	30	133

* Calculation based on records with VL ≥200 copies/ml.

** Not done in month 1.

Table 3.

Times to start ART and ARV schemes used in people under the Rapid model.

Characteristics	*n* (%) *N* = 204
Time to start ART	
Same day	145 (71.1%)
1–7 days	59 (28.9%)
ARV Treatment Scheme	
Tenofovir/Emtricitabine/Efavirenz	202 (99.0%)
Efavirenz + Abacavir/Lamivudine	1 (0.5%)
Lamivudine/Zidovudine + Efavirenz	1 (0.5%)

Table 4.

Cost of starting ART between Universal and Rapid models.

Characteristics	Universal	Rapid
Cost of operating		
Cost of operation per day (USD$)	781	1108
Cost of operation per month (USD$)[a]	16,395	23,274
Cost of operation per year (USD$)	196,740	279,284
Increase due to change in care model (%)	Reference	42%
Opportunity costs of the newly diagnosed person living with HIV to start ART		
Number of visits to initiate ART	3	1–2
Opportunity cost (USD$)	43	14–29
Potential savings from using Rapid (%)	Reference	33–67

[a]It is assumed that the staff works full time 21 days a month.