Predictors of attrition among adults in a rural HIV clinic in southern Mozambique: 18-year retrospective study

Edy Nacarapa1,4, M. Elisa Verdu1, Joana Nacarapa1,2, Artur Macuacua3, Bartolomeu Chongo1, Dulce Osorio1, Isabelle Munyangaju2, Didier Mugabe4, Roger Paredes5,6, Ana Chamarro4, Boris Revollo5, Silvio S. Alexandre7, Mulassua Simango7, Diego Torrus8 & Jose-Manuel Ramos-Rincon8*

HIV remains a major cause of morbidity and mortality for people living in many low-income countries. With an HIV prevalence of 12.4% among people aged over 15 years, Mozambique was ranked in 2019 as one of eight countries with the highest HIV rates in the world. We analyzed routinely collected data from electronic medical records in HIV-infected patients aged 15 years or older and enrolled at Carmelo Hospital of Chokwe from 2002 to 2019. Attrition was defined as individuals who were either reported dead or lost to follow-up (LTFU) (≥ 90 days since the last clinic visit with missed medical pick-up after 3 days of failed calls). Kaplan–Meier survival curves and Cox regression analyses were used to model the incidence and predictors of time to attrition. From January 2002 to December 2019, 16,321 patients were enrolled on antiretroviral therapy (ART): 59.2% were women, and 37.9% were aged 25–34 years old. At the time of the analysis, 7279 (44.6%) were active and on ART. Overall, the 16,321 adults on ART contributed a total of 72,987 person-years of observation. The overall attrition rate was 9.46 per 100 person-years. Cox regression showed a higher risk of attrition in those following an inpatient regimen (hazard ratio [HR] 3.18, 95% confidence interval [CI] 2.89–3.50; \( p < 0.001 \)), having CD4 counts under 50 cells/µL (HR 1.91, 95% CI 1.63–2.24, \( p < 0.001 \)), receiving anti-TB treatment within 90 days of ART initiation (HR 6.53, 95% CI 5.72–7.45; \( p < 0.001 \)), classified as WHO clinical stage III (HR 3.75, 95% CI 3.21–4.37; \( p < 0.001 \)), and having Kaposis’s sarcoma (HR 1.99, 95% CI 1.65–2.39, \( p < 0.001 \)). Kaplan–Meier analysis showed that patients with CD4 counts of less than 50 cells/µL on ART initiation had a 40% lower chance of survival at 18 years. Low CD4 cell counts, ART initiation as an inpatient, WHO clinical stage III, and anti-tuberculosis treatment within 90 days of ART initiation were strongly associated with attrition. Strengthening HIV testing and ART treatment, improving the diagnosis of tuberculosis before ART initiation, and guaranteed psychosocial support systems are the best tools to reduce patient attrition after starting ART.

Abbreviations

| Abbreviation | Description |
|--------------|-------------|
| 3TC          | Lamivudine  |
| ABC          | Abacavir    |
| ART          | Antiretroviral therapy |
| ATT          | Anti tuberculosis treatment |
| AZT          | Zidovudine  |
| BMI          | Body mass index |

1Carmelo Hospital of Chókwè – The Daughters of Charity, Saint Vicente of Paul, TB/HIV Division, Avenida Trabalho, Chokwe, Gaza Province, Mozambique. 2Tinpswalo Association, Vincentian Association to Fight AIDS and TB, Research Unit, Chókwè, Gaza Province, Mozambique. 3Macia Health Centre, Macia, Gaza, Mozambique. 4National Institute of Health, Maputo, Mozambique. 5IrsiCaixa – Institute of AIDS Research, Barcelona, Spain. 6FLS Foundation – Fight AIDS Foundation, Barcelona, Spain. 7Gaza Health Provincial Direction, Xai-Xai, Mozambique. 8Department of Internal Medicine, University General Hospital of Alicante and Miguel Hernandez University, Elche, Spain. 

*email: jose.ramosr@umh.es
Mozambique is a low-income country in southern Africa with among the highest HIV prevalence in the world, estimated at 12.6% among adults (15–49 years old)\cite{1,2}. In 2020, there were an estimated 2.1 million people living with HIV (PLWHIV) in the country\cite{3}, up from the 1.5 million who had been diagnosed in 2010\cite{4}. Likewise, the number of people on antiretroviral therapy (ART) nearly quadrupled from 2012 to 2017 (309,000–1.2 million)\cite{5}. Therefore, significant progress in the fight against HIV/AIDS has been made with the support of programs and bodies such as the Global Fund, the President's Emergency Plan for AIDS Relief (PEPFAR) and the Mozambican Ministry of Health. However, though Mozambique achieved treatment coverage of more than 55% by the end of 2018\cite{6}, this is far from the 95% recommended by UNAIDS\cite{7}.

The attrition rate (resulting from mortality or loss to follow-up [LTFU]) remains one of the key challenges to the success of the Mozambican national ART program. Data from 94 health facilities from all the Mozambican provinces revealed that the overall mortality rate was 3.4 deaths per 100 person-years, and 12.9 deaths per 100 person-years in the first 90 days. Attrition rates were 19.8 and 57.2 losses per 100 person-years, respectively\cite{8}. Data from multi-country ART programs in 350 health facilities in four other Eastern African countries (Ethiopia, Kenya, Mozambique, and Tanzania) from 2005 to 2014 reported attrition rates of 26.2% at 12 months, 34.0% at 24 months, and 40.1% at 36 months after starting ART\cite{9}. Other data from a large multi-country program in 198 HIV clinics in Kenya (69 clinics), Mozambique (33 clinics), Rwanda (44 clinics) and Tanzania (52 clinics) revealed that the sex-related differences in the relationship between age, mortality and LTFU applied to both younger patients on ART as well as to older patients aged 50–59 years, and that women on ART appear to have disproportionate risk of death as they age compared to men\cite{10}.

Known predictors of attrition include low initial CD4 T-cell lymphocyte counts, low baseline body mass index (BMI), history of hospitalization, advanced WHO clinical staging, older age at HIV diagnosis, and being a man\cite{11–13}. Other studies from the region show anemia and decreased red blood cell counts and platelets as predictors of death during the first year of ART treatment\cite{14}.

To continuously evaluate the success of ART programs in Southern Africa, data on attrition, one of the key WHO reportable indicators, should be periodically reported. Until now, there has been a paucity of data to describe attrition from ART care in Chokwe District, Mozambique. This study aimed to describe the incidence and predictors of attrition (death and loss to follow-up) in adults initiating ART in a rural HIV clinic of Carmelo Hospital Chókwè (CHC), Chokwe District, Mozambique.

**Methods**

**Study design and population.** This retrospective cohort study included data for all HIV-infected individuals aged 15 years or older who initiated ART at the CHC between January 2002 and December 2019. Individuals who were referred to the CHC after initiating ART in a center other than CHC were excluded from the analysis (n = 1681) (Fig. 1).

**Setting.** CHC is a state-owned reference hospital in the district of Chókwè, a large rural district in Gaza Province in southern Mozambique, administered by Catholic missionaries (the Daughters of Charity, Saint Vincent de Paul) since 1993. Chókwè is predominantly rural, with a surrounding catchment population of approximately 200,000 inhabitants. Agriculture is the sole source of income for roughly 80% of the population, and approximately 40% of the population migrates seasonally to South Africa, seeking work in the mines. According to the last national HIV prevalence study in 2015, Gaza Province had the highest provincial HIV prevalence in the country at 24.4%\cite{5}.

**Definitions.** We classified the ART outcomes as retention or attrition. Retention (encompassing adherence) was defined as documented active and alive HIV-infected adults who were still on ART (assessed at intervals longer than 6 months post-initiation). Attrition was defined as death and LTFU.

Our reported mortality rate represents the number of documented deaths during ART per 100 person-years of observed therapy. The attrition rate represents the number of patients lost through attrition (death, LTFU) per 100 person-years. Patients were considered LTFU if they did not show up for their consultation in the 90 days preceding data abstraction, with missed treatment pick-up after 3 days of failed calls, unless the medical record stated that the patient had died, stopped ART, or was transferred out. The date of LTFU was recorded as the date of the last recorded visit, or 1 day after ART initiation if the patients never returned after ART initiation. To enable comparison with published literature, we report 1-year attrition\cite{15,16}. Patients transferred to other facilities during the 18 treatment years were excluded from the 18-year attrition proportion. Transfers were censored in...
time-to-event analyses at the date of transfer. To facilitate survival analysis, we assumed that individuals who initiated ART but never returned over the 18 years of follow-up contributed 1 day of follow-up. Individuals remaining in care were censored at the end of the 18-year study period. Individuals who were either reported dead, LTFU or had transferred to other health care facilities were censored at their last clinic visit date. To allow comparison with other ART programs in low-resource settings, the first CD4 count was used to estimate the treatment outcome.

CD4 counts were determined using the FlowCount PLG CD4 assay and analyzed with Beckman Coulter Epics XL-MCL Flow Cytometers (both Beckman Coulter, Inc., Johannesburg, South Africa). Blood hemoglobin was determined with an automated hematology analyzer, Sysmex XT2000i (Sysmex Europe, Inc., Hamburg, Germany) or HemoCue photometer assay (HemoCue AB, Helsingborg, Sweden).

Similar to other cohort studies in resource-constrained settings, adherence to ART was estimated by measuring timeliness of patient visits to scheduled medicine pick-up appointments at clinic-based pharmacies during the first 6 months of ART.

Categories used to classify exposure to anti-tuberculosis treatment (ATT) were: 1) completed ATT before ART initiation; 2) initiated ATT < 90 days after ART initiation; and 3) unexposed to ATT at ART initiation.

Data collection. Data collection was performed using DREAM software (Diseases Relief through Excellence and Advanced Means), version 6.1.0.757, and electronic medical record (EMRs), designed according to criteria of excellence to manage the prevention and treatment centers of the DREAM Program of Sant’Egidio Community, located in 11 African countries, including Mozambique. Since 2002, the Catholic missionary organizations Daughters of Charity Saint Vincent de Paul (http://www.daughtersips.org/hivaid) and the Community of Sant’Egidio (http://www.dream.santegidio.org) have a collaboration agreement that allows the Daughters of Charity health facilities to use the DREAM software to manage their HIV-infected patients. Carmelo Hospital of Chokwe is a health facility administered by the Daughters of Charity and uses the DREAM Dataset as main the main EMR system. It works through Microsoft Access and JavaScript and is supervised by the hospital’s local IT department. All offices work electronically and use the database for routine consultations, so all patient information is automatically stored on a common server. The ART database collects and stores long-term EMRs, sociodemographic data, clinical histories, laboratory tests (hematology, biochemistry), identification codes, scheduling of new appointments, and pharmaceutical stocks.

Recorded data from eligible ART participants for the study were collected and anonymized to remove identifying details: each patient was assigned an alphanumeric code (ID), and the anonymous data were included in the data sheet.

To convert data from Microsoft Access to SPSS, the Access data were first exported to a Microsoft Excel spreadsheet, and in turn the spreadsheet data were imported to SPSS for subsequent data analysis.

For each patient, we included the following data: gender, age (age band and median), point of entry (inpatient or outpatient), CD4 count at baseline, previous ART exposure, previous ATT (ATT prior to ART initiation, ATT within 90 days of ART initiation, and no exposure to ATT), WHO clinical stage of HIV disease, Kaposi’s sarcoma diagnosis, ART therapy, and final ART outcome.

Data analysis. Statistical analysis was performed using IBM SPSS Statistics Software version 25 (IBM Corporation, International Business Machines Corp, Release 2017, https://www.ibm.com/legal/copytrade, USA). Patients’ baseline characteristics, as described above, were compared according to outcomes.

Time-to-event methods were used to investigate predictors of attrition. Time was measured from ART initiation to death or LTFU. Patients still alive at the date of data collection were considered active in ART. Patients
who did not come to the clinic for at least 90 days after their last scheduled appointment were considered LTFU\textsuperscript{18}. Attrition was calculated by summing the number of patients who experienced the event (deaths, LTFU) during a particular period divided by the total years of follow-up during this period. Multivariable analysis was performed by Cox regression models. The proportional hazard assumption was assessed with log survival curves based on Schoenfeld residuals. We used Kaplan–Meier survival estimates to calculate the cumulative incidence of attrition. The cumulative incidence of mortality and LTFU were calculated using competing risk analysis.

The Mozambican National Bioethics Committee for Health \textit{(Comité Nacional de Bioética para a Saúde, 25/CNBS/2019)} approved this analysis. Analysis was performed on de-identified, aggregated patient level data, and no individual informed consent was obtained. The need for written informed consent was explicitly waived, and the research was performed in accordance with the Declaration of Helsinki.

**Ethics approval and consent to participate.** The Mozambican National Bioethics Committee for Health \textit{(Comité Nacional de Bioética para a Saúde, 25/CNBS/2019)}, approved this analysis (25/CNBS/2019). Analysis was performed on de-identified, aggregated patient level data, and the need for written informed consent was explicitly waived.

**Consent for publication.** We performed analysis on routine administrative data; consent for publication is not applicable.

**Results**

**ART treatment outcomes.** A total of 25,275 HIV-infected adults aged 15 years or older were enrolled in HIV care from 1 January 2002 to 31 December 2019. Of these, 16,321 (64.6%) initiated ART at CHC during the 18-year study period (Fig. 1).

Of the total sample, 2135 (13.1%) were listed as transferred to another facility, while 7279 (44.6%) were active on ART during the study period (Fig. 2).

Median age at enrollment was 35 years (interquartile range [IQR] 15–93); 9657 (59.2%) were women, and 6190 (37.9%) were aged 25–34 years. Median follow-up was 9 years (IQR, 1.0–18.0 years). The vast majority (n = 15,454, 94.7%) were classified as ART-naive (Table 1).

Outpatient consultations were the main source of entry (n = 13,890, 85.1%). At baseline, about a third of the patients (n = 5495, 33.7%) were classified as having WHO clinical stage IV disease. The median CD4 cell count was 192 cells/µL (IQR 0–2654), and nearly a third (n = 4665; 28.6%) of new enrollees had a CD4 count of 200–349 cells/µL. A similar proportion (n = 4667; 28.6%) were in TB treatment within the first 90 days of ART initiation, and 299 (1.8%) patients had Kaposi's sarcoma (KS). A third (n = 5511; 33.8%) were under the AZT + 3TC + NVP regimen.

Of the 9042 (55.4%) patients with an unfavorable HIV treatment outcome, 2776 (17.0%) died, and 4131 (25.3%) were LTFU (Fig. 2). The proportion of deaths was significantly higher in adults aged 25–34 years (n = 982; 35.4%), those receiving ATT within 90 days of ART initiation (n = 2072; 97.4%), patients with CD4 counts of less than 50 cells/µL (n = 1220; 43.9%), men (n = 1448; 52.2%), those with WHO clinical stage IV of HIV disease (n = 2417; 87.1%), and people starting ART as inpatients (n = 1578; 56.8%);

**Patient characteristics by gender, age, and point of entry.** Women comprised 59.2% (n = 9657) of the sample initiating ART at CHC; 40.2% (n = 3883) of the women were aged 25–34 years-old, 88.9% (n = 8589)
|                | Total | Retention | Attrition | Death | LTFU |
|----------------|-------|-----------|-----------|-------|------|
| **Gender**     |       |           |           |       |      |
| Male           | 6664  | 40.80%    | 2361      | 32.40%| 1448 | 52.2%| 2023 | 49.0% |
| Female         | 9657  | 59.20%    | 4918      | 67.60%| 1328 | 47.8%| 3108 | 51.0% |
| **Age (years), median (IQR)** |       |           |           |       |      |
| 15–24          | 1697  | 10.40%    | 628       | 8.60% | 208  | 7.5% | 586  | 14.2% |
| 25–34          | 6190  | 37.90%    | 2618      | 36.00%| 982  | 35.4%| 1755 | 42.5% |
| 35–44          | 4713  | 28.90%    | 2285      | 31.40%| 786  | 28.3%| 1085 | 26.3% |
| 45–54          | 2490  | 15.30%    | 1216      | 16.70%| 515  | 18.6%| 447  | 10.8% |
| 55+            | 1231  | 7.50%     | 532       | 7.30% | 285  | 10.3%| 258  | 6.2%  |
| **Point of entry** |       |           |           |       |      |
| In-patient     | 2431  | 14.90%    | 315       | 4.30% | 1578 | 56.8%| 346  | 8.4%  |
| Out-patient    | 13,890| 85.10%    | 6964      | 95.70%| 1198 | 43.2%| 3785 | 91.6% |
| **CD4+ T-cell count (Cell/µL), median (IQR)** |       |           |           |       |      |
|     <50        | 2713  | 16.6%     | 593       | 8.1%  | 1220 | 43.9%| 597  | 14.5% |
|    50–99       | 2858  | 17.5%     | 1173      | 16.1% | 594  | 21.4%| 676  | 16.4% |
|   100–199      | 2804  | 17.2%     | 1135      | 15.6% | 451  | 16.2%| 821  | 19.9% |
|  200–349       | 4665  | 28.6%     | 2299      | 31.6% | 399  | 14.4%| 1330 | 32.2% |
|  350–499       | 1356  | 8.3%      | 737       | 10.1% | 62   | 2.2% | 414  | 10.0% |
|   500+         | 1925  | 11.8%     | 1342      | 18.4% | 50   | 1.8% | 293  | 7.1%  |
| **Previous ART exposition** |       |           |           |       |      |
| ART naive      | 15,454| 94.70%    | 6944      | 95.40%| 2627 | 94.6%| 3843 | 93.0% |
| ART non-naive  | 867   | 5.30%     | 335       | 4.60% | 149  | 5.4% | 288  | 7.0%  |
| **Previous Anti-TB Treatment (ATT)** |       |           |           |       |      |
| Complete ATT before ART initiation | 511   | 3.10%     | 224       | 3.10% | 54   | 2.5% | 152  | 3.7%  |
| Initiated ATT < 90 days after ART initiation | 4667  | 28.60%    | 1061      | 14.60%| 2072 | 97.4%| 1040 | 25.2% |
| Unexposed to ATT initiation | 10,490| 64.30%    | 5994      | 82.30%| 1    | 0.0% | 2937 | 71.1% |
| **WHO clinical staging of HIV disease** |       |           |           |       |      |
| Clinical stage I | 4501  | 27.60%    | 2787      | 38.30%| 75   | 2.7% | 1066 | 25.8% |
| Clinical stage II | 3588  | 22.00%    | 1990      | 27.30%| 119  | 4.3% | 970  | 23.5% |
| Clinical stage III | 2737  | 16.80%    | 1235      | 17.00%| 165  | 5.9% | 870  | 21.1% |
| Clinical stage IV | 5495  | 33.70%    | 1267      | 17.40%| 2417 | 87.1%| 1225 | 29.7% |
| **Kaposi Sarcoma** |       |           |           |       |      |
| Kaposi Sarcoma | 299   | 1.80%     | 54        | 0.70% | 133  | 4.8% | 80   | 1.9%  |
| No Kaposi Sarcoma | 16,022| 98.20%    | 7225      | 99.30%| 2643 | 95.2%| 4051 | 98.1% |
| **ART enrollment year** |       |           |           |       |      |
| 2002          | 8     | 0.00%     | 2         | 0.00% | 4    | 0.1% | 0    | 0.0%  |
| 2003          | 77    | 0.50%     | 42        | 0.60% | 18   | 0.6% | 6    | 0.1%  |
| 2004          | 63    | 0.40%     | 29        | 0.40% | 21   | 0.8% | 6    | 0.1%  |
| 2005          | 234   | 1.40%     | 94        | 1.30% | 80   | 2.9% | 25   | 0.6%  |
| 2006          | 785   | 4.80%     | 293       | 4.00% | 239  | 8.6% | 147  | 3.6%  |
| 2007          | 1232  | 7.50%     | 439       | 6.00% | 348  | 12.5%| 295  | 7.1%  |
| 2008          | 1282  | 7.90%     | 526       | 7.20% | 284  | 10.2%| 286  | 6.9%  |
| 2009          | 1273  | 7.80%     | 538       | 7.40% | 277  | 10.0%| 287  | 6.9%  |
| 2010          | 1469  | 9.00%     | 528       | 7.30% | 285  | 10.3%| 425  | 10.3% |
| 2011          | 1205  | 7.40%     | 437       | 6.00% | 237  | 8.5% | 359  | 8.7%  |
| 2012          | 1398  | 8.60%     | 565       | 7.80% | 207  | 7.5% | 442  | 10.7% |
| 2013          | 1030  | 6.30%     | 477       | 6.60% | 101  | 3.6% | 342  | 8.3%  |
| 2014          | 1732  | 10.60%    | 828       | 11.40%| 194  | 7.0% | 497  | 12.0% |
| 2015          | 1415  | 8.70%     | 698       | 9.60% | 152  | 5.5% | 386  | 9.3%  |
| 2016          | 1164  | 7.10%     | 612       | 8.40% | 140  | 5.0% | 271  | 6.6%  |
| 2017          | 844   | 5.20%     | 431       | 5.90% | 111  | 4.0% | 194  | 4.7%  |
| 2018          | 674   | 4.10%     | 396       | 5.40% | 65   | 2.3% | 123  | 3.0%  |

Continued
presented to CHC to initiate outpatient the ART regimen; 32.6% (n = 3145) had CD4 counts of 200–349 cells/µL, and 32.8% (n = 3168) presented with WHO clinical stage I disease (p < 0.0001) (Table 2).

Patient characteristics by CD4 count, WHO clinical stage, and ATT exposure. Of the total sample, 16.6% (n = 2713) of the patients initiated ART with CD4 counts of less than 50 cells/µL. Over half of these (n = 1474, 54.3%) were men, 39.6% (n = 1071) were aged 25–34 years, 39.6% (n = 1075) presented to CHC to initiate ART as inpatients; 64.7% (n = 1654) started ATT within 90 days of ART initiation, and 66.9% (n = 1814) presented with WHO clinical stage I disease (Table 3).

Cox proportional hazards model for attrition. Among the 2776 PLWHIV who died, 1448 (52.2%) were men, 982 (35.4%) were aged 25–34 years, 1578 (56.65%) started ART as inpatients, 1220 (43.9%) had CD4 counts of less than 50 cells/µL, 2072 (97.4%) were on ATT within 90 days of ART initiation, 2627 (84.6%) were ART-naïve, 133 (4.8%) had Kaposi’s sarcoma, 2417 (87.1%) presented with WHO stage IV disease, and 638 (23.0%) initiated ART on D4T (stavudine 30 mg) + 3TC (lamivudine 150 mg) + NVP (nevirapine 200 mg) (Table 1).

Overall, the 16,321 adults on ART contributed a total of 72,987 person-years to the study data. The overall attrition rate was 9.46 per 100 person-years. According to the multivariable Cox regression model, women were at lower risk of attrition than men (hazard ratio [HR] 0.930, 95% confidence interval [CI] 0.869–0.996; p = 0.039). Patients aged 35–44 years old were at lower risk of attrition compared to those aged 55 years or older (HR 0.83, 95% CI 0.74–0.94, p = 0.002).

Those who initiated ART as inpatients carried a three-fold higher risk of attrition compared to outpatients (HR 3.18, 95% CI 2.89–3.50, p < 0.001). Receiving ATT within 90 days of ART initiation was associated with a six-fold higher risk of attrition compared to those who were not on ATT (HR 6.53, 95% CI 5.72–7.45, p < 0.001). Compared to patients with WHO clinical stage IV disease, every other stage was associated with three times higher risk of attrition (stage I: HR 3.52, 95% CI 2.99–4.13, p < 0.001; stage II: HR 3.46, 95% CI 2.96–4.05, p < 0.001; stage III: HR 3.75; 95% CI 3.21–4.37, p < 0.001). Having Kaposi’s sarcoma was also associated with a higher risk of attrition (HR 1.99, 95% CI 1.65–2.39, p < 0.001).

Compared to a CD4 count of more than 500 cells/µL, a CD4 count of less than 50 cells/µL was associated with a higher risk of attrition (HR 1.91, 95% CI 1.63–2.24, p < 0.001), while a CD4 count of 350–499 cells/µL was associated with a lower risk (HR 0.79, 95% CI 0.65–0.97, p < 0.023) (Table 4).

Women, patients who were ART-naïve, those with CD4 count of more than 200 cells/µL at ART enrollment year, and certain drug combinations (ABC/AZT/D4T + 3TC + LPV/RTV) were not associated with higher mortality (Table 4).

Survival estimates. Kaplan–Meier estimates for the probability of 18-year survival by CD4 cell count on ART initiation are presented in Fig. 3. PLWHIV who had a CD4 count of more than 500 cells/µL had the highest probability of approximately 90% of survival at 18 years following ART initiation, while those with a CD4 count of less than 50 cells/µL had a survival probability of approximately 40% at 18 years in comparison.

| N = 16,321 | Total | Retention | Attrition | Death | LTFU |
|-----------|-------|-----------|-----------|-------|------|
|           | N     | %         | N         | %     | N    | %     |
| 2019      | 436   | 2.70%     | 344       | 4.70% | 13   | 0.5%  |

Table 1. Characteristics of HIV patients enrolled at Carmelo Hospital of Chókwè of between January 1, 2002 and December 31, 2019 by Outcome Status. ART antiretroviral treatment, ABC abacavir, 3TC lamivudine, EFV efavirenz, LPV/RTV lopinavir/ritonavir, AZT zidovudine, D4T stavudine; NVP nevirapine, DTG dolutegravir.
| Gender       | Female | Male | Total | p value |
|--------------|--------|------|-------|---------|
|              | N      | %    | N     | %       | N     | %     |
| Age (years), median (IQR) | 33 (15–93) | 37 (15–91) | 35 (15–93) | <0.0001 |
| Age band     |        |      |       |         |
| 15–24        | 1362   | 14.1%| 335   | 5.0%    | 1697  | 10.4% |
| 25–34        | 3883   | 40.2%| 2307  | 34.6%   | 6190  | 37.9% |
| 35–44        | 2527   | 26.2%| 2186  | 32.8%   | 4713  | 28.9% |
| 45–54        | 1341   | 13.9%| 1149  | 17.2%   | 2490  | 15.3% |
| 55+          | 544    | 5.6% | 687   | 10.3%   | 1231  | 7.5%  |
| Point of entry|       |      |       |         |
| In-patient   | 1068   | 11.1%| 1363  | 20.5%   | 2431  | 14.9% |
| Out-patient  | 8589   | 88.9%| 5301  | 79.5%   | 13,890| 85.1% |
| CD4+ T-cell count (Cell/µL), median (IQR) | 228 (0–2895) | 138 (0–2802) | 192 (0–2895) | <0.0001 |
| CD4+ T-cell count (Cell/µL) Range | 228 (0–2895) | <0.0001 |
| <50          | 1239   | 12.8%| 1474  | 22.1%   | 2713  | 16.6% |
| 50–99        | 1556   | 16.1%| 1302  | 19.5%   | 2858  | 17.5% |
| 100–199      | 1577   | 16.3%| 1227  | 18.4%   | 2804  | 17.2% |
| 200–349      | 3145   | 32.6%| 1520  | 22.8%   | 4665  | 28.6% |
| 350–499      | 909    | 9.4% | 447   | 6.7%    | 1356  | 8.3%  |
| 500+         | 1231   | 12.7%| 694   | 10.4%   | 1925  | 11.8% |
| Previous ART exposition |       | <0.0001 |
| ART naive    | 9274   | 96.0%| 6180  | 92.7%   | 15,454| 94.7% |
| ART non-naive| 383    | 4.0% | 484   | 7.3%    | 867   | 5.3%  |
| Anti-TB Treatment | <0.0001 |
| Complete ATT before ART initiation | 252    | 2.7% | 259   | 4.1%    | 511   | 3.3%  |
| Initiated ATT < 90 days after ART initiation | 2064   | 22.2%| 2603  | 40.8%   | 4667  | 29.8% |
| Unexposed to ATT initiation | 6979   | 75.1%| 3511  | 55.1%   | 10,490| 67.0% |
| WHO clinical staging of HIV disease | <0.0001 |
| Clinical stage I | 3168   | 32.8%| 1333  | 20.0%   | 4501  | 27.6% |
| Clinical stage II | 2478   | 25.7%| 1110  | 16.7%   | 3588  | 22.0% |
| Clinical stage III | 1517   | 15.7%| 1220  | 18.3%   | 2737  | 16.8% |
| Clinical stage IV | 2494   | 25.8%| 3001  | 45.0%   | 5495  | 33.7% |
| Kaposi Sarcoma |       | <0.0001 |
| Kaposi Sarcoma | 137    | 1.4% | 162   | 2.4%    | 299   | 1.8%  |
| No Kaposi Sarcoma | 9520   | 98.6%| 6502  | 97.6%   | 16,022| 98.2% |
| ART enrollment year | <0.0001 |
| 2002         | 5      | 0.1% | 3     | 0.0%    | 8     | 0.0%  |
| 2003         | 42     | 0.4% | 35    | 0.5%    | 77    | 0.5%  |
| 2004         | 36     | 0.4% | 27    | 0.4%    | 63    | 0.4%  |
| 2005         | 145    | 1.5% | 89    | 1.3%    | 234   | 1.4%  |
| 2006         | 494    | 5.1% | 291   | 4.4%    | 785   | 4.8%  |
| 2007         | 776    | 8.0% | 456   | 6.8%    | 1232  | 7.5%  |
| 2008         | 820    | 8.5% | 462   | 6.9%    | 1282  | 7.9%  |
| 2009         | 812    | 8.4% | 461   | 6.9%    | 1273  | 7.8%  |
| 2010         | 846    | 8.8% | 623   | 9.3%    | 1469  | 9.0%  |
| 2011         | 686    | 7.1% | 519   | 7.8%    | 1205  | 7.4%  |
| 2012         | 812    | 8.4% | 586   | 8.8%    | 1398  | 8.6%  |
| 2013         | 632    | 6.5% | 398   | 6.0%    | 1030  | 6.3%  |
| 2014         | 1054   | 10.9%| 678   | 10.2%   | 1732  | 10.6% |
| 2015         | 842    | 8.7% | 573   | 8.6%    | 1415  | 8.7%  |
| 2016         | 652    | 6.8% | 512   | 7.7%    | 1164  | 7.1%  |
| 2017         | 428    | 4.4% | 416   | 6.2%    | 844   | 5.2%  |
| 2018         | 358    | 3.7% | 316   | 4.7%    | 674   | 4.1%  |
| 2019         | 217    | 2.2% | 219   | 3.3%    | 436   | 2.7%  |
| ART therapy initiation | <0.0001 |
| ABC + 3TC + EFV | 31     | 0.3% | 25    | 0.4%    | 56    | 0.3%  |
| Continued    |        |      |       |         |
high-income settings. CD4 cell counts, even if they survive the first 5 years of therapy. These findings are in keeping with studies from may include screening programs and intensive adherence counseling. To health facilities to test for HIV and to initiate and adhere to ART. We fully acknowledge that more women to those with CD4 counts of more than 500 cells/µL. These findings are a little higher than observed in other Mozambican studies. In our cohort, the attrition rate on active TB patients was 24.13 per 100 person-years, and the frequency of attrition was 49.7%. The overwhelming majority of patients receiving ATT within 90 days (97.4%) died, while 25.3% of those LTFU had a fatal outcome. These results show high mortality and LTFU in severely immunosuppressed patients, highlighting LTFU as a fundamental problem for the health care in PLHIV. Risk factors for ART interruption are still poorly understood in many settings, including Mozambique.

The survival analysis shows that in our cohort, patients with CD4 counts under 50 cells/µL had an 18-year survival rate of less than 50%. These data are consistent with other reports. The baseline CD4 cell count is the dominant prognostic factor for survival in PLHIV starting ART. Our study showed that patients who started treatment at an advanced disease stage are at a higher risk of mortality than those who start treatment with higher CD4 cell counts, even if they survive the first 5 years of therapy. These findings are in keeping with studies from high-income settings.

On analyzing the first 2 years of follow-up, we observed a considerable drop in the survival curve among people with CD4 counts of less than 50 cells/µL, from 100 to 60%; by 5 years, survival stood at just 50%. This finding is strongly related to the fact that severe immunosuppression in this population is not restricted to HIV infection alone; rather, multiple factors are at play, including hunger, adult malnutrition, and poor nutritional supplementation. These people are considered "immunological non-responders," that is, HIV-infected individuals who fail to achieve normalization of CD4 T-cell counts despite persistent virological suppression, which leads to AIDS and non-AIDS comorbidities. This population continues to have a substantially increased mortality ratio even after 3 years of treatment. Thus, clinical factors such as immunological non-response, AIDS and non-AIDS-related multiple events predict a substantially increased risk of death after 3 years of ART treatment.

Recovery of CD4 lymphocytes occurs in the first 2 years after starting ART and is associated with age and the pre-existing degree of HIV-1-related immunodeficiency, so long-term exposure to HIV-1 infection damages the immune system in ways that are difficult to correct due to exhaustion.

Better understanding of patterns and risk factors that cause-specific mortality in the ART era can inform the development of appropriate care for HIV-infected individuals and guidelines for risk factor management. This may include screening programs and intensive adherence counseling.

We observed that patients who received ATT within the first 90 days of their ART initiation had a six-fold higher risk of attrition than those who were unexposed to ATT. These results are a little higher than those observed in other Mozambican studies. In our cohort, the attrition rate on active TB patients was 24.13 per 100 person-years, and the frequency of attrition was 49.7%. The overwhelming majority of patients receiving ATT within 90 days (97.4%) died, while 25.3% of those LTFU had a fatal outcome. These results show high mortality but low LTFU, so having TB is a favorable predictor against LTFU.

In our sample, men were underrepresented (39%), as published elsewhere. There were few men who went to health facilities to test for HIV and to initiate and adhere to ART. We fully acknowledge that more women than men take an active role in accessing HIV services, and studies show that their adherence to ART is also higher. This tendency may be rooted in different dimensions of gender norms in rural areas.

Our cohort shows a higher ART initiation rate, of around 37.9%, and a higher death rate among 25–34-year-olds (35.4%) compared to an Ethiopian University Teaching Hospital study, which reported an ART initiation rate of 27.9% in the same age group. Just over 20% of men initiated ART as inpatients, compared to about 11%
## Table: CD4 cell count per microliter

| CD4 cell count per microliter | <50  | 50–99 | 100–199 | 200–349 | 350–499 | 500+ | Total |
|-------------------------------|------|-------|---------|---------|---------|------|-------|
| N                             | 17   | 87    | 146     | 279     | 418     | 829  | 192   |
| N (%)                         | (0–49)| (50–99)| (100–199)| (200–349)| (350–499)| (500–2895)| (0–2895)|

### Gender

|               | N (%) |
|---------------|-------|
| Female        | 1239  |
| Male          | 1474  |

### Age (years), median (IQR)

|               | 15–24 | 25–34 | 35–44 | 45–54 | 55+    |
|---------------|-------|-------|-------|-------|--------|
| N (%)         | 212   | 1071  | 880   | 378   | 172    |
| N (%)         | 7.8%  | 39.5% | 32.4% | 13.9% | 6.3%   |
| CD4 + T-cell count (Cell/µL), median (IQR) | 17 (0–49) | 87 (50–99) | 146 (100–199) | 279 (200–349) | 418 (350–499) | 829 (500–2895) | 192 (0–2895) |

### Point of entry

|                | N (%) |
|----------------|-------|
| In-patient    | 1075  |
| Out-patient   | 1638  |

### Previous ART exposition

|               | N (%) |
|---------------|-------|
| ART naive     | 2533  |
| ART non-naive | 180   |

### WHO clinical staging of HIV disease

|                | N (%) |
|----------------|-------|
| Clinical stage I | 186 |
| Clinical stage II | 233 |
| Clinical stage III | 480 |
| Clinical stage IV | 1814 |

### Kaposi Sarcoma

|                | N (%) |
|----------------|-------|
| Kaposi Sarcoma | 72 |
| No Kaposi Sarcoma | 2641 |

### ART enrollment year

| Year | N (%) |
|------|-------|
| 2002 | 3 |
| 2003 | 22 |
| 2004 | 15 |
| 2005 | 66 |
| 2006 | 169 |
| 2007 | 176 |
| 2008 | 254 |
| 2009 | 229 |
| 2010 | 256 |
| 2011 | 226 |
| 2012 | 262 |
| 2013 | 148 |
| 2014 | 323 |
| 2015 | 228 |
| 2016 | 231 |
| 2017 | 53 |
| 2018 | 33 |
| 2019 | 19 |

### ART therapy initiation

| Therapy Initiation | N (%) |
|--------------------|-------|
| ABC + 3TC + EFV    | 22 |
| ABC + 3TC + LPV/RTV| 5 |
| AZT + 3TC + ABC    | 46 |

Continued
Table 3. Characteristics of HIV patients enrolled at Carmelo Hospital of Chokwè between January 1, 2002 and December 31, 2019 by CD4 Cells count status. ART antiretroviral treatment, ABC abacavir, 3TC lamivudine, EFV efavirenz, LPV/RTV lopinavir/ritonavir, AZT zidovudine, D4T stavudine; NVP nevirapine, DGT dolutegravir.

| CD4 cell count per microliter | N  | %  | N  | %  | N  | %  | N  | %  | N  | %  | N  | %  | N  | %  | N  | %  | N  | %  | N  | %  |
|------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| AZT + 3TC + EFV              | 91 | 3.4%| 54 | 1.9%| 73 | 2.6%| 106 | 2.3%| 60 | 4.4%| 34 | 1.8%| 418 | 2.6%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| AZT + 3TC + LPV/RTV         | 18 | 0.7%| 5  | 0.2%| 11 | 0.4%| 13  | 0.3%| 2  | 0.1%| 3  | 0.2%| 52  | 0.3%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| AZT + 3TC + NVP             | 662 | 24.4%| 1148 | 40.2%| 1164 | 41.5%| 2151 | 46.1%| 155 | 17.8%| 145 | 7.5%| 5511 | 33.8%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| D4T + 3TC + ABC            | 188 | 6.9%| 104 | 3.6%| 85  | 3.0%| 121 | 2.6%| 21  | 1.5%| 12  | 0.6%| 531  | 3.3%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| D4T + 3TC + EFV            | 289 | 10.7%| 146 | 5.1%| 117 | 4.2%| 86  | 1.8%| 16  | 1.2%| 12  | 0.6%| 666  | 4.1%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| D4T + 3TC + LPV/RTV        | 1  | 0.0%| 0  | 0.0%| 1  | 0.0%| 0  | 0.0%| 0  | 0.0%| 0  | 0.0%| 0  | 0.0%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| D4T + 3TC + NVP            | 397 | 14.6%| 398 | 13.9%| 327 | 11.7%| 421 | 9.0%| 29  | 2.1%| 16  | 0.8%| 1588 | 9.7%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| TDF + 3TC + DTG            | 1  | 0.0%| 7  | 0.2%| 4  | 0.1%| 1  | 0.0%| 0  | 0.0%| 55  | 2.9%| 68  | 0.4%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| TDF + 3TC + EFV            | 907 | 33.4%| 801 | 28.0%| 900 | 32.1%| 1587 | 34.0%| 963 | 71.0%| 1609 | 83.6%| 6767 | 41.5%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| TDF + 3TC + LPV/RTV        | 86  | 3.2%| 155 | 5.4%| 81  | 2.9%| 93  | 2.0%| 11  | 0.8%| 16  | 0.8%| 442  | 2.7%|     |    |     |    |     |    |     |    |    |    |    |    |    |

Outcomes

|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| LTFU | 597 | 22.0%| 676 | 23.7%| 821 | 29.3%| 1330 | 28.5%| 414 | 30.5%| 293 | 15.2%| 4131 | 25.3%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| Retention | 593 | 21.9%| 1173 | 41.0%| 1135 | 40.5%| 2299 | 49.3%| 737 | 54.4%| 1342 | 69.7%| 7279 | 44.6%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| Death | 1220 | 45.0%| 594 | 20.8%| 451 | 16.1%| 399 | 8.6%| 62  | 4.6%| 50  | 2.6%| 2776 | 17.0%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| Transfer-out | 303 | 11.2%| 415 | 14.5%| 397 | 14.2%| 637 | 13.7%| 143 | 10.5%| 240 | 12.5%| 2135 | 13.1%|     |    |     |    |     |    |     |    |    |    |    |    |    |
| Total Attrition | Attrition rate/100 py | Attrition |
|-----------------|-----------------------|-----------|
| N %             | N %                   | (overall = 9.46) | Hazard Ratio | Lower CI | Upper CI | p value |

**Gender**

| Male | 6664 | 40.8 | 3471 | 50.3 | 7.02 | - | - | - |
| Female | 9657 | 59.2 | 3436 | 49.7 | 14.43 | 0.93 | 0.869 | 0.996 | 0.039 |

**Age (years), median (IQR)**

| Age band | N | % | N | % | (overall = 10.49) | Hazard Ratio | Lower CI | Upper CI | p value |
|----------|----|---|----|---|-------------------|--------------|----------|----------|---------|
| 55+      | 1231 | 7.5 | 543 | 7.9 | - | - | - | - | - |
| 15–24    | 1697 | 10.4 | 794 | 11.5 | 12.24 | 1.077 | 0.935 | 1.241 | 0.306 |
| 25–34    | 6190 | 37.9 | 2737 | 39.6 | 10.34 | 0.919 | 0.82 | 1.031 | 0.149 |
| 35–44    | 4713 | 28.9 | 1871 | 27.1 | 8.87 | 0.832 | 0.74 | 0.936 | 0.002 |
| 45–54    | 2490 | 15.3 | 962 | 13.9 | 7.53 | 0.922 | 0.812 | 1.046 | 0.207 |

**Point of entry**

| N | % | N | % | (overall = 9.46) | Hazard Ratio | Lower CI | Upper CI | p value |
|----|---|----|---|-------------------|--------------|----------|----------|---------|
| Out-patient | 13,890 | 85.1 | 4983 | 72.1 | 7.37 | - | - | - |
| In-patient | 2431 | 14.9 | 1924 | 27.9 | 35.60 | 3.18 | 2.894 | 3.495 | < 0.0001 |

**CD4+ T-cell count (Cell/µL), median (IQR)**

| Range | N | % | N | % | (overall = 8.11) | Hazard Ratio | Lower CI | Upper CI | p value |
|-------|----|---|----|---|-------------------|--------------|----------|----------|---------|
| 500+ | 1923 | 11.8 | 343 | 5.0 | 8.11 | - | - | - | - |
| <50 | 2713 | 16.6 | 1817 | 26.3 | 22.28 | 1.91 | 1.626 | 2.242 | < 0.0001 |
| 50–99 | 2858 | 17.5 | 1270 | 18.4 | 8.20 | 1.182 | 1.006 | 1.388 | 0.042 |
| 100–199 | 2804 | 17.2 | 1272 | 18.4 | 9.27 | 1.024 | 0.996 | 1.031 | 0.149 |
| 200–349 | 4665 | 28.6 | 1729 | 25.0 | 6.69 | 0.794 | 0.65 | 0.969 | 0.023 |
| 350–499 | 1356 | 8.3 | 476 | 6.9 | 8.56 | 0.794 | 0.65 | 0.969 | 0.023 |

**Kaposi Sarcoma**

| N | % | N | % | (overall = 7.37) | Hazard Ratio | Lower CI | Upper CI | p value |
|----|---|----|---|-------------------|--------------|----------|----------|---------|
| 16,022 | 98.2 | 6694 | 96.9 | 9.29 | - | - | - | - |
| 299 | 1.8 | 213 | 3.1 | 22.44 | 1.987 | 1.652 | 2.39 | < 0.0001 |

**ART enrollment year**

| Year | N | % | N | % | (overall = 20.85) | Hazard Ratio | Lower CI | Upper CI | p value |
|------|----|---|----|---|-------------------|--------------|----------|----------|---------|
| 2019 | 436 | 2.7 | 53 | 0.8 | 20.85 | - | - | - | - |
| 2002 | 8 | 0.0 | 4 | 0.1 | 6.89 | 0.14 | 0.054 | 0.358 | < 0.0001 |
| 2003 | 77 | 0.5 | 24 | 0.3 | 2.74 | 0.31 | 0.182 | 0.526 | < 0.0001 |
| 2004 | 63 | 0.4 | 27 | 0.4 | 4.75 | 0.415 | 0.247 | 0.697 | 0.001 |
| 2005 | 234 | 1.4 | 105 | 1.5 | 5.56 | 0.318 | 0.216 | 0.467 | < 0.0001 |
| 2006 | 785 | 4.8 | 386 | 5.6 | 6.93 | 0.347 | 0.246 | 0.491 | < 0.0001 |
| 2007 | 1232 | 7.5 | 643 | 9.3 | 7.89 | 0.319 | 0.228 | 0.448 | < 0.0001 |
| 2008 | 1282 | 7.9 | 570 | 8.3 | 6.65 | 0.293 | 0.209 | 0.411 | < 0.0001 |
| 2009 | 1273 | 7.8 | 564 | 8.2 | 7.32 | 0.295 | 0.21 | 0.414 | < 0.0001 |
| 2010 | 1469 | 9.0 | 710 | 10.3 | 9.53 | 0.383 | 0.274 | 0.534 | < 0.0001 |
| 2011 | 1205 | 7.4 | 596 | 8.6 | 11.03 | 0.457 | 0.329 | 0.635 | < 0.0001 |
| 2012 | 1398 | 8.6 | 649 | 9.4 | 10.57 | 0.376 | 0.27 | 0.522 | < 0.0001 |
| 2013 | 1030 | 6.3 | 443 | 6.4 | 10.42 | 0.305 | 0.218 | 0.427 | < 0.0001 |
| 2014 | 1732 | 10.6 | 691 | 10.0 | 11.03 | 0.493 | 0.36 | 0.676 | < 0.0001 |
| 2015 | 1415 | 8.7 | 538 | 7.8 | 12.24 | 0.525 | 0.382 | 0.72 | < 0.0001 |
| 2016 | 1164 | 7.1 | 411 | 6.0 | 13.92 | 0.559 | 0.407 | 0.769 | < 0.0001 |

Continued
Conclusion

The results of this cohort study indicate that attrition after ART initiation is high. Nearly 40% of patients die or are LTFU. Low CD4 cell counts, starting ART as an inpatient, WHO clinical stage IV, and being a man were strongly associated with attrition. Although the mortality of patients diagnosed with tuberculosis after ART initiation was extremely high, patients who started anti-tuberculosis treatment before ART had similar attrition as patients without tuberculosis. The results of this study indicate that interventions aimed at initiating patients sooner after HIV seroconversion, improving the diagnosis and treatment of TB and other comorbidities (like Kaposi’s sarcoma), and giving extra support to patient groups at higher risk of attrition could potentially reduce the mortality and LTFU in HIV programs in Mozambique.

Table 4. Cox proportional hazards model for attrition among PLWH on ART at Carmelo Hospital of Chókwè (2002–2019). 

| ART therapy initiation | Total | Attrition | Attrition rate/100 py | Attrition |
|------------------------|-------|-----------|----------------------|-----------|
|                        | N     | %         | N                   | %         |
|                        |       | (overall = 9.46) | Hazard Ratio | Lower CI | Upper CI | p value |
| 2017                   | 844   | 5.2       | 305                 | 4.4       | 18.92    | 0.761   | 0.553 | 1.046 | 0.092 |
| 2018                   | 674   | 4.1       | 188                 | 2.7       | 21.54    | 0.98    | 0.706 | 1.36  | 0.904 |

| ART therapy initiation | Total | Attrition | Attrition rate/100 py | Attrition |
|------------------------|-------|-----------|----------------------|-----------|
|                        |       | N         | %                    |           |
|                        |       | (overall = 9.46) | Hazard Ratio | Lower CI | Upper CI | p value |
| TDF + 3TC + LPV/RTV    | 442   | 2.7       | 145                 | 2.1       | 3.50     | -       | -     | -     |
| ABC + 3TC + EFV        | 56    | 0.3       | 30                  | 0.4       | 31.57    | 3.978   | 2.589 | 6.111 | <0.0001 |
| ABC + 3TC + LPV/RTV    | 16    | 0.1       | 11                  | 0.2       | 10.54    | 2.189   | 1.05  | 4.561 | 0.037  |
| AZT + 3TC + ABC        | 203   | 1.2       | 109                 | 1.6       | 12.40    | 2.984   | 2.152 | 4.139 | <0.0001 |
| AZT + 3TC + EFV        | 418   | 2.6       | 194                 | 2.8       | 12.79    | 2.571   | 1.757 | 3.201 | <0.0001 |
| AZT + 3TC + LPV/RTV    | 52    | 0.3       | 19                  | 0.3       | 4.07     | 0.695   | 0.336 | 1.438 | 0.327  |
| AZT + 3TC + NVP        | 5511  | 33.8      | 1960                | 28.4      | 5.11     | 1.851   | 1.479 | 2.317 | <0.0001 |
| D4T + 3TC + ABC        | 531   | 3.3       | 406                 | 5.9       | 34.91    | 6.497   | 5.055 | 8.35  | <0.0001 |
| D4T + 3TC + EFV        | 666   | 4.1       | 556                 | 8.0       | 70.37    | 7.842   | 6.127 | 10.036 | <0.0001 |
| D4T + 3TC + LPV/RTV    | 3     | 0.0       | 2                   | 0.0       | 6.78     | 0.778   | 0.107 | 5.634 | 0.803  |
| D4T + 3TC + NVP        | 1588  | 9.7       | 1169                | 16.9      | 35.62    | 6.934   | 5.502 | 8.738 | <0.0001 |
| TDF + 3TC + DTG        | 68    | 0.4       | 1                   | 0.0       | 3.92     | 0.477   | 0.113 | 2.004 | 0.312  |
| TDF + 3TC + EFV        | 6767  | 41.5      | 2305                | 33.4      | 10.41    | 1.895   | 1.483 | 2.421 | <0.0001 |

1 p-values based on Cox regression proportional hazard risk. ART antiretroviral treatment, ABC abacavir, 3TC lamivudine, EFV efavirenz, LPV/RTV lopinavir/ritonavir, AZT zidovudine, D4T stavudine, NVP nevirapine, DGT dolutegravir.

Figure 3. Kaplan–Meier plot for PLHIV on ART at Carmelo Hospital of Chókwè (2002–2019), by CD4 cell count per µL.
Data availability
The datasets analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

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Author contributions

E.N., contribute on study design, data acquisition, study implementation, analysis and implementation of data, major contribution to writing, read an approved final version. E.V., J.N., A.M., & B.C., contributed equally on study design, data acquisition, study implementation, analysis and implementation of data, major contribution to writing, read an approved final version.

Competing interests

The authors declare no competing interests.

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Correspondence and requests for materials should be addressed to J.-M.R.-R.

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