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# Factors Linked to Tuberculosis Prevalence in HIV Patients Attending Kojja Health Center IV in Mukono District

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**ABSTRACT**

An estimated 2 million people die each year from TB worldwide. The prevalence of pulmonary tuberculosis infections among HIV/AIDS patients enrolled in Kojja Health Center IV Mukono district, and the factors influencing this prevalence. The Kojja Health Center IV ART clinic hosted this retrospective cohort health center-based study between August 2021 and November 2021. The majority of HIV patients at Kojja HC IV were female, 227 (74.7%), married, 131 (43.1%), running small businesses, 113 (37.2%), and 167 (54.9%) were of normal weight. Their baseline CD4 cell count was 200 (65.8%), and their TB prevalence while on ART was 51 (16.8%). The asymptomatic opportunistic infections (NOSS) 67 (22%), ESCA 33 (11%) were the most common. The asymptomatic opportunistic infections (NOSS) accounted for 67 (22%), ESCA for 33 (11%) and ORCA and PFV for 21 (7% of all opportunistic infections). The results of this study point to the possibility that patients receiving ART at Kojja HC IV are currently dealing with the issue of active pulmonary TB. While using ART, there is a higher chance of getting active TB among male patients, those with advanced HIV illness, and those who do not receive IPT.

**Keywords**: Prevalence, tuberculosis, HIV.

## INTRODUCTION

Globally, about 2 million deaths due to tuberculosis occur annually throughout the world [1]. According to WHO, about 1/3 of the world population is infected by TB half of which are in sub – Sahara Africa. 5 -10% of these will show symptoms and they become sick or infectious at some point, more so if they are HIV positive. Recent data estimates show that 3-7 million HIV patients develop TB per year and up to 5 million people develop acute pulmonary TB [1-3]. Tuberculosis cases have doubled or trebled in the past 10 years in several African countries owing to the HIV epidemic and Tuberculosis is responsible for about 13 percent of all AIDS death worldwide [1, 4-7]. Africa is facing the worst tuberculosis epidemic since the advent of the antibiotics era [8-10]. Driven by a generalized human immune deficiency virus (HIV) epidemic and compounded by weak health care systems, inadequate diagnostic laboratories and conditions that promote transmission of infectious agents, the devastating situation has become exacerbated by the emergence of drug-resistant strains of mycobacterium tuberculosis [11-13]. In Uganda, the HIV/AIDS epidemic has been accompanied by a severe epidemic of tuberculosis. Available data suggests that this increase in TB infection rate is mainly as a result of the burden of HIV infection primarily because HIV induces immune suppression. HIV is the most patient risk factor for the progression of TB infection to acute disease [14-16]. Individuals infected with tuberculosis alone have an approximately 10% life time risk of developing

acute TB compared to 10% annual risk among HIV-infected patients with a life time risk of developing TB which approaches 50% or more among them [17-21].

## Methodology

### Study design

This was a retrospective cohort health center-based study which was conducted at Kojja Health Center IV ART clinic between August 2021 and November 2021.



### Study area

Kojja Health Center IV is located in Mukono district, central Uganda. Mukono District is bordered by Kayunga District to the north, Buikwe District to the east, Kalangala District to the south-west, Kira municipality in Wakiso District to the west, and Luweero District to the north-west.

### Study population

The study population was all HIV positive patients' records who attended Kojja HC IV ART clinic for the period June 2020 to June 2021

### Inclusion criteria

The study considered all adult positive HIV seropositive patients' records captured between June 2020 to June 2021.

### Exclusion criteria

All young HIV positive patients were excluded, as well adult patient's records in the desired period but which were incomplete.

### Sample size determination

A minimum sample size of 304 patients was estimated using the Kish Lisle formula (1965) for cross-sectional studies, assuming 10% of HIV patients developed TB while receiving ART (Van Rie et al., 2016) with an allowable error of 0.03 at 95% confidence interval (CI).

### Sampling procedures

All patients' record files that met the inclusion criteria were selected and considered for sampling. Once the record files were got, sampling was performed based on odd number sequence starting from 1, 3, 5, 7…..etc. until the desired sample size of 304 was obtained.

### Data collection methods and management

Data was collected using a pre-designed data extraction tool. The data tool was designed to extract all the relevant data needed to achieve the objectives of the study.
The tool was able to extract patient demographic data, clinical data and individual ART regime data.

### Data analysis

Quantitative data checked for completeness, coded, double entered and cleaned using Epi Info version 7, then exported to STATA 11 software for analysis. All continuous variables were summarized as medians with interquartile range while the categorical variables were as proportions with percentages. The proportion of patients who developed TB while receiving ART was calculated and expressed as percentage, and the logistic regression model was used to determine the odds ratios and 95% CI to find out the degree of association between the outcome of interest and the potential predictors of TB while using ART. In all calculations, factors were said to have a significant statistical association with the outcome of interest if $p < 0.05$.

### Ethical considerations

Approval to conduct this study was obtained from Kampala International University – Western campus Faculty of Clinical Medicine & Dentistry and from the Health center administration of Kojja HC IV.
Only codes were used to identify patients' records files to ensure no names are used.

## RESULTS

The median age of HIV patients at Kojja HC IV was 37 (32–46) years, majority were female 227 (74.7%), married 131 (43.1%), operating small businesses 113 (37.2%), of normal weight 167 (54.9%), with a ≥200Baseline CD4 in cells/µl 200 (65.8%) and a TB prevalence while on ART of 51 (16.8%) as shown in Table 1 and Figure 2.

**Figure 1:** Column Graph showing the demographic characteristics and prevalence of TB among adult HIV patients attending Kojja HV IV.

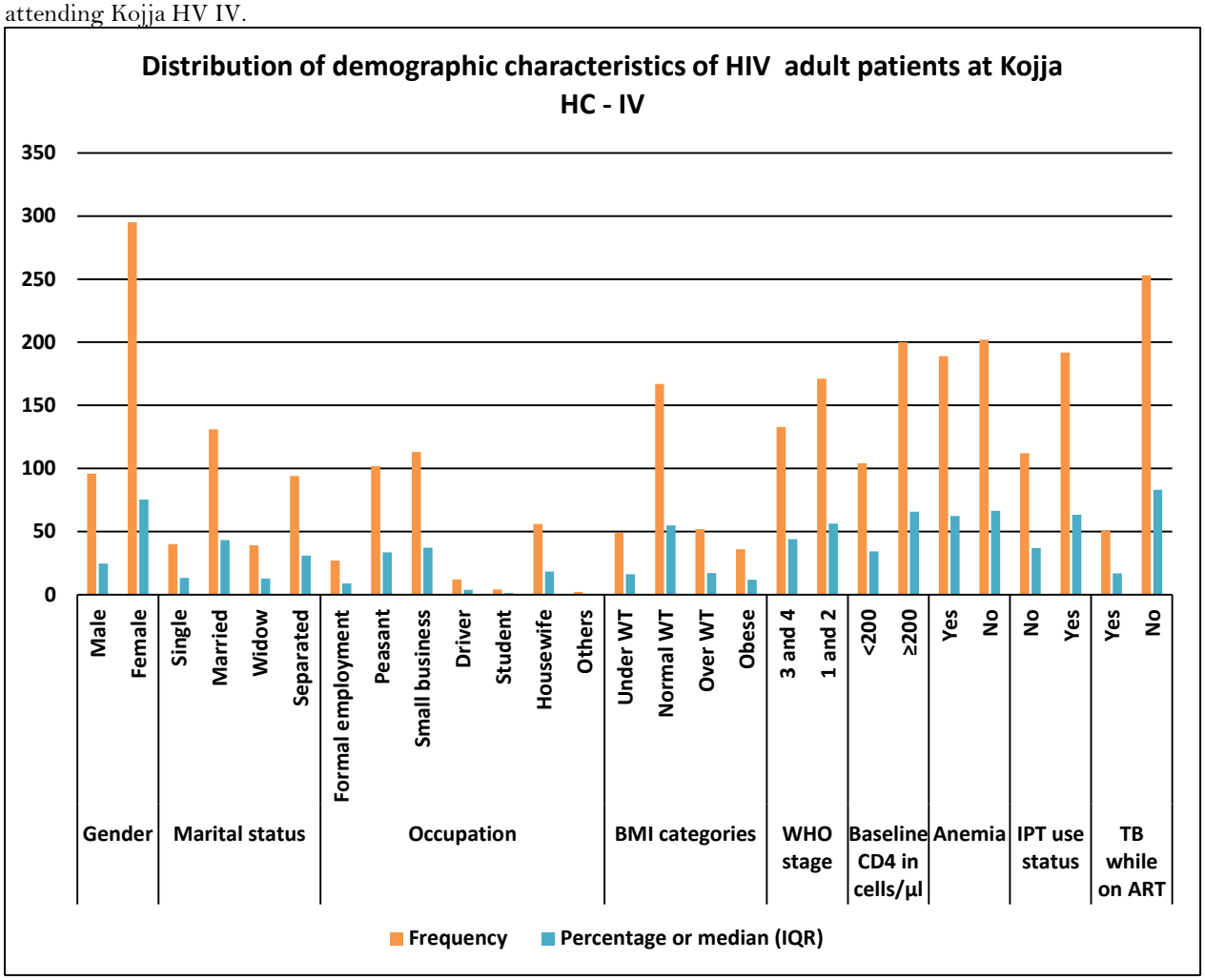


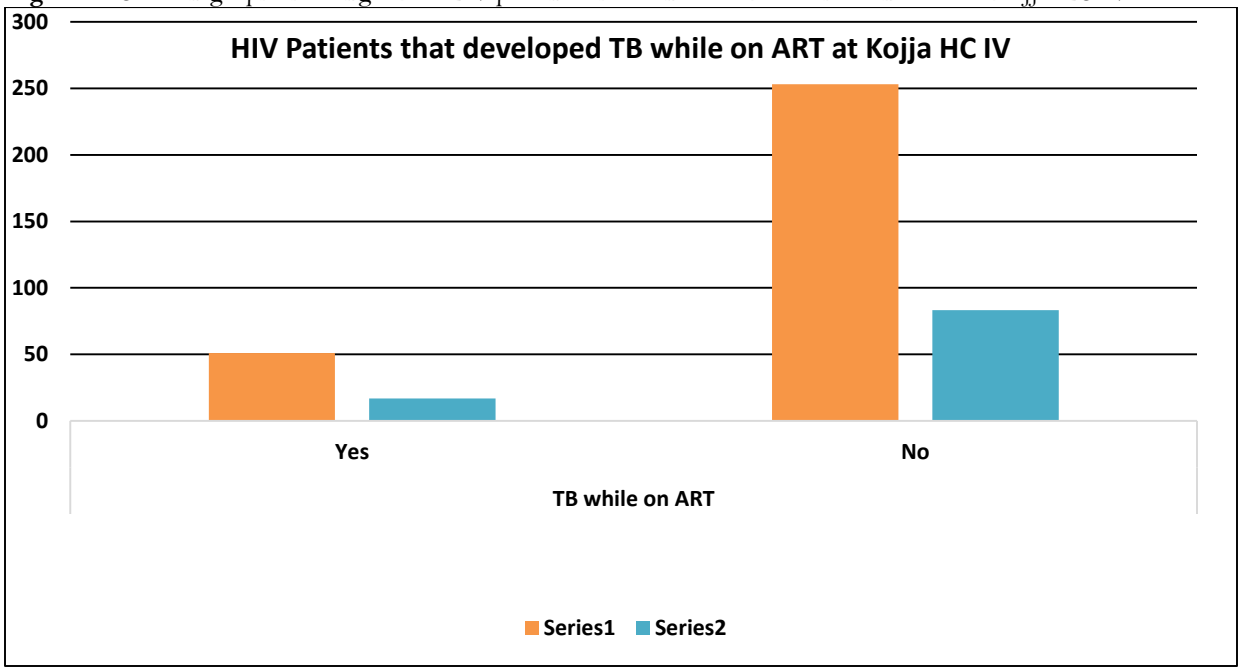

**Table 1:** Demographic characteristics of adult HIV patients at Kojja HC IV

| Variables | Frequency | Percentage or median (IQR) |
|---|---|---|
| **Age in years** | 304 | 37 (32–46) |
| ***Gender*** | | |
| Male | 77 | 25.3 |
| Female | 227 | 74.7 |
| ***Marital status*** | | |
| Single | 40 | 13.2 |
| Married | 131 | 43.1 |
| Widow | 39 | 12.8 |

| | | |
|---|---|---|
| Separated | 94 | 30.9 |
| ***Occupation*** | | |
| Formal employment | 27 | 8.9 |
| Peasant | 102 | 33.6 |
| Small business | 113 | 37.2 |
| Driver | 12 | 3.9 |
| Student | 4 | 1.3 |
| Housewife | 56 | 18.4 |
| Others | 2 | 0.7 |
| ***BMI categories*** | | |
| Under WT | 49 | 16.1 |
| Normal WT | 167 | 54.9 |
| Over WT | 52 | 17.1 |
| Obese | 36 | 11.8 |
| ***WHO stage*** | | |
| 3 and 4 | 133 | 43.8 |
| 1 and 2 | 171 | 56.3 |
| ***Baseline CD4 in cells/µl*** | | 289 (125–509) |
| <200 | 104 | 34.2 |
| ≥200 | 200 | 65.8 |
| ***HB in g/dL*** | | 11 (9.6–12.6) |
| ***Anemia*** | | |
| Yes | 189 | 62.2 |
| No | 202 | 66.4 |
| ***Duration on ART (mo)*** | | 15 (11–21) |
| ***IPT use status*** | | |
| No | 112 | 36.8 |
| Yes | 192 | 63.2 |
| ***TB while on ART*** | | |
| Yes | 51 | 16.8 |
| No | 253 | 83.2 |

Of the adult HIV patients studied in retrospective, 51 patients contracted pulmonary tuberculosis accounting for a prevalence of 16.8% as shown in Figure 3.

**Figure 2:** Column graph showing adult HIV patients that contracted TB while on ART at Kojja HC IV




Of the adult HIV patients attending Kojja HC IV studied in retrospect, 235 accounting for 77.3% had opportunistic infections. The opportunistic infections that the patients presented with where Recurrent Bacterial Pneumonia (BPNA), Chronic Diarrhoea (CDIA), Cryptococcal Meningitis (CRYM), Esophageal Candidiasis (ESCA), Herpes zoster (HPZ), Kaposi sarcoma (KS), Asymptomatic (NOSS), Oral Candidiasis (ORCA), Persistent Fever (PFV), Persistent Generalized Lymphadenopathy (PGL) and Pruritic (PPE).
The most prevalent opportunistic infections were the asymptomatic ones (NOSS) 67 (22%), ESCA 33 (11%) followed by ORCA and PFV accounting for 21 (7%) each as shown in Table 2 and Figure 3.

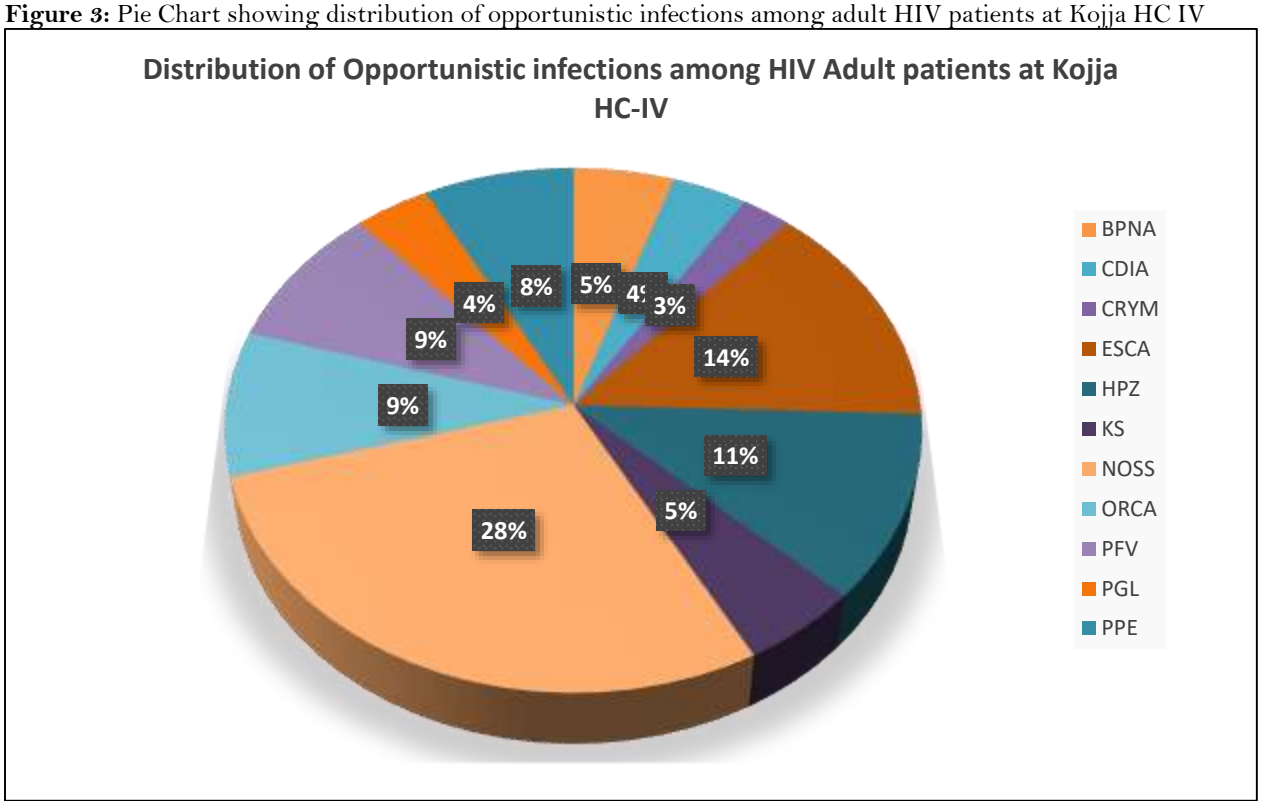
**Table 2:** Distribution of opportunistic infections among adult HIV patients at Kojja HC IV

| Opportunistic Infection | Frequency | Percentage (%) |
|---|---|---|
| **BPNA:** Recurrent Bacterial Pneumonia | 12 | 4 |
| **CDIA:** Chronic Diarrhoea | 9 | 3 |
| **CRYM:** Cryptococcal Meningitis | 6 | 2 |
| **ESCA:** Esophageal Candidiasis | 33 | 11 |
| **HPZ:** Herpes zoster | 27 | 9 |
| **KS:** Kaposi sarcoma | 12 | 4 |
| **NOSS:** Asymptomatic | 67 | 22 |

| | | |
|---|---|---|
| **ORCA:** Oral Candidiasis | 21 | 7 |
| **PFV:** Persistent Fever | 21 | 7 |
| **PGL:** Persistent Generalized Lymphadenopathy | 9 | 3 |
| **PPE:** Pruritic | 18 | 6 |



**Figure 3:** Pie Chart showing distribution of opportunistic infections among adult HIV patients at Kojja HC IV



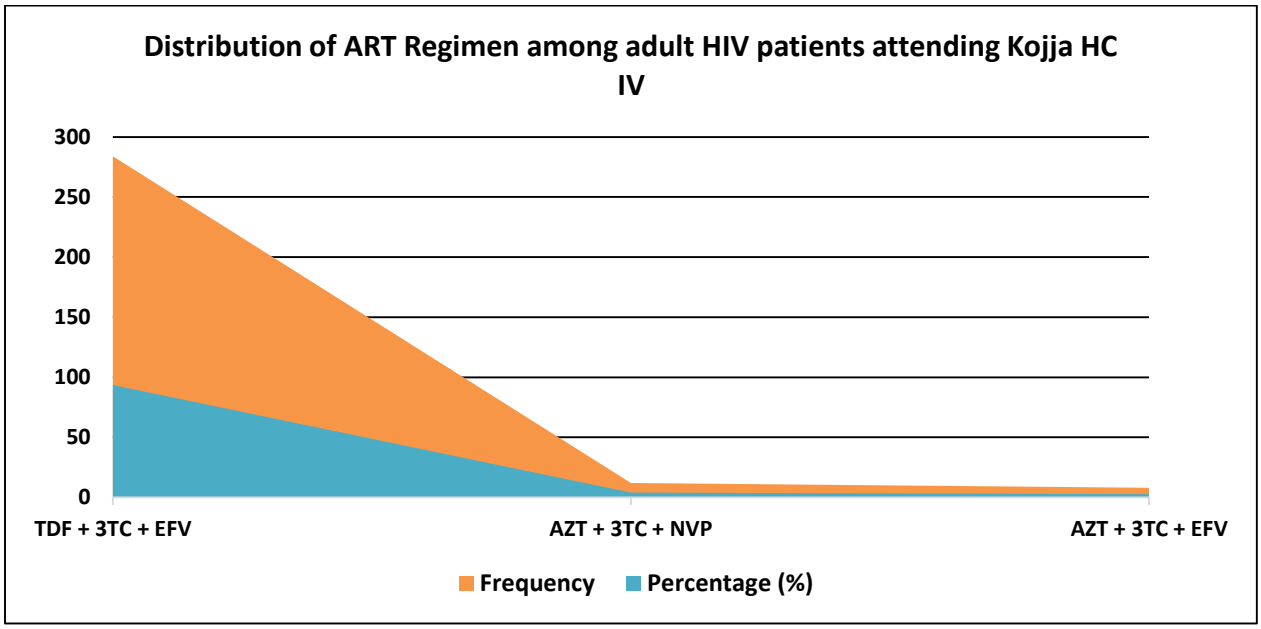

Of the 304 patients at Kojja HC IV patients studied, majority 284 (93.7%), were on tenofovir- (TDF-) based regimens, while the rest were on zidovudine- (ZVD-) based regimens as shown in Table 3 and Figure 5

**Table 3:** Distribution of ART regimens among adult HIV patients at Kojja HC IV

| ART Regimen | Frequency | Percentage (%) |
|---|---|---|
| **TDF + 3TC + EFV** | 284 | 93.7 |
| **AZT + 3TC + NVP** | 12 | 3.6 |
| **AZT + 3TC + EFV** | 8 | 2.7 |

**AZT:** Zidovudine; **EFV:** Efavirenz; **3TC:** Lamivudine; **NVP:** Nevirapine; **TDF:** Tenofovir

**Figure 4:** Area chart showing distribution of ART regimens among adult HIV patients at Kojja HC IV




In logistic regression model, being a male was independently associated with developing pulmonary TB (OR = 2.6; p = 0.005), as well as having WHO clinical stage 3 and 4 AIDS-defining illness at baseline (OR = 2.1; p = 0.024), lower CD4 count than 200 cells/µl (OR = 8.2; p < 0.001), and havingnot used IPT (OR = 3.6; p = 0.042). The difference in distribution of other factors was not statistically significant as shown in Table 4.

| Variables | TB while receiving ART | | | | Unadjusted | | Adjusted | |
|---|---|---|---|---|---|---|---|---|
| | Yes (*N*=51) | %age | No (*N*=253) | %age | OR (95% CI) | *p* value | OR (95% CI) | *p* value |
| ***Gender*** | | | | | | | | |
| Male | 28 | 54.9 | 52 | 20.5 | 4.8 (2.5–9.3) | **<0.001** | 2.6 (1.3–6.2) | **0.005** |
| Female | 23 | 45.1 | 201 | 79.4 | | | | |
| ***Age group*** | | | | | | | | |
| ≤50 y ears | 8 | 15.7 | 42 | 16.6 | 1.0 (0.4–2.2) | 0.949 | | |
| ≥50 years | 43 | 84.3 | 211 | 83.3 | | | | |
| ***Marital status*** | | | | | 0.6 (0.2–1.7) | 0.368 | | |
| Single | 5 | 9.8 | 36 | 14.2 | 1.4 (0.7–2.5) | 0.333 | | |
| Married | 25 | 49.0 | 104 | 41.1 | 1.7 (0.9–3.3) | 0.166 | | |
| Separated | 20 | 39.2 | 69 | 27.3 | 0.1 (0.0–0.8) | 0.034 | | |
| Widow | 1 | 2.0 | 44 | 17.4 | | | | |
| ***Occupation*** | | | | | 0.7 (0.2–3.0) | 0.622 | | |
| Formal | 2 | 3.9 | 17 | 6.7 | 0.4 (0.2–1.0) | 0.061 | | |
| Peasant | 7 | 13.7 | 70 | 27.7 | 1.5 (0.8–2.9) | 0.179 | | |
| Small business | 21 | 41.2 | 80 | 31.6 | 4.3 (1.2–15.0) | **0.025** | 2.5 (0.4–13.3) | 0.294 |
| Driver | 5 | 9.8 | 6 | 2.4 | 2.3 (0.4–11.8) | 0.290 | | |
| Student | 2 | 3.9 | 6 | 2.4 | 1.1 (0.4–3.0) | 0.796 | | |
| Housewife | 6 | 11.8 | 5 | 2.0 | 0.7 (0.2–1.6) | 0.380 | | |
| Others | 7 | 13.7 | 49 | 19.4 | | | | |
| ***BMI categories*** | | | | | 3.0 (1.4–6.1) | **0.001** | 1.4 (0.6–3.2) | 0.463 |
| Under WT | 17 | 33.3 | 35 | 13.8 | 0.7 (0.3–1.2) | 0.223 | | |
| Normal WT | 25 | 49.0 | 148 | 58.5 | 0.7 (0.3–1.8) | 0.476 | | |
| Over WT | 7 | 13.7 | 47 | 18.6 | 0.4 (0.1–2.0) | 0.329 | | |
| Obese | 2 | 3.9 | 22 | 8.7 | | | | |
| ***WHO stage*** | | 2.0 | | | | | | |
| 3 and 4 | 37 | 72.5 | 108 | 42.7 | 3.5 (1.7–7.0) | **<0.001** | 2.1 (1.0–5.2) | **0.024** |
| 1 and 2 | 14 | 27.4 | 145 | 57.3 | | | | |
| ***Baseline CD4 cells*** | | | | | | | | |
| <200 | 42 | 82.3 | 68 | 26.9 | 11.8 (5.2–26.4) | **<0.001** | 8.2 (3.9–21.0) | **<0.001** |
| ≥200 | 9 | 17.6 | 185 | 73.1 | | | | |
| ***Anemia*** | | | | | | | | |
| Yes | 26 | 51.0 | 121 | 47.8 | 1.1 (0.6–2.1) | 0.694 | | |
| No | 25 | 49.0 | 132 | 52.1 | | | | |
| ***IPT use status*** | | | | 0.4 | | | | |
| No | 46 | 90.2 | 181 | 71.5 | 3.8 (1.3–11.1) | **0.016** | 3.6 (1.0–9.4) | **0.042** |
| Yes | 5 | 9.8 | 72 | 28.4 | | | | |
| ***ART Regimen*** | | | | | 0.3 (0.1–1.1) | 0.080 | | |
| TDF/3TC/EFV | 46 | 90.2 | 244 | 96.4 | 4.1 (0.7–23.6) | 0.104 | | |
| AZT/3TC/EFV | 3 | 5.9 | 3 | 1.2 | 2.0 (0.4–10.1) | 0.367 | | |
| AZT/3TC/NVP | 2 | 3.9 | 6 | 2.4 | | | | |

## DISCUSSION

The TB prevalence rate while on ART observed in this study is similar to a previous prevalence rate of 10% reported from South Africa in 2011[22], and it is also consistent with that reported in 2015 from Eastern Uganda, where a total of 52607 were enrolled and 5944 (11.3%) were found to develop active TB while on ART follow-up program. However, a much lower rate of TB was reported in 2014 from a study involving 1824 ART experienced patients in Mexico where only 45 (2.47%) developed active TB. Another smaller TB rate of 5.6% was reported from the Netherlands in 2010 [23]. On the other hand, a much higher prevalence of TB was reported from a recent study in South Africa by Gupta involving 1544 patients on ART where 424 (30.1%) developed active TB in a course of 5 years [24]. The difference in TB rates could partly be explained by the overall prevalence of TB and HIV which is lower in most of the developed countries as compared to resource-restricted countries. However, even with these differences, it is important to note that though ART has significant effect on the overall occurrence of TB among HIV patients [25], the occurrence of TB while receiving ART is still higher as compared to the general population as reported previously, and it has been noted to be associated with increased mortality rate in this subgroup of patients [26]. Another study from Nigeria reported similar findings that patients who had lower baseline CD4 counts <200 cells/μl and those with prior history of TB had increased risk of developing TB while receiving ART. Reporting 8% prevalence rate of TB while receiving ART in addition to lower CD4 counts, patients who developed TB on ART were also most likely to have a positive tuberculin skin test and prior history of admission [27]. In this study also, patients who did not receive IPT while on ART were likely to develop TB as compared to those who received IPT. In 2015, one study from Ethiopia had a similar observation to this finding [28]. In this study, it was demonstrated that occurrence of TB while receiving ART was more common among those who did not use IPT as compared to those who used IPT (AHR = 2.41; p 0.05). Similarly, a prior study in Dar-es Salaam, Tanzania, by Liu et al. had indicated that patients who did not use IPT had increased risk of developing active TB while receiving ART (AHR = 2.25; p<0.001) as compared to those who were on IPT [29]. Findings suggest that occurrence of TB while receiving ART is still a common problem in Tanzania as well and IPT could potentially reduce the TB-related morbidity and mortality in these patients. Use of IPT alone has been shown to reduce the risk of active TB by 32% among those living with HIV [30], whereas ART alone has been shown elsewhere to reduce the risk of active TB by up to 67% [31] and risk of mortality by 64–95% especially when initiated timely. Concomitant use of ART and IPT was reported previously to have a much greater effect on incidence of TB of up to 80% [32].



## CONCLUSION

In conclusion, the findings of this study suggest that active pulmonary TB is a present problem among patients receiving ART at Kojja HC IV. Male patients, those with advanced HIV disease, and those who do not receive IPT are at an increased risk of developing active TB while on ART. A timely HIV diagnosis and treatment could potentially reduce the incidence of tuberculosis while on ART. These findings also support the use of IPT in patients who are negative for tuberculosis in order to reduce the severity of this problem while on ART.

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