Research Article

Hospitalization and Predictors of Inpatient Mortality among HIV-Infected Patients in Jimma University Specialized Hospital, Jimma, Ethiopia: Prospective Observational Study

Kirubel Minsamo Mishore (1), Nezif Hussein, and Solomon Assefa Huluka (2,3)

1School of Pharmacy, College of Health and Medical Sciences, Haramaya University, Harar, Ethiopia
2Department of Pharmacy, College of Public Health and Medical Sciences, Jimma University, Jimma, Ethiopia
3Department of Pharmacology and Clinical Pharmacy, School of Pharmacy, Addis Ababa University, P.O.Box 1176, Addis Ababa, Ethiopia

Correspondence should be addressed to Solomon Assefa Huluka; solomon.assefa@aau.edu.et

Received 12 August 2019; Revised 31 March 2020; Accepted 24 April 2020; Published 27 May 2020

Academic Editor: Bhaskaran Unnikrishnan

Copyright © 2020 Kirubel Minsamo Mishore et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Despite the number of patients enrolled in ART is increased, HIV/AIDS continues to constitute a significant proportion of medical admissions and risk of mortality in low- and middle-income countries. As one of these countries, the case in Ethiopia is not different. The aim of this study was thus to assess reasons for hospitalization, discharge outcomes, and predictors of inpatient mortality among people living with HIV (PLWH) in Jimma University Specialized Hospital (JUSH), Jimma, Southwest Ethiopia. Prospective observational study was conducted in medical wards of JUSH from February 17th to August 17th, 2017. In this study, 101 PLWH admitted during the study period were included. To identify the predictors of mortality, multiple logistic regression analysis was employed. Of the 101 hospitalized PLWH, 62 (61.4%) of them were females and most of them (52.5%) were between 25 and 34 years of age. A majority (79.2%) of the study participants were known HIV patients, before their admission. Tuberculosis (24.8%), infections of the nervous system (18.8%), and pneumonia (9.9%) comprised more than half of the reasons for hospitalization. Moreover, drug-related toxicity was a reason for hospitalization of 6 (5.9%) patients. Outcomes of hospitalization indicated that the overall inpatient mortality was 18 (17.8%). The median CD4 cell counts for survivors and deceased patients were 202 cells/μL (IQR, 121–295 cells/μL) and 70 cells/μL (IQR, 42–100 cells/μL), respectively. Neurologic complications (AOR = 13.97; 95% CI: 2.32–84.17, P = 0.004), CD4 count ≤ 100 cells/μL (AOR = 16.40; 95% CI: 2.88–93.42, P = 0.002), and short hospital stay (AOR = 12.98, 95% CI: 2.13–78.97, P = 0.005) were found to be significant predictors of inpatient mortality. In conclusion, opportunistic infections are the main reason of hospitalization in PLWH.

1. Introduction

Globally, close to 35 million people are believed to live with HIV. Sub-Saharan Africa, worst affected region, in particular accounts for 71% of HIV infections [1]. Life expectancy for patients infected with HIV has improved significantly in the era of highly active antiretroviral therapy (HAART) [2]. The decline in hospitalization due to HAART, however, has been unevenly distributed and inconsistent. Despite the global decrease in AIDS-related death and improvement of access to HAART, eastern and southern Africa remain the most HIV-affected regions [3]. In such low- and middle-income countries, HIV and its associated immunosuppression (AIDS) continue to constitute a significant deal of morbidity and mortality in adults. In some of these countries, the problem is acute [4–6].

In resource-poor settings, between 20% and 52% of hospital beds in medical wards are occupied by HIV-infected patients at any given time, mostly with opportunistic infections [7] and ended up with longer hospital stays [8]. Furthermore, it is reported that non-HIV-related hospitalizations of HIV-infected patients is increasing, globally [9].
Most reports of hospitalization from HIV infection in the era of HAART are from the developed countries [10–13]. This is mainly because publications reporting HIV-related hospitalization from developing countries are infrequent.

Data on the spectrum of both HIV- and non-HIV-related illnesses that result in hospital admission are essential for policymakers and stakeholders to plan actions in reducing morbidity, mortality, and further hospitalization [14]. Recently, Negera and Mega [15] reported that body mass index (BMI) of less than 18.5 is a significant predictor of inpatient mortality in Ethiopia. However, with the paucity of published data on HIV/AIDS in Ethiopia, little is known about other reasons for hospitalizations, discharge outcomes, and predictors of inpatient mortality in hospitalized patients with HIV. Thus, this study aimed to assess reasons for hospitalization, discharge outcomes, and predictors of inpatient mortality among people living with HIV in Jimma University Specialized Hospital (JUSH), Jimma, Southwest Ethiopia.

2. Methods

2.1. Study Area and Period. This study was conducted from 17th February to 14th August 2017 in medical wards of JUSH, which is the only teaching and referral hospital in Southwest Ethiopia. The hospital provides services for approximately 9000 inpatient and 80,000 outpatient attendants a year from the catchment population of about 15 million people. It has more than 450 beds. In this hospital, the HIV test was performed using the HIV 1/2 STAT-PAK1 RDT (Chembio Diagnostics, Medford, NY, USA) kit. In JUSH, *Mycobacterium tuberculosis* diagnosis was made using the Xpert assay (Cepheid Xpert MTB/RIF®).

2.2. Study Design and Participants. A hospital-based prospective observational study was employed. The study population included 101 patients who met the following criteria: HIV seropositive (either known prior to hospitalization or tested positive following hospitalization), adult patients (≥15 years), admitted to medical wards of JUSH in the study period, willing to participate in the study, and stayed for at least 24 hours in the inpatient wards. To confirm HIV status of patients, every hospitalized patient underwent provider-initiated counseling and testing (PICT).

2.3. Data Collection and Data Quality. Patient demographics, anthropometric measurements, reason for hospitalization, comorbidities, complications, laboratory profile, and HAART status were collected using a predesigned data collection form. All CD4 cell counts included in study analyses were either done during hospitalization or within the previous 1 month before hospitalization. The clinical staging of patients was carried out using WHO guidelines for the clinical staging of HIV/AIDS for adults.

Adherence to HAART was assessed for 46 patients who were on HAART for at least 6 months prior to their admission. Adherence was estimated from patients’ self-report of missed doses out of 30 doses of their prescribed medication and reported as good (≥95%), fair (85 to 95%), or poor (<85%) if and only if they missed 2 and less, 3 to 5, or 6 and more doses, respectively [16]. Data were collected by hospital pharmacists, working in medical wards, after being trained on interview techniques, data collection methods, and techniques of measurements. Moreover, to determine the outcomes of hospitalization, they followed the patients prospectively until discharged or died.

2.4. Data Processing and Analysis. Data were coded, entered, cleaned, and analyzed using SPSS version 20 statistical package. Bivariate and multivariate logistic regression analyses with 95% confidence interval were employed in order to infer associations and predictions. In bivariate analysis, all explanatory variables that are associated with the outcome variable (inpatient mortality) with a *P* value of <0.2 were included in the final logistic model. *P* value < 0.05 was considered as statistically significant for all the independent variables in the final model.

2.5. Ethical Consideration. Letter of ethical clearance was obtained from the Ethical Review Board of College of Public Health and Medical Sciences, Jimma University. Informed, voluntary, written, and signed consent/assent was obtained from each study participants/caregivers. Privacy and confidentiality were strictly maintained throughout the study.

3. Results

3.1. Sociodemographic Characteristics of the Study Population. Of 101 hospitalized PLWH enrolled in the study, 62 (61.4%) of them were females and 53 (52.5%) of the patients were between 25 and 34 years of age. Most of the study participants were urban residents (64.4%) and unemployed (62.4%). As it is illustrated in Table 1, the measured mean BMI of patients was 17.63 ± 3.24 kg/m². Slightly more than one-third of the patients (34.8%) had severe malnutrition (BMI < 16 kg/m²).

3.2. Clinical Characteristics of the Participants. Clinical characteristics and laboratory findings of the patients are presented in Tables 2 and 3, respectively. The result showed that 21 (20.8%) of participants were newly diagnosed HIV-positive patients (tested on hospitalization). For known HIV patients (79.2%), the median duration of time since their diagnosis was 24 months (IQR, 6–60). Majority (82.2%) of the patients were in WHO clinical stage 4 and 44.6% of them had complications. The main (46.7%) complication of the hospitalized patient was severe neurologic dysfunctions. More than a quarter (27.7%) of the participants had a history of prior hospitalization in the last 12 months, and opportunistic infections were the leading (53.6%) reasons for their previous hospitalization (Table 2).

In this study, 29 (28.7%) of the patients had CD4 cell counts of ≤100 cells/μL (IQR, 93.5–279.0). The median CD4 cell count for survivors and died was 202 cells/μL (IQR, 121–295) and 70 cells/μL (IQR, 42–100), respectively.
Hospitalized Patients.
Tuberculosis (TB) was the most leading (36.8%) reason for treatment switch (Table 4). Among 19 (29.2%) patients who had regimen changes, treatment failure was found to be the reason for hospitalization (Figure 1). The median duration of hospital stay for the patients was found to be 13 days (IQR, 8–20 days). As it is revealed in Figure 2, 82.2% of the admitted patients survived: 69 (68.3%) discharged, 10 (9.9%) of them discharge against medical advice (DAMA), and 4 (4.0%) transferred cases. The remaining 18 (17.8%) were deceased, of whom 12 (66.7%) died within the first 7 days of their hospital stay.

3.5. Factors Associated with Inpatient Mortality. Both univariate and multivariate logistic regression analyses (Table 5) showed that presence of neurologic complications, CD4 count ≤100 cell/µL, and hospital stay of less than 7 days were predictors of inpatient mortality. PLWH hospitalized with neurologic complications were almost fourteen times more likely to die inpatient compared with those who were not (AOR = 13.97; 95% CI: 2.32–84.17, \( P = 0.004 \)). The odds of dying inpatient were significantly (\( P = 0.002 \)) higher in PLWH hospitalized with CD4 count ≤100 cells/µL compared with CD4 count > 100 cells/µL (AOR = 16.40; 95% CI: 2.88–93.42).

4. Discussion
In this study, opportunistic and other infectious diseases were dominant attributes of hospitalization. The spectrum of opportunistic infection is in agreement with previous reports on hospitalized HIV/AIDS patients from other parts of Ethiopia [17–19] and other low- and middle-income countries [3, 5, 20–23]. Our study, however, reported a relatively lower proportion of TB. This could be because of the better availability of free HAART, which determines the frequency and severity of opportunistic infections such as active TB disease [7, 18, 24].

The prevalence of CNS infections observed during our study period was 18.8%. This is in line with a similar study conducted in Kenya [25] and lower than other studies [26, 27]. The common CNS infections identified were cryptococcal meningitis (36.8%), bacterial meningitis (31.6%), and cerebral toxoplasmosis (31.6%). This proportion of CNS infections was consistent with other studies [3, 15, 20–23]. HAART-related toxicity was also among the commonly occurred reasons for hospitalization. Proper counseling about the adverse effects of antiretroviral drugs and aggressive monitoring of patients before and within the first few weeks of commencement of HAART will help to reduce morbidity associated with the use of these drugs.

The overall inpatient mortality in our study population was 17.8%, similar to previous reports [3, 23, 31]. Our finding, nevertheless, was higher than previous studies in India [6] and France [30]. The high mortality is probably reflective of the advanced nature of the disease during hospitalization [10, 20]. Although there were differences in study design, a higher mortality rate was reported in other studies [16, 20, 21, 32].

Logistic regression analysis showed that presentation with neurologic complications, low CD4 count (≤100 cells/µL), and short duration of hospital stay (<7 days) were predictors of inpatient mortality. Multiple studies reported a statistically significant association of low CD4 cell counts as the predictor of inpatient mortality [20, 33]. HIV patients hospitalized with neurologic complications were almost 14 times more likely to die inpatient compared with those without neurologic complications. This is in accordance with findings from other studies from Ethiopia by Berhe et al. [34] and elsewhere by Gill et al. [35].

**Table 1: Sociodemographic characteristics of PLWH hospitalized to the medical wards of JUSH, Jimma, Southwest Ethiopia, 2017 (N = 101).**

| Characteristics                  | Frequency | Percent |
|----------------------------------|-----------|---------|
| **Sex**                          |           |         |
| Male                             | 39        | 38.6    |
| Female                           | 62        | 61.4    |
| **Age group**                    |           |         |
| 15–24                            | 8         | 7.9     |
| 25–34                            | 53        | 52.5    |
| 35–44                            | 25        | 24.7    |
| 45+                              | 15        | 14.9    |
| **Residence**                    |           |         |
| Urban                            | 65        | 64.4    |
| Rural                            | 36        | 35.6    |
| **Level of education**           |           |         |
| No education                     | 29        | 28.7    |
| Primary                          | 42        | 41.6    |
| Secondary+                       | 30        | 29.7    |
| **Marital status**               |           |         |
| Single                           | 15        | 14.8    |
| Married                          | 50        | 49.5    |
| Divorced                         | 25        | 24.8    |
| Widowed                          | 11        | 10.9    |
| **Occupation**                   |           |         |
| Government employee              | 10        | 9.9     |
| Self-employed                    | 28        | 27.7    |
| Unemployed                       | 63        | 62.4    |
| **Body mass index (in kg/m²)**   |           |         |
| <16                              | 35        | 34.7    |
| 16–18.5                          | 23        | 22.7    |
| 18.5–24.9                        | 43        | 42.6    |
| ≥25                              | 0         | 0.0     |

Anemia was reported in 88 of 96 (85.4%) patients (defined as hemoglobin (Hg) < 13 gm/dL for males and <12 gm/dL for females), and it was severe (Hg < 8 gm/dL) in 21 (21.9%) of them.
### Table 2: Clinical characteristics of PLWH hospitalized to medical wards of JUSH, Jimma, Southwest Ethiopia, 2017.

| Characteristics                        | Category          | Frequency | Percent |
|----------------------------------------|-------------------|-----------|---------|
| HIV status at admission                | Known             | 80        | 79.2    |
|                                        | New               | 21        | 20.8    |
| Duration of HIV in month (N = 80)      | <6 months         | 21        | 26.3    |
|                                        | ≥6 months         | 59        | 73.7    |
| Clinical stage of HIV/AIDS on hospitalization | Stage 1       | 5         | 5.0     |
|                                        | Stage 2           | 2         | 2.0     |
|                                        | Stage 3           | 13        | 13.0    |
|                                        | Stage 4           | 81        | 80.2    |
| Complication (N = 45)                  | Neurologic        | 21        | 46.7    |
|                                        | Respiratory       | 14        | 31.1    |
|                                        | Hypovolemic shock | 2         | 4.4     |
|                                        | Hepatic encephalopathy | 2   | 4.4    |
|                                        | Gastric bleeding  | 2         | 4.4     |
|                                        | Nephropathy       | 2         | 4.4     |
| Comorbidity (N = 22)                   | Cardiovascular    | 8         | 36.4    |
|                                        | Gastrointestinal  | 5         | 22.7    |
|                                        | Urologic          | 5         | 22.7    |
|                                        | Respiratory       | 4         | 18.2    |
| Reasons for hospitalization (known HIV-positive patients) in the last 12 months (N = 28) | Opportunistic infections | 15 | 53.6 |
|                                        | DVT               | 2         | 7.1     |
|                                        | COPD*             | 2         | 7.1     |
|                                        | Malaria           | 2         | 7.1     |
|                                        | Bacterial meningitis | 2   | 7.1    |
|                                        | Not specified     | 5         | 17.9    |

*Chronic obstructive pulmonary disease; DVT = deep venous thrombosis.

### Table 3: Laboratory profile of PLWH hospitalized to the medical wards of JUSH, Jimma, Southwest Ethiopia, 2017.

| Parameters                          | Median (IQR) | References |
|-------------------------------------|--------------|------------|
| Hemoglobin (gm/dL) (N = 96)         | 9.75 (8.50–11.50) | 12.0–17.0 |
| Hematocrit (%) (N = 96)             | 30.24 (26.19–34.70) | 40.0–54.0 |
| Platelet (×10^9/L) (N = 93)         | 252.0 (149.50–402.0) | 150–500   |
| Aspartate aminotransferase (unit/L) (N = 77) | 40.0 (21.40–80.50) | 0–38      |
| Alanine aminotransferase (unit/L) (N = 76) | 25.25 (16.05–45.83) | 0–40      |
| Serum creatinine (mg/dL) (N = 70)   | 0.85 (0.68–1.29) | 0.8–1.2   |
| Blood urea nitrogen (mg/dL) (N = 70) | 24.13 (14.38–41.54) | 8–20      |
| CD4 count (cells/μL) (N = 101)      | 193.0 (93.30–279.0) | 500–1,500 |

### Table 4: Antiretroviral therapy related characteristics of PLWH admitted to medical wards of JUSH, Jimma, Southwest Ethiopia, 2017.

| Characteristics                         | Category          | Frequency | Percent |
|-----------------------------------------|-------------------|-----------|---------|
| Prior HAART use (N = 80)                | Yes               | 65        | 81.2    |
|                                        | No                | 15        | 18.8    |
| Type of HAART regimen (N = 65)          | First line        | 58        | 89.2    |
|                                        | Second line       | 7         | 10.8    |
| First-line regimen (N = 58)             | TDF + 3TC + EFV   | 37        | 63.8    |
|                                        | AZT + 3TC + NVP   | 11        | 19.0    |
|                                        | TDF + 3TC + NVP   | 5         | 8.6     |
|                                        | Others            | 5         | 8.6     |
| Second-line regimen (N = 7)             | ABC + ddi + LPV/r | 6         | 85.7    |
|                                        | ABC + 3TC + LPV/r | 1         | 14.3    |
| Adherence status among HAART users for ≥6 months (N = 46) | Good | 28 | 60.9 |
|                                        | Fair              | 2         | 4.3     |
|                                        | Poor              | 16        | 34.8    |
Table 4: Continued.

| Characteristics                                      | Category       | Frequency | Percent |
|-------------------------------------------------------|----------------|-----------|---------|
| History of regimen change (N = 65)                    | Yes            | 19        | 29.2    |
|                                                       | No             | 46        | 70.8    |
| Reason for regimen change (N = 19)                    | Treatment failure | 7        | 36.8    |
|                                                       | Toxicity/side effects | 6        | 31.6    |
|                                                       | Due to new TB  | 3         | 15.8    |
|                                                       | Others         | 3         | 15.8    |
| Prior co-trimoxazole prophylaxis in known HIV patients (N = 80) | Yes            | 51        | 63.8    |
|                                                       | No             | 29        | 36.2    |

Figure 1: Reasons for hospitalization of PLWH to medical wards of JUSH, Jimma, Southwest Ethiopia, 2017 (N = 101). *Chronic liver disease, herpes zoster, cellulitis, and disseminated Kaposi sarcoma each accounts for 1.

Figure 2: Discharge outcomes of PLWH admitted to the medical wards of JUSH, Jimma, Southwest Ethiopia, 2017 (N = 101).
Our study has some limitations that should be considered while interpreting the findings. These include the following: certain disease conditions might have been overestimated or underestimated due to inadequate diagnostic facilities. Outcome measures for our study depended on the survival status at last contact with our patient in the hospital; we cannot exclude an underrepresentation of mortality rate as some DAMA patients might have died outside our hospital.

5. Conclusion

Tuberculosis, infections of the nervous system, and pneumonia were the top three leading reasons for hospitalization. Furthermore, our study disclosed that presentation with neurologic complication, low CD4 count, and short hospital stay were found to be predictors of inpatient mortality.

Abbreviations

AIDS: Acquired immunodeficiency syndrome  
CNS: Central nervous system  
COPD: Chronic obstructive pulmonary disease  
DAMA: Discharge against medical advice  
DVT: Deep venous thrombosis  
HAART: Highly active antiretroviral therapy  
HIV: Human immunodeficiency virus  
IQR: Interquartile range  
JUSH: Jimma University Specialized Hospital  
PLWH: People living with HIV  
TB: Tuberculosis.

Data Availability

The data used to support the finding of this study are available from the corresponding author upon request.

Disclosure

This study was done for the partial fulfillment Mr. Mishore’s master’s degree in clinical pharmacy.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

The authors would like to express appreciations to Jimma University and the health facility where the research was conducted. The authors would like to extend their appreciation to data collectors and medical ward clinical staffs for their support during data collection.

References

[1] V. Ntlantsana, J. Richard, and P. Wendy, "HIV viraemia during pregnancy in women receiving preconception antiretroviral therapy in KwaDukuza, KwaZulu-Natal," Southern African Journal of HIV Medicine, vol. 20, no. 1, pp. 1–8, 2019.
[2] Z. Gheibi, Z. Shayan, H. Joulaei, F. Mohammad, B. Shohreh, and S. Mostafa, "Determinants of AIDS and non-AIDS related mortality among people living with HIV in Shiraz, Southern Iran: a 20-year retrospective follow-up study," BMC Infectious Diseases, vol. 19, p. 1094, 2019.
[3] A. Kumar, K. R. Kilaru, S. Sandiford, and S. Forde, "Trends in the HIV related hospital admissions in the HAART era in Barbados, 2004–2006," AIDS Research and Therapy, vol. 7, no. 4, p. 2328, 2016.
[4] UNAIDS, "Global AIDS update 2016," 2018, http://www.unaids.org/sites/default/files/media_asset/global-AIDS-update-2016_en.pdf.
[5] D. Ogoina, R. O. Obiako, H. M. Muktar et al., "Morbidity and mortality patterns of hospitalised adult HIV/AIDS patients in the era of highly active antiretroviral therapy: a 4-year retrospective review from Zaria, Northern Nigeria," AIDS Research and Treatment, vol. 2012, Article ID 940580, 10 pages, 2012.
[6] A. D. Harries, A. B. Suthar, K. C. Takarinda et al., "Ending the HIV/AIDS epidemic in low- and middle-income countries by 2030: is it possible?" F1000Research, vol. 5, p. 2328, 2016.
[7] H. Krentz, S. Dean, and M. Gill, "Longitudinal assessment (1995–2003) of hospitalizations of HIV-infected patients within a geographical population in Canada," HIV Medicine, vol. 7, no. 7, pp. 457–466, 2006.
[8] K. Falster, H. Wand, B. Donovan et al., "Hospitalizations in a cohort of HIV patients in Australia, 1999–2007," AIDS, vol. 24, no. 9, pp. 1329–1339, 2010.
[9] B. P. Linas, B. Wang, M. Smurzynski et al., "The impact of HIV/HCV co-infection on health care utilization and disability: results of the ACTG longitudinal linked randomized trials (ALLRT) cohort," Journal of Viral Hepatitis, vol. 18, no. 7, pp. 506–512, 2011.

Table 5: Univariate and multivariate analyses of factors associated with inpatient mortality among PLWH admitted to the medical wards of JUSH, Jimma, Southwest Ethiopia, 2017 (N = 101).

| Variables                  | Category | Died (N = 18) | Survived (N = 83) | COR (95% CI) | P value* | AOR (95% CI) | P value* |
|---------------------------|----------|---------------|------------------|--------------|----------|--------------|----------|
| Sex                       | Male     | 10 (25.6%)    | 29 (74.4%)       | 2.33 (0.83–6.54) | 0.109    | 0.57 (0.09–3.43) | 0.539    |
|                           | Female   | 8 (12.9%)     | 54 (87.1%)       | 1.000        |          | 1.000        |          |
| Neurologic complication   | Yes      | 13 (61.9%)    | 8 (38.1%)        | 24.38 (6.89–86.19) | 0.000    | 13.97 (2.32–84.17) | 0.004    |
|                           | No       | 5 (6.2%)      | 75 (93.8%)       | 1.000        |          | 1.000        |          |
| CD4 count                 | ≤100     | 14 (48.3%)    | 15 (51.7%)       | 15.9 (4.57–6) | 0.001    | 16.40 (2.88–93.42) | 0.002    |
|                           | >100     | 4 (5.6%)      | 68 (94.4%)       | 1.000        |          | 1.000        |          |
| Hospital stay in days     | <7       | 12 (46.2%)    | 14 (53.8%)       | 9.86 (3.17–30.69) | 0.000    | 12.98 (2.13–78.97) | 0.005    |
|                           | ≥7       | 6 (8.0%)      | 69 (92.0%)       | 1.000        |          | 1.000        |          |

COR = crude odds ratio; AOR: adjusted odds ratio; CI: confidence interval; *P value < 0.05 indicates a statistically significant association.
[10] M. U. Sani, A. Z. Mohammed, B. Adamu, S. M. Yusuf, A. A. Samaial, and M. M. Borodo, "AIDS mortality in a tertiary health institution: a four-year review," Journal of National Medical Association, vol. 98, no. 6, pp. 862–866, 2006.

[11] A. Mocroft, A. d’Arminio Monforte, O. Kirk et al., "Changes in hospital admissions across Europe: 1995–2003. Results from the EuroSIDA study," HIV Medicine, vol. 5, no. 6, pp. 437–447, 2004.

[12] M. Floris-Moore, Y. Lo, R. S. Klein et al., "Gender and hospitalization patterns among HIV-infected drug users before and after the availability of highly active antiretroviral therapy," JAIDS Journal of Acquired Immune Deficiency Syndromes, vol. 34, no. 3, pp. 331–337, 2003.

[13] S. Paul, H. M. Gilbert, L. Lande et al., "Impact of antiretroviral therapy on decreasing hospitalization rates of HIV-infected patients in 2001," AIDS Research and Human Retroviruses, vol. 18, no. 7, pp. 501–506, 2002.

[14] S. D. Lawn, A. D. Harries, and R. Wood, "Strategies to reduce early morbidity and mortality in adults receiving antiretroviral therapy in resource-limited settings," Current Opinion in HIV and AIDS, vol. 5, no. 1, pp. 18–26, 2010.

[15] G. Z. Nega and T. A. Mega, "Clinical outcome of admitted HIV/AIDS patients in Ethiopian tertiary care settings: a prospective cohort study," PLoS One, vol. 14, no. 12, Article ID e0226683, 2019.

[16] D. Haile, A. Takele, K. Gashaw, H. Demelash, and D. Nigatu, "Predictors of treatment failure among adult antiretroviral treatment (ART) clients in bale zone hospitals, South Eastern Ethiopia," PLoS One, vol. 11, no. 10, Article ID e0164299, 2016.

[17] A. Bane, A. G. Yohannes, and D. Fekade, "Morbidity and mortality of adult patients with HIV/AIDS at Tikur Anbessa Teaching Hospital, Addis Ababa, Ethiopia," Ethiopian Medical Journal, vol. 41, no. 2, pp. 131–140, 2003.

[18] G. Reniers, T. Araya, G. Davey et al., "Steeple declines in population-level AIDS mortality following the introduction of antiretroviral therapy in Addis Ababa, Ethiopia," AIDS, vol. 23, no. 4, pp. 511–518, 2009.

[19] M. Tamiru and J. Haidar, "Hospital bed occupancy and HIV/AIDS in three major public hospitals of Addis Ababa, Ethiopia," International Journal of Biomedical Sciences, vol. 6, no. 3, pp. 195–201, 2010.

[20] P. A. Agaba, E. Digin, R. Makai et al., "Clinical characteristics and predictors of mortality in hospitalized HIV-infected Nigerians," The Journal of Infection in Developing Countries, vol. 5, no. 5, pp. 377–382, 2011.

[21] M. Colvin, S. Dawood, I. Kleinschmidt, S. Mullick, and U. Laloo, "Prevalence of HIV and HIV-related diseases in the adult medical wards of a tertiary hospital in Durban, South Africa," International Journal of STD & AIDS, vol. 12, no. 6, pp. 386–389, 2001.

[22] K. Thinyane and V. Cooper, "Clinical profiles of HIV-infected, HAART-naive patients admitted to a tertiary level hospital in Maseru, Lesotho," The Internet Journal of Infectious Diseases, vol. 11, no. 1, pp. 1–6, 2013.

[23] S. K Sharma, T. Kadhiriavan, A. Banga, T. Goyal, I. Bhatia, and P. K. Saha, "Spectrum of clinical disease in a series of 135 hospitalised HIV infected patients from North India," BMC Infectious Diseases, vol. 4, no. 52, 2004.

[24] B. E. Jones, S. M. M. Young, D. Antoniskis, P. T. Davidson, F. Kramer, and P. F. Barnes, "Relationship of the manifestations of tuberculosis to CD4 cell counts in patients with human immunodeficiency virus infection," American Review of Respiratory Disease, vol. 148, no. 5, pp. 1292–1297, 1993.

[25] J. O. Jowi, P. M. Mativo, and S. S. Musoke, "Clinical and laboratory characteristics of hospitalized patients with neurological manifestations of HIV/AIDS at the Nairobi hospital," East African Medical Journal, vol. 84, no. 2, pp. 67–76, 2007.

[26] O. S. Abayomi, F. Ojini, N. Okubadejo et al., "Pattern and outcome of neurological manifestations of HIV/AIDS—a review of 154 cases in a Nigerian University Teaching Hospital—a preliminary report," African Journal of Neurological Sciences, vol. 24, no. 1, pp. 29–36, 2005.

[27] J. F. D. Oliveira, D. B. Greco, G. C. Oliveira, P. P. Christo, M. D. C. Guimarães, and R. C. Oliveira, "Neurological disease in HIV-infected patients in the era of highly active antiretroviral treatment: a Brazilian experience," Revista da Sociedade Brasileira de Medicina Tropical, vol. 39, no. 2, pp. 146–151, 2006.

[28] M. J. Núñez, L. Martin-Carbonero, V. Moreno et al., "Impact of antiretroviral treatment-related toxicities on hospital admissions in HIV-infected patients," AIDS Research and Human Retroviruses, vol. 22, no. 9, pp. 825–829, 2006.

[29] J. E. Sackoff, D. B. Hanna, M. R. Pfeiffer, and L. V. Torian, "Causes of death among persons with AIDS in the era of highly active antiretroviral therapy: New York City," Annals of Internal Medicine, vol. 145, no. 6, pp. 397–406, 2006.

[30] C. Rapp, A. Reggad, A. Aoun, C. Ficko, D. Andriamanantena, and C. Plateau, "Hospitalisation causes of HIV-infected patients in 2011 in an HIV reference center in the Paris region, France," Journal of the International AIDS Society, vol. 15, no. 4, Article ID 18126, 2012.

[31] S. S. Dias, V. Andreozzi, M. O. Martins, and J. Torgal, "Predictors of mortality in HIV-associated hospitalizations in Portugal: a hierarchical survival model," BMC Health Services Research, vol. 9, 2009.

[32] C. A. Balkema, E. M. Iruzen, J. J. Taljaard, M. D. Zeier, and C. F. Koegelenberg, "Prospective study on the outcome of human immunodeficiency virus-infected patients requiring mechanical ventilation in a high Burden setting," An International Journal of Medicine, vol. 109, no. 1, pp. 35–40, 2018.

[33] H. N. Luma, B. C. Tchaleu, E. Temfack et al., "HIV-associated central nervous system disease in patients admitted at the Douala general hospital between 2004 and 2009: a retrospective study," AIDS Research and Treatment, vol. 2013, Article ID 709810, 6 pages, 2013.

[34] T. Berhe, Y. Melkamu, and A. Amare, "The pattern and predictors of mortality of HIV/AIDS patients with neurologic manifestation in Ethiopia: a retrospective study," AIDS Research and Therapy, vol. 9, no. 1, p. 11, 2012.

[35] J. K. Gill, L. Greene, R. Miller et al., "ICU admission in patients infected with the human immunodeficiency virus—a multicentre survey," Anaesthesia, vol. 54, no. 8, pp. 727–732, 1999.