Influencing Factors of Mortality Among Adult HIV Patients Under Antiretroviral Therapy: The Case of Hossana Queen Elleni Mohammad Memorial Hospital, Ethiopia

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Abstract: Even though the use of ART has brought a significant reduction in the mortality and morbidity of patients living with HIV/AIDS globally, still a number of patients die after the start of Antiretroviral Therapy. This study aimed at identifying influencing factors of mortality among adult HIV infected patients who are on ART in Hossana Queen Elleni Mohammad Memorial Hospital. The data for the study were obtained from Hossana Queen Elleni Mohammad Memorial Hospital Antiretroviral Therapy clinic. The HIV infected patients $\geq$ 15 years of age. Binary logistic regression model was applied to analyze the data so as to identify the influencing factors associated with mortality of HIV infected patients. A total of 400 adult HIV infected patients who were under ART were included in the study. Of 400 patients, 18.75% of them died. Age of the patients 40 or above (OR=1.73, 95% CI: 1.13–1.92), primary education (OR=0.29, 95% CI: 0.030–0.71), secondary or above education (OR=0.13, 95% CI: 0.03–0.16), alcohol (OR=3.35, 95% CI: 1.79– 6.27), baseline weight 50 kg or above (OR=0.42, 95% CI: 0.23–0.77), TB positive (OR=3.76, 95% CI: 2.06–6.83), and baseline CD4 200 or above (OR=0.24, 95% CI: 0.19– 0.50) were significantly associated with mortality among HIV patients under Antiretroviral Therapy. Health workers need to support those patients with no or little education by continuous awareness creation of taking care of themselves and knowing what factors facilitate death. Furthermore, patients who drink alcohol need to reduce excessive drinking.

Keywords: Mortality, HIV, Binary Logistic Regression Model

1. Introduction

AIDS-related illnesses remain one of the leading causes of death globally and are projected to continue as a significant global cause of premature mortality in the coming decades [1]. Globally, in 2011 about 34.2 million people were living with HIV/AIDS of which 30.7 million, 16.7 million and 3.4 million were adults, women and children younger than 15 years respectively. In the same year, there were 1.7 million deaths due to AIDS of which about 230,000 were children younger than 15 years and rest of them were adults [2].

Sub-Saharan Africa has the most serious HIV and AIDS epidemic in the world. In 2010, about 68% of all people living with HIV resided in sub-Saharan Africa, a region with only

12% of the global population. Sub-Saharan Africa also accounted for 70% of new HIV infections in 2010, although there was a notable decline in the regional rate of new infections. The epidemic continues to be most severe in southern Africa, with South Africa having more people living with HIV (an estimated 5.6 million) than any other country in the world. Almost half of the deaths from AIDS-related illnesses in 2010 occurred in southern Africa. AIDS has claimed at least one million lives annually in sub-Saharan Africa since 1998. Since then, however, AIDS-related deaths have steadily decreased, as free antiretroviral therapy has become more widely available in the region. The total number of new HIV infections in sub-Saharan Africa has dropped by more than 26%, down to 1.9 million from the estimated 2.6 million at the height of the epidemic in 1997 [3].

About 56% of HIV patients of sub-Saharan Africans in need of ART were receiving it in 2011 [4] and it increased to 68% in 2012 [5]. It is highly acknowledged that increasing access to ART decreases the impact of HIV in the region [6].

In Ethiopia since the first two AIDS cases were reported in 1986, the prevalence rate has continuously increased until the year 2000 when it begun to show some decline [7]. The adult HIV prevalence in 2009 was estimated to be between 1.4% and 2.8% in the country. The prevalence of HIV was 1.8% and 2.8% for males and females respectively. There were an estimated 131145 new HIV infections and 44,751 AIDS-related deaths of which females accounted for 57% of the total infections and deaths. The total estimated number of HIV positive pregnant women and annual HIV positive births in the same year were 84189 and 14140 respectively. There were an estimated 72945 children aged below 15 years living with HIV of which 20522 needed ART [8].

The Antiretroviral (ARV) drugs improve the quality of HIV patients by helping them to stay well longer than they otherwise would. The drugs slow down the replication of HIV within the body of the patients. As a result of the widespread use of ART, the HIV/AIDS pandemic that was regarded as an infectious disease with an almost universal fatal outcome has been transformed into a manageable chronic infectious disease [9, 10].

It is crucial to identify factors that influence mortality among the HIV infected patients so as to inform the policymakers to intervene and set strategies that can improve the quality of life of people living with it. Thus, this study aimed to identify the influencing factors of mortality among HIV infected patients under Antiretroviral Therapy in Hossana Queen Elleni Mohamad Memorial Hospital.

2. Methods and Materials

2.1. Study Design, Period and Area

A retrospective cross-sectional study design was employed on HIV infected patients who were under ART from March 2009 to May 2015 in Hossana Queen Elleni Mohamad Memorial Hospital in Hossana. Hossana town is administrative center for Hadiya zone and it is 235 km away

from capital of Ethiopia, Addis Ababa.

2.2. Population and Sample Size

Population of the study was HIV infected patients who aged 15 years or older and under ART in Hossana Queen Elleni Mohamad Memorial Hospital ART clinic. 400 HIV infected patients were included in this study.

2.3. Data Collection Tool, Procedures and Quality Control

The data were extracted from the available standard national medical registers which have been adopted by Federal Ministry of Health (FMOH) to be uniformly used by clinicians to simply identify and document clinical and laboratory variables. The registers include pre-ART register and follow up form, ART intake form, patients' card and death certificate complemented by registration by home visitors. The data were collected by data clerks working in the clinic and the completeness and consistency of the data were examined by researchers.

2.4. Inclusion and Exclusion Criteria

2.4.1. Inclusion Criteria
   a) HIV infected patients aged 15 years or older and have started ART.
   b) HIV infected patients with complete intake form, registers and follow up form.

2.4.2. Exclusion Criteria
Loss to follow up (withdraw, transfer out).

2.5. Variables Included in the Study

2.5.1. Response Variable
Response variable was mortality of adult HIV infected patient.

2.5.2. Independent Variables
Various explanatory variables were used as predictors of mortality of HIV infected patients under ART. These variables are classified as Demographic factors (Age, Sex, Marital status), Socio-economic factors (Residence, Level of educational), Behavioral factors (Tobacco and Alcohol) and Clinical factors (WHO clinical stage, Baseline CD4 counts, Baseline weight, Antiretroviral regimen, and TB status).

2.6. Model

We applied Binary logistic regression as the response variable is categorical and has only two categories.

2.7. Data Analysis

The data were analyzed using the statistical packages SPSS version 24.

3. Results and Discussion

3.1. Descriptive Statistics Results

A total of 400 adult HIV infected patients aged 15 years or

older taking ART in Hosana Queen Elleni Mohamad Memorial Hospital were eligible for this study. Among the patients, 75 (18.75%) of them died while 325 (81.25%) were alive. As it is shown in Table 1, the percentage of mortality of patients was higher for those who live urban areas (19.8%) than the rural areas (17.6%). Similarly, the percentage mortality of male patients is higher (21.0%) than female patients (16.9%). With regard to their age, the percentage of mortality of patients was higher for patients aged 40 or older years (22.5%) than below 40 years (17.5%). The highest percentage of mortality of patients was observed for patients who were separated (40.0%) while it was lowest for patients who were married (14.3%). Similarly, it was highest for patients who have no education (22.6%) as opposed to the lowest percentage of mortality of patients for those patients whose level of education was secondary or above (15.0%). The percentage of mortality of patients was higher for patients who were TB positives (37.3%) than for patients who were TB negatives (11.7%). The percentage of mortality of HIV infected patients taking ART is higher for the patients who smoke Tobacco (33.0%) than for patients who do not smoke (13.6%). Similarly, it was higher for the patients who drink alcohol (28.3%) than for patients who do not drink (15.6%). The percentage of mortality of patients was higher for those whose baseline weight was less than 50 kg (27.5%) than the patients whose baseline weight was 50 kg or above. Similarly, it was higher for those patients whose baseline CD4 count was less than 200 (28.5%) than the patients whose baseline CD4 count was 200 or above (11.4%).

Table 1. *Summary of descriptive statistics of mortality of HIV infected patients under ART.*

Variables	Categories	Died		Total	Percentage of death
		No	Yes		
Sex	Female	182	37	219	16.9%
	Male	143	38	181	21.0%
Age	Below 40	241	51	292	17.5%
	40 or older	84	24	108	22.2%
Residence	Rural	159	34	193	17.6%
	Urban	166	41	207	19.8%
Marital Status	Never married	63	18	81	22.2%
	Married	198	33	231	14.3%
	Separated	15	10	25	40.0%
	Divorced	20	4	24	16.7%
	Widowed	29	10	39	25.6%
Level of education	No education	65	19	84	22.6%
	Primary	130	33	163	20.2%
	Secondary or above	130	23	153	15.0%
Tobacco	No	254	40	294	13.6%
	Yes	71	35	106	33.0%
Alcohol	No	254	47	301	15.6%
	Yes	71	28	99	28.3%
Baseline weight	Less than 50 kg	108	41	149	27.5%
	50 kg or above	217	34	251	13.5%
WHO Clinical stage	Stage I	93	11	104	10.6%
	Stage II	107	19	126	15.1%
	Stage III	102	39	141	27.7%
	Stage IV	23	6	29	20.7%
TB Status	Negative	256	34	290	11.7%
	Positive	69	41	110	37.3%
Antiretroviral Regimen	d4t-3TC-NVP or d4t-3TC-EFV	65	29	94	30.9%
	AZT-3TC-NVP or AZT-3TC-EFV	119	27	146	18.5%
	TDF-3TC-NVP or TDF-3TC-EFV	141	19	160	11.9%
Baseline CD4 count	Less than 200	123	49	172	28.5%
	200 or above	202	26	228	11.4%

3.2. Inferential Statistics Results

According to Table 2, age, level of education, alcohol, baseline weight, TB status and baseline CD4 count were significant predictors of mortality of HIV infected patients at 5% level of significance. Table 2 also shows that the odds of being died for HIV infected patients who aged 40 years or older was 1.7296 (OR=1.73, 95% CI: 1.13, 1.92) times higher than those HIV patients who aged below 40 years. The odds of being died for HIV infected patients whose level of education was primary was 0.29 times (OR=0.29, 95% CI: 0.03, 0.71) less than HIV patients who had no education while the odds of being died for patients whose level of education was secondary or above was 0.13 times (OR=0.13, 95% CI: 0.03, 0.16) less than those patients who had no education. The odds of being died for HIV infected patients whose baseline weight was 50 kg or above was 0.42 times (OR=0.42, 95% CI: 0.23, 0.77) less than those patients whose baseline weight was less than 50 kg. Similarly, the odds of being died for HIV infected patients whose baseline CD4 count was 200 or above was 0.24 times (OR=0.24, 95% CI: 0.19, 0.50) less than those patients whose baseline CD4

count was less than 200. Also, the odds of being died for HIV patients who were TB positive were 3.76 times (OR=3.76, 95% CI: 2.06, 6.83) higher than patients who were TB negative. Similarly, the odds of being died for HIV patients who drink alcohol were 3.35 times (OR=3.35, 95% CI: 1.79, 6.27) higher than patients who do not drink alcohol.

***Table 2.** Results of Binary Logistic Regression Analysis for mortality of HIV Infected Patients.*

Parameter	Estimate	Standard error	Wald chi- square	Df	Pr > ChiSq	OR	95% CI of OR
Intercept	-2.1281	0.4021	28.0016	1	0.024*	-	-
Age			8.1068	1	0.013*		
Below 40 (Ref)							
40 or older	0.5479	0.1924	8.1068	1	0.013*	1.7296	1.1323 1.9159
Level of education			37.8264	2	0.028*		
No education (Ref)							
Primary	-1.2399	0.3942	9.8717	1	0.043*	0.2894	0.0346 0.7093
Secondary or above	-2.0629	0.4147	24.7295	1	0.007*	0.1271	0.0275 0.1557
Alcohol			14.3186	1	0.000*		
No (Ref)							
Yes	1.2099	0.3194	14.3186	1	0.000*	3.3535	1.7931 6.2715
Baseline weight			7.9649	1	0.012*		
Less than 50 (Ref)							
50 kg or above	-0.8612	0.3049	7.9649	1	0.031*	0.4226	0.2325 0.7682
TB Status			18.7618	1	0.000*		
Negative (Ref)							
Positive	1.3231	0.3052	18.7618	1	0.000*	3.7551	2.0644 6.8303
Baseline CD4			11.0624	1	0.032*		
Less than 200 (Ref)							
200 or above	-1.4118	0.4243	11.0624	1	0.032*	0.2437	0.1922 0.5016

(* =Significant at 5% level) and (Ref =Reference category).

3.3. Discussion

In this study, a total of 400 adult HIV infected patients under ART were included in the study, of which 18.75% of them died. The study revealed that the older HIV patients were more likely to die compared to the younger patients. This is consistent with the studies done previously in South Africa [11] and in United States [12]. This might be due to older aged patients progressed to AIDS at a faster rate than younger aged patients and older patients might have a reduced capacity to generate new CD4 cells in response to viral killing. Similarly, our study revealed that HIV infected patients who drink alcohol were more likely died compared to those patients who do not drink alcohol. This finding is similar with findings of studies done in French [13] which found that alcohol and other substances abuse were associated with mortality, non-adherence to medication and lower quality of life of HIV infected patients. This might be due to ARV non-adherence in addition to the complications that alcohol brings in to one's health.

The HIV infected patients whose level of education was secondary or above were less likely to die compared to those patients with no education. This result is consistent with studies done previously in Nigeria [14]. Similarly, our study revealed that the patients whose level of education was Primary were less likely to die compared to those patients with no education which is inconsistent result with previous study done in Addis Ababa in Ethiopia [15], which revealed that patients with primary education were more likely to die than patients who had no formal education. This might be because of the fact that educated patients can have better awareness about the factors that facilitate mortality than uneducated ones.

The study also revealed that the HIV infected patients with low baseline CD4 count were more likely to die compared to those patients with high baseline CD4 count. The result is consistent with findings from the studies done previously in Addis Ababa, Ethiopia [15], in French [16], in West Africa [17] and in Thailand [18]. Similarly, our study revealed that patients with low baseline weight were more likely to die compared to those patients with high baseline weight. This result confirmed similar finding from previous study done in Adama, Ethiopia [19]. Similar with the previous study done in West Africa [17], this study confirmed that HIV infected patients who were TB positives at ART initiation were more likely to die compared to those HIV infected patients who were TB negatives. This might be due to the fact that TB is the leading cause of death worldwide in HIV-infection and mycobacterium tuberculosis is a virulent organism that can produce disease in HIV-infected persons at any stage of disease even when the immune suppression is minimal.

4. Conclusions

This study was aimed to identify the influencing factors of mortality among HIV infected patients under Antiretroviral Therapy in Hossana Queen Elleni Mohamad Memorial Hospital. The study revealed that age, level of education, alcohol, baseline weight, TB status, and Baseline CD4 count were the influencing factors of mortality of HIV infected patients under ART. Older aged patients, TB positive patients, patient who drink alcohol were significantly associated with increased risk of death, while the educated patients, patients with higher Baseline CD4 count, and

patients with higher baseline weight were significantly associated with decreased risk of death. Health workers need to support those patients with no or little education by continuous awareness creation of taking care of themselves and knowing what factors facilitate death. Patients who drink alcohol need to be given advice to reduce excessive drinking. Health workers need to support those patients with no or little education by continuous awareness creation of taking care of themselves and knowing what factors facilitate death. Furthermore, patients who drink alcohol need to be given advice to reduce excessive drinking.

Abbreviations

AIDS	Acquired immunodeficiency syndrome
ART	Antiretroviral treatment
ARV	Antiretroviral
AZT	Zidovudine
CI	Confidence interval
d4t	Stavudine
3TC	Lamivudine
EFV	Efavirenz
FHAPCO	Federal HIV/AIDS Prevention and Control Office
FMOH	Federal Ministry of Health
HAART	Highly active antiretroviral therapy
HIV	Human immunodeficiency virus
HQEMM	Hossana Queen Elleni Mohamad Memorial
NVP	Neverapine
TB	Tuberculosis
TDF	Tenofovir Disoproxil Fumarate
UNAIDS	United Nations Program of HIV/AIDS
WHO	World health organization

Declarations

Availability of Data

The data used for the final analysis in this study is available from corresponding author upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

Authors' Contributions

The corresponding author (GG) designed and compiled the study. All authors contributed to analysis and interpretation of data. The corresponding author wrote the first draft and all the authors contributed to the final draft and gave final approval of the version to be published.

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