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Factors Affecting the Followup Status of HIV Infected Tuberculosis Patients Taking HAART Treatment at Jimma University Specialized Hospital

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Abstract: Highly active antiretroviral treatment is the life time treatment given for HIV/AIDS patients in order to reduce HIV related mortality and morbidity. Even if, the treatment is given to reduce the HIV mortality the reason of lost to followup from the treatment is unclear in most cases. The main objective of this study was also to determine the followup status and associated factors of HAART treatment for HIV infected tuberculosis patients during their followup period. The study considered a retrospective cohort 254 HIV infected tuberculosis patients whom age were 18 years and above taking HAART treatment at Jimma University specialized Hospital from February 2009 to July 2014. Chi-square test of association and multinomial logistic regression were employed to know the associated factors and their effects on the followup status patients taking HAART treatment. The result of the study showed functional status, marital status, use of chat, use of smoking and use of alcohol were factors that have significant association with HAART treatment followup status of the patients. Furthermore, the multinomial model showed baseline weigh, smoking status and functional status were factors that have significant effect for the death of the patients. For the transferring out of the patients to another Hospital from the HAART treatment unemployment was identified as a significant factor. Similarly,Functional status and smoking status were the factors that have significant effects for the missing out of the patients due to unknown reasons from the treatment. Based on the finding of the study having low base line weight, being in bedridden functional status category group and smoking were the high risk factors for the death of the patients from HAART treatment. Whereas, being in working functional status category group lowers the risk of missing out due to unknown reasons from their treatment. Furthermore, being unemployed work type was also the high risk factor for the transferring out of the patients to another Hospital from the highly active antiretroviral treatment at the study area.

Keywords: Multinomial logistic model,HAART,Chi-square test,Odds ratio

1 Introduction

1.1 Background of the study

HAART is a customized combination of different classes of medications that a physician prescribes based on such factors as the patients viral load (how much virus is in the blood), the particular strain of the virus, the CD4+ cell count and other considerations. HAART can control viral load, delaying or preventing the onset of symptoms or progression to AIDS, there by prolonging survival in people infected with HIV[1]. It is a lifetime treatment given for HIV/AIDS patients in order to suppress the progression of the disease with different mechanisms of action to treat the virus [2].

Globally rapid expansion and early access to HAART services have resulted in a dramatic decrease in HIV-related mortality and mobility[3]. However, the interaction between HIV and TB infections is bidirectional during the treatment. This is due to HIV infection increases the risk of both primary and reactivation TB[4,5]and this risk increases markedly with advancing HIV disease[5,6].

Incidence of TB continues to decrease during the first 5 years of HAART and so HAART may contribute more to tuberculosis control in low-income countries than was previously estimated from short-term follow-up. Patients with

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advanced pretreatment immunodeficiency had persistently increased risk of TB during HAART; this may reflect limited capacity for immune restoration among such patients[7]

Even HAART is used to reduce HIV related mortalities and morbidities reasons for defaulting from HAART were unclear in most cases. Reasons given were loss of hope in medication, lack of food, mental illness, holy water, no money for transport, and other illnesses[8]. Taking hard drugs (cocaine, cannabis and IV drugs), excessive alcohol consumption, being bedridden, living outside Jimma town and having an HIV negative or unknown HIV status partner were associated with defaulting ART.The patients phase of life, drug related factors, and clinical stages were also another associated factors for the lost to follow up from HAART[9].

1.2 Multinomial logistic model

In recent years, specialized statistical methods for analyzed categorical data have increased, particularly for application in biomedical science. Logistic regression model is also among the statistical tools that utilize the relationship between two or more variables[10].

The multinomial logistic regression (MLR) is a generalization of the logistic regression for dichotomous response variables. It can be extended to any number of categories of the response variable[11,12,13,14]. At each combination of the levels of the predictor variables, the MLR model assumes that the outcomes of the categories of the response variable have a multinomial distribution. In addition to the health and life sciences, the MLR is used in econometrics, socio metrics, and other fields of application for the prediction of probabilities of polytomous response variables as a function of a set of predictor variables[15].

Previous studies conducted in Ethiopia addressed the defaulters(lost to follow up) from HAART treatment and identified factors associated with defaulter. However defaulter by itself has different categories such as missed to follow up due to unknown reasons, defaulted due to death and defaulted due to transferring out to another hospital due to various factors associated with the patients. Therefore, studying factors associated with defaulter does not address the issues of specific category of the defaulter where as multinomial logistic model are used to identify factors associated with each category lost to follow of the treatment. That is,the model associates determinant factors missing the follow up due to unknown reasons, died and transfer out to another hospital from HAART treatment.

In general, the main objective of this study was to identify factors associated with HIV infected TB patient follow up status of HAART treatment during the follow up period.That is factors associated with missed from taking HAART, death and transfer out to another hospital using the multinomial logistic model.

2 Materials and methods

2.1 Data source

The data for the study was obtained from Jimma University Specialized Hospital from HIV and TB outpatient Clinic, South West of Ethiopia.HIV/TB co-infected patients who were 18 years old and above who were on HAART between the times of first February 2009 to first July 2014 were eligible for the analysis. Among 856 total co-infected patients during the time period 254 who fulfill the eligibility criteria were considered for the study.

2.2 Variables of the Study

The outcome variable considered for the study was the status of the patient during the follow up period. The status of the patient was the categorical covariate having four levels where the first level is active to HAART for patient currently on HAART follow up till fist July 2014, the second level was missed to follow up for patient missed from taking HAART due to unknown reasons, the third level is died for patient missed from taking HAART due to death whereas the forth level is transferred out patient for the patient transferred out to another hospital to take HAART. We have also considered different demographic and baseline clinical outcomes that we proposed as associate factors that predicts the status of the patients were given on table one below. Notice that WHO Clinical Stage is categorical covariates having four levels according to WHO. Where Stage I indicates asymptomatic disease, Stage II indicates mild disease, Stage III indicates advanced disease and Stage IV indicates severe disease in which the severity of the disease increases from Stage I to Stage IV. Functional

Table 1: Independent variables considered for the study.

Variables	Values of variables	Type
Base line Age	Years	Continuous
Base line CD4	count cell counts per mm 3	Count
Baseline Weight	Kilogram	Continues
Marital status	Single, married, separated, windowed and divorced	Categorical
Residence	Rural and urban	Categorical
Educational level	Not educated, primary, secondary and tertiary	Categorical
Working time	Par timer, working full time and un employed	Categorical
Use of alcohol	use and do not use	Categorical
Smoking	Smoker and non smoker	Categorical
Use of soft drug	Use and do not use	Categorical
Type of tuberculosis	Pulmonary TB and extra pulmonary TB	Categorical
WHO clinical stage	Stage I,II,III and IV	Categorical
Functional status	Working, ambulatory and bed ridden	Categorical
Religion	Muslim, orthodox and protestant	Categorical
Sex	Female and male	Categorical

Status of the patients is also categorical covariate with three categories where working functional status level is for those patients who can able to work day to day while ambulatory patients are those patients who can able to work some time but bedridden patients cannot able to work due to the disease. Working time is also another categorical covariates with four categorical groups part time worker who works part time; full time worker; not working because of medical illness and unemployed who do not have work.

2.3 Methods of data analysis

In many medical and epidemiological the generalized linear modeling technique of multinomial logistic regression can be used to model unordered categorical response variables. This model can be understood as a simple extension of logistic regression that allows each category of an unordered response variable to be compared to an arbitrary reference category providing a number of logit regression models. A binary logistic regression model compares one dichotomy (for example, passed-failed, died-survived, etc.) whereas the multinomial logistic regression model compares a number of dichotomies. This procedure outputs a number of logistic regression models that make specific comparisons of the response categories. When there are J categories of the response variable, the model consists of $J-1$ logit equations which are fit simultaneously. Multinomial logistic regression is a technique that basically fits multiple logistic regressions on a multi-category unordered response variable that has been dummy coded.

The main aim of this study also to apply the multinomial logistic regression in which the outcome variable of the study assumes four values. That is during the follow up time period the patient may currently on taking the treatment, missed the follow up due to unknown reasons, Transferred out to another Hospital or died during the follow up period which can be expressed as follows:

$$Y_i = \begin{cases} 0, & \text{For the patients who are currently on HAART} \\ 1, & \text{For the patients who missed the follow up} \\ 2, & \text{For the patients who transferred out to another Hospital} \\ 3, & \text{For the died patients} \end{cases}$$

Where; Y_i is the HAART treatment followup status of the i^{th} patient. Therefore, the main aim of the study was to related these out comes with covariates to determinant the factors that determine the follow up status of patients who where taking HAART at the study area. Before proceeding to the multinomial logistic regression the chi-square test of association were employed to explore the association between the response variables and the predictors

2.3.1 Chi-square test of association

Chi-square test of association were employed to explore the association between the follow up status of the patient and different independent variables considered in the study to be used as an input for multinomial logistic regression. The

hypothesis to be tested with chi-square test was null hypothesis which states that the patient status on HAART treatment and the independent categorical variables are independent where the test statistics to test this hypothesis was expresses as follows:

$$\chi^2 = \sum_{j=1}^{r}\sum_{i=1}^{c}\frac{(0_{ij}-E_{ij})^2}{E_{ij}} \sim \chi_{(r-1)(c-1)}(\alpha) \tag{1}$$

Where; $O_{ij}$is observed value in j_{th}row and i_{th}column where as $E_{ij} = \frac{rowtotal*columntotal}{grandtotal}$ which have chi-square distribution with (r-1)(c-1) degrees of freedom where r and c are number of rows and columns respectively. Moreover, it can be verified as there is an association if the computed chi-square value is greater than the critical value of chi-square or if the computed probability of observing computed chi-square statistic value (p-value) is greater than the level of significance(alpha value).

2.3.2 Modeling the followup status HIV infected TB patients taking HAART

After identifying the association between the HAART treatment status of the patients and independent covariates the multinomial logistic regression were employed to identify the effects of independent variables on the status of patients to HAART treatment. Therefore, for $y_i \varepsilon \{0,1,2,3\}$ outcome variable having four categories observed for n independent patients with p-explanatory variables to construct the logits in the multinomial case, the study considered patients currently on HAART treatment as base level and all the logits are constructed relative to it.

Letπ_j denote the multinomial probability of an observation falling in the j^{th} category where $\sum_j \pi_j = 1$, to find the relationship between this probability and the p explanatory variables, in multiple logistic regression model we express the logit of j^{th} category as:

$$log(\frac{\pi_j(\mathbf{X}_j)}{\pi_k(\mathbf{X}_j)}) = \mathbf{X}_j^T\beta_j \tag{2}$$

Where,$\beta_j = (\beta_{1j},\beta_{2j},...,\beta_{pj})$ pxJ matrices of coefficients and $\mathbf{X}_j$ is the n_j by p matrices of independent variables for j= 2,...,J whereas the probability of falling in j^{th} category was given by $\pi_j(\mathbf{X}_j) = \pi_k(\mathbf{X}_j)exp(\mathbf{X}_j^T\beta_j$ and $\pi_k(\mathbf{X}_j) = \frac{1}{\sum_{j=2}exp(\mathbf{X}_j^T\beta_j)}$ for j=1,2,...,J which simplified to

$$\pi_j(\mathbf{X}_j) = \frac{exp(\mathbf{X}_j^T\beta_j)}{1+\sum_{j=2}exp(\mathbf{X}_j^T\beta_j)} \tag{3}$$

2.3.3 Model estimation techniques

Let $\mathbf{Y}_i = (y_{i1},y_{i2},...,y_{iJ})^T$ be a J by 1 column vector of responses observation for the i^{th} patient, with the corresponding J by 1 column vector of probabilities $\pi_i = (\pi_{i1}\pi_{i2},...,\pi_{iJ})^T$ then, the likelihood function is given by:

$$\begin{aligned} L(\beta) &= \prod_{i=1}^{n}\pi_{i1}^{y_{i1}}\pi_{i2}^{y_{i2}},...,\pi_{iJ}^{y_{iJ}}(1-\pi_{i1}-\pi_{i2},...,-\pi_{iJ})^{(1-y_{i1}-y_{i2},...,-y_{iJ})} \\ L(\beta) &= \prod_{i=1}^{n}\frac{exp(\mathbf{X}_j^T\beta_j)}{1+\sum_{j=2}exp(\mathbf{X}_j^T\beta_j)})^{y_{i1}}(\frac{exp(\mathbf{X}_j^T\beta_j)}{1+\sum_{j=2}exp(\mathbf{X}_j^T\beta_j)})^{y_{i2}}...(\frac{exp(\mathbf{X}_j^T\beta_j)}{1+\sum_{j=2}exp(\mathbf{X}_j^T\beta_j)})^{y_{iJ}} \end{aligned} \tag{4}$$

The corresponding log-likelihood is then given by:

$$l(\beta) = \sum_{i=1}^{n}y_{i1}exp(\mathbf{X}_j^T\beta_j)+...+y_{iJ}exp(\mathbf{X}_j^T\beta_j)-\sum_{i=1}^{n}log(1+\sum_{j=2}exp(\mathbf{X}_j^T\beta_j) \tag{5}$$

The maximum likelihood method used to calculate maximum likelihood estimate by using an iterative fitting process that attempts to cycle through repetitions to find an answer.

2.3.4 Adequacy test of the fitted model

The goodness of fit measures how the model describes the response variable. Asses of fit is used to investigate how the values predicted by the model closer to that of the observed values.Therefore, model adequacy test is the key issues before proceeding to any inferences.

The Wald test: The Wald test was considered to test the significance of individual parameter in the estimated model to identify whether the a given covariate have significant effect on HAART treatment status of a patient or not. The fore the wald test statistics was expresses as:

$$Z = \frac{\hat{\beta}_j}{SE(\hat{\beta}_j)} \backsim N(0,1) \tag{6}$$

Likelihood ratio tests: The likelihood ratio test was used to test for an adequacy fitted model is nested in the previous model which is given by:

$$\chi^2_{LR} = 2(l_{full} - l_{current}) \tag{7}$$

Where, $l_{current}$ the log-likelihood of the current fitted model and l_{full} is the log-likelihood of the saturated model which is approximately distributed with χ^2

3 Results and Discussion

3.1 The followup status of the patients taking HAART treatment over 48 months visit

As can be observed from table two of number of patients visit for 48 months within six months interval among total 254 patients visited for the study only 126(49.61%) were active to HAART whereas 32(12.60%), 56(22.05%) and 40(15.75%) were the patients who left the follow up from the HAART due to death, missing due to unknown reasons and transferring out to another Hospitals respectively.

Specifically, when we look at the trend of the patients over the visit of 48 months the number of patients active to HAART were decreasing over the time visit of six months interval due to death, missing and transferring out of the patients to another Hospital. Even the number of missing out of the patients due to unknown reasons were decreasing over the time still larger number of patients belongs to this category group in comparison with died and transferred out patient group.

Table 2: The followup status the patients within six months visit

Time in month	Active n (%)	Died n (%)	Missed n (%)	Transfer out n (%)	Total n (%)
0	126(49.61)	32(12.60)	56(22.05)	40(15.75)	254(100.00)
6	100(64.10)	15(9.62)	24(15.38)	17(10.90)	156(100.00)
12	97(72.39)	9(6.72)	18(13.43)	10(7.46)	134(100.00)
18	79(75.24)	6(5.71)	13(12.38)	7(6.67)	105(100.00)
24	51(78.46)	3(4.62)	8(12.31)	3(4.62)	65(100.00)
30	31(72.09)	3(6.98)	7(16.28)	2(4.65)	43(100.00)
36	18(78.26)	1(4.35)	3(13.04)	1(4.35)	23(100.00)
42	7(77.78)	1(11.11)	1(11.11)	0(0.00)	9(100.00)
48	3(100.00)	0(0.00)	0(0.00)	0(0.00)	3(100.00)

3.2 Baseline some demographic and clinical characteristics with the followup status of the patients

Table 3: Baseline covariates with current followup status of the patients taking HAART treatment

Covariates	Active n (%)	Died n (%)	Missed n (%)	Transfer out n (%)	Total n (%)
Sex					
Female	61(48.41)	14 (43.75)	24 (42.86)	16 (40.00)	115 (45.28)
Male	65(51.59)	18(56.25)	32(57.14)	24(60.00)	139(54.72)
Religion					
Muslim	43(34.13)	15(46.88)	17(30.36)	16(40.00)	91(35.83)
Orthodox	75(59.52)	15(46.88)	37(66.07)	19(47.50)	146(57.48)
Protestant	8(6.35)	2(6.25)	2(3.57)	5(12.50)	17(6.69)
Educational level					
Not educated	26(20.63)	8(25.00)	13(23.21)	12(30.00)	59(23.23)
Primary	56(44.44)	14(43.75)	20(35.71)	18(45.00)	108(42.52)
Secondary	37(29.37)	8(25.00)	19(33.93)	6(15.00)	70(27.56)
Tertiary	7(5.56)	2(6.25)	4(7.14)	4(10.00)	17(6.69)
Residence					
Rural	21(16.67)	4(12.50)	7(12.50)	6(15.00)	38(14.96)
Urban	105(83.33)	28(87.50)	49(87.50)	34(85.00)	216(85.04)
Marital status					
Divorced	6(4.76)	2(6.25)	7(12.50)	6(15.00)	21(8.27)
Married	65(51.59)	12(37.50)	18(32.14)	16(40.00)	111(43.70)
Separated	8(6.35)	9(28.13)	10(17.86)	1(2.50)	28(11.02)
Single	33(26.19)	8(25.00)	19(33.93)	13(32.50)	73 (28.74)
Widowed	14(11.11)	1(3.13)	2 (3.57)	4 (10.00)	21(8.27)
Clinical stage					
Stage-I	4(3.17)	0(0)	1(1.79)	3(7.14)	8(3.15)
Stage-II	16(12.70)	2(6.25)	2(3.57)	3(7.14)	23(9.06)
Stage-III	61(48.41)	14(43.75)	27(48.21)	21(50.00)	123(48.43)
Stage-IV	45(35.71)	16(50.00)	26(46.43)	13(30.95)	100(39.37)
Functional status					
Ambulatory	53(42.06)	13(40.63)	37(66.07)	23(57.50)	126(49.61)
Bedridden	5(3.97)	9(28.13)	7(12.50)	5(12.50)	26(10.24)
Working	68(53.97)	10(31.25)	12(21.43)	12(30.00)	102(40.16)
Alcohol					
No	91(72.22)	15(46.88)	28(50.00)	22(55.00)	156(61.42)
Yes	35(27.78)	17(53.13)	28(50.00)	18(45.00)	98(38.58)
Smoke					
No	108(85.71)	17(53.13)	38(67.86)	29(72.50)	192(75.59)
Yes	18(14.29)	15(46.88)	18(32.14)	11(27.50)	62(24.41)
Type of TB					
Extra pulmonary	60(47.62)	17(53.13)	25(44.64)	20(50.00)	122(48.03)
Pulmonary	66(52.38)	15(46.88)	31(55.36)	20(50.00)	132(51.97)
Working time					
Not working	12(9.52)	1(3.13)	4(7.14)	1(2.50)	18(7.09)
Par timer	4(3.17)	1(3.13)	2(3.57)	1(2.50)	8(3.15)
Un employed	71(56.35)	21(65.63)	38(67.86)	32(80.00)	162(63.78)
Full time worker	39(30.95)	9(28.13)	12(21.43)	6(15.00)	66(25.98)

As the baseline demographic and clinical characteristic of table 3 shows regarding the sex composition among the 254 co infected patients 115(45.28%) were females where as 139(54.72%) were males. Regarding status of the patients with sex 61(48.40%),14(43.8%),24(42.9%) and 16(40%) were active(currently on HAART), missed to follow up due to unknown reasons , died and transferred out to another Hospital females in comparison with males category group.

Most of the co-infected patients were ambulatory (126(49.61%)) where as 26(10.24%) of the were at bedridden functional status and 102(40.16%) of the were at working functional status category group at base line. When we look over the status of the patients by their functional status 53(42.10%), 13(40.60%),37(66.10%) and 23(57.5%) were active, missed, died and transferred out ambulatory functional status group patients where as 5(4.00%),9(28.10%),7(12.50%) and 5(12.50%) were active, missed, died and transferred out bedridden functional status group patients in comparison with working functional status group patient status.

When we look over the baseline WHO clinical stage of the patients of 123(48.30%) clinical stage III patient group 61(48.40%), 14(43.80%),27(48.20%) and 21(52.5%) were active, missed, died and transferred out patients where as among 8(3.15%) clinical stage I patient group 4(3.20%), 0(0.00%),1(1.80%), 3(7.50%), 8(3.15%) were active, missed, died and transferred out patients which represents lager and smaller number of the co-infected patients in comparison with clinical stage II and stage IV patients group respectively.

The baseline working time of the patients category description also shows among the total co-infected patients considered for the study 71(56.35%), 21(65.63%), 38(67.86%), 32(80.00%) and 162(63.78%)of the patients were active to HAART, died,missed the follow up and transferred out patients of unemployed patient category group which represents larger proportion of the remaining working time category groups.

3.3 Association of base line covariates with followup status of the patients taking HAART treatment

As stated under the methodology part chi-square test of association were employed to test the association of the categorical covariates considered and follow up status of HAART treatment of patients.Therefore, the test result of table 4 below shows among ten categorical independent considered for the study only baseline functional status, marital status, use of soft drug specially chat,smoking status and use of alcohol were significantly associated with status of the patients to HAART treatment since the probability of observing larger chi-square test statistics (p-value) for these categorical covariates were less that 5% level of significance.

Table 4: Chi-square test of association

covariates	DF	Chi-square value	p-value	covariates	DF	Chi-square test	p-value
sex	3	1.112	0.774	Marital status	12	30.401	0.002**,b
Functional status	6	33.385	0.000**	Residence	3	0.707	0.872
Clinical stage	9	10.651	.300b	Drug	3	12.252	0.007**
Religion	6	6.846	.335b	Smoking statue	3	17.774	0.000**
Educational level	9	6.249	0.715	Using alcohol	3	12.839	0.005**

NB:**Indicates significance at 5% level of significance

3.4 Determinant factors affecting the followup status of the patients taking HAART treatment

As can be observed from the estimated multinomial model of table 5 the estimated value of chi-square statistics (104.25) with p-value (3.3133e-07) which is less 5% level of significance indicates the estimated over all model is significantly different from zero whereas the description of the model is as follows:

As can be observed from the estimated multinomial logistic model bedridden functional status group, weight and separated marital status group have significant effects at 5% level of significance whereas unemployed and working full time work type category group have significant effects at 10% level of significance on the death of the co-infected patients in comparison with patients currently taking HAART treatment. This study also confirms with Silashi *etal*[16]which revealed bedridden functional status higher risk of death for HIV/TB co-infected patients whereas Deribe *etal*[8]found being in bedridden functional status group was the higher risk for the defaulting from HAART treatment

The estimated coefficient for the logit of death corresponding to bedridden functional status 2.114 indicates the logit of death for bedridden functional status category group was 2.114 in comparison with ambulatory functional status group patients whereas the estimated coefficient for smoker category group 2.042 also indicates the logit of death among smoker category group was 2.042 higher in comparison with none smoker group holding other variables constant. Similarly, estimated coefficient for the logit of death corresponding to weight -0.058 which was negative also implies the logit of death patient was decreased by 0.058 with unit increment of weight of a patient holding other variables constant whereas estimated coefficient for unemployed patients group 2.198 also implies the logit of death among the unemployed individuals was 2.198 higher in comparison with not working patients group due to medical illness at 10% level of significance.

The estimated logit for the missed patients due to unknown reasons from HAART showed working functional status group, smoker group, windowed marital status group have significant effects at 5% level of significance whereas tertiary

educational level category, married marital status category and being in unemployed type of work of patients category group have significant effects at 10% level of significance.

The estimated logit coefficients of missed patients corresponding to working functional status -1.457 indicates that the logit of missing from HAART for working functional status patients group was lower by -1.457 in this category group in comparison with ambulatory functional status patients category group where the estimated coefficient for married marital status category -1.172 indicates the logit of missing from HAART was lower by -1.172 for this category group in comparison with divorced marital status group patients at 10% level of significance. However, the estimated coefficient for the logit of missed corresponding to smoker patients group 1.131 indicates the loti of missing was 1.131larger than that of none smoker patients group were estimated coefficient for the windowed patients group -2.531 implies the logit of missing in this category group was -2.531 lower in comparison with divorced patients category group.

Similarly, the estimated logit for the transferred out patients to another hospital showed that working functional status group, unemployment type of work of patients have significant at 5% level of significance whereas only married marital status category of patients have significant effects at 10% level of significance.

The estimated logit coefficients for the transferring out of the patients corresponding to working functional status -1.003 indicates the logit of transferring out to another hospital was -1.003 lower in this category group in comparison with ambulatory patients group were the estimated coefficient for unemployed patients group 2.321 implies the logit of transferring out to another Hospital was 2.321 higher in this category group in comparison with patients group who were not working due to medical illness Mberi *et al*[17]also found lost to followup from HAART treatment is higher among unemployed patients group.

Table 5: Estimated multinomial logistic model

covariates	**Died**		**Missed**		**Transferred out**	
	Coeff(SE)	P-value	Coeff(SE)	P-value	Coeff(SE)	P-value
Intercept	-2.027(1.816)	0.264	0.546(1.202)	0.649703	-1.796(1.552)	0.247
Functional status						
ambulatory(Ref)						
Bedridden	2.114(0.754)	0.00**	0.562(0.705)	0.424	0.943(0.767)	0.219
Working	-0.527(0.526)	0.316	-1.457(0.421)	0.000**	-1.003(0.438)	0.0219**
Smoking status						
None smoker(Ref)						
Smoker	2.042(0.533)	0.000**	1.131(0.449)	0.012**	0.691(0.494)	0.162
Educational level						
Not educated(Ref)						
Primary	0.079(0.594)	0.894	-0.255(0.497)	0.608412	-0.288(0.494)	0.559
Secondary	0.105(0.680)	0.877	0.292(0.519)	0.574	-0.985(0.614)	0.109
Tertiary	1.785(1.123)	0.112	1.478(0.866)	0.087*	1.234(0.884)	0.163
Weight	-0.058(0.027)	0.028**	-0.029(0.019)	0.125	0.004(0.020)	0.834
Marital status						
Divorced(Ref)						
Married	0.389(1.041)	0.708	-1.172(0.691)	0.0898*	-1.224(0.713)	0.085*
Separated	2.619(1.150)	0.022**	0.615(0.822)	0.454	-1.761(1.260)	0.162
Single	0.297(1.056)	0.778	-0.678(0.694)	0.328	-0.911(0.726)	0.209
Windowed	-1.094(1.488)	0.462	-2.531(1.032)	0.014**	-1.349(0.901)	0.134
Working time						
Not working(Ref)						
Part timer	2.019(1.676)	0.228	1.224(1.149)	0.286	2.210(1.615)	0.171
Unemployed	2.198(1.199)	0.066*	1.180(0.707)	0.095*	2.321(1.122)	0.038**
Full time working	1.961(1.231)	0.111	0.857(0.765)	0.262	1.226(1.191)	0.303

LogLikelihood=-261.11,chisquare = 104.25(p.value = 3.3133e-07**)

NB:** and *Indicates significance at 5% and 10% level of significance respectively

3.4.1 Estimated odds ratio for the estimated multinomial model

The estimated odds ratios were used to explain how the odds of belonging to specified category was larger of lower in comparison with the reference category group in case of categorical covariates holding other covariates fixed or it

Table 6: Estimated odd ratios of the estimated model

covariates	Died		Missed		Transferred out	
	OR	95% confidence	OR	95%confidence	OR	95% confidence
Intercept	0.132	[0.004,4.628]	1.726	[0.164,18.213]	0.166	[0.008,3.476]
Functional status						
Ambulatory(Ref)						
Bedridden	8.285	[1.889,36.329]**	1.755	[0.441,6.981]	2.569	[0.571,11.548]
Working	0.590	[0.211,1.654]	0.233	[0.102,0.531]**	0.367	[1.108,1.701]**
Smoking status						
None smoker(Ref)						
Smoker	7.704	[2.709,21.909]**	3.099	[1.285,7.472]**	1.995	[0.758,5.253]
Educational level						
Not educated(Ref)						
Primary	1.082	[0.338,3.467]	0.775	[0.293,2.053]	0.750	[0.285,1.973]
Secondary	1.111	[0.293,4.210]	1.339	[0.484,3.702]	0.374	[0.112,1.245]
Tertiary	5.958	[0.659,53.842]	4.384	[0.803,23.949]	3.434	[0.608,19.402]
Weight	0.944	[0.896,0.994]**	0.971	[0.936,1.008]	1.004	[0.965,1.045]
Marital status						
Divorced(Ref)						
Married	1.476	[0.192,11.354]	0.310	[1.212,3.368]	0.294	[0.073,1.189]*
Separated	13.723	[1.441,130.703]**	1.849	[0.369,9.267]	0.172	[0.015,2.031]
Single	1.346	[0.170,10.663]	0.508	[0.130,1.979]	0.402	[0.097,1.667]
Windowed	0.335	[0.018,6.183]	0.080	[0.011,0.602]**	0.260	[0.044,1.517]
Work type						
Not working(Ref)						
Par timer	7.532	[0.282,201.121]	3.402	[0.358,32.346]	9.120	[0.385,216.264]
Unemployed	9.006	[0.859,94.415]*	3.256	[0.814,13.018]*	10.184	[1.129,91.840]*
Full time worker	7.106	[0.637,79.257]	2.356	[0.526,10.558]	3.408	[0.330,35.192]

NB: ** and * Indicates significance at 5% and 10% level of significance

explains how the odds in specified category was increasing or decreasing with a unit increment of the continuous covariates holding other variables constant. Therefore, the odds of the estimated logistic coefficient were discussed here under depending on table 6 as follows:

For the died estimated model the estimated odd ratio for bedridden functional status category group 8.285 indicates the odds of death of patients in this category group was 8.285 times that of ambulatory patients category groups were the estimated odds for smokers category patients group 7.704 indicates the odds of death among this category patients were 7.704 times that of none smoker patients groups. The estimated odd for weight 0.944 indicates the odd of death was decreased by 0.944 with a unit increase in base line weight of co-infected patients.

For the missed co-infected patients due to unknown reasons the estimated odd ration for working functional status group patients 0.233 shows that the missing from the treatment of patients category groups were 0.233 times that of ambulatory functional status patients group whereas the estimated odd ratio for smoker patient category group 3.099 indicates the odds of missing from the treatment in this category group were 3.099 times larger than that of none smokers patients category group. Similarly the estimated odd ratio for tertiary educational level category group 4.384 shows the odd ratio in this category group were 4.384 times larger than none educated educational level category group patients at 10% level of significance.

For the transferred out patients to another hospitals the estimated odd ratio for working functional patients group 0.367 shows the odd ratio for this category group were 0.367 times lower than that of ambulatory patients category group whereas the estimated odd ratio for unemployed patients 10.184 shows the odd of transferring out to another hospital for this category group was 10.184 times larger than that of that of not working patients group.

4 Conclusion

The study showed death of the patients were higher in bedridden functional status, smoker and separated marital status group in comparison with ambulatory, none smoker and divorced patient group respectively and increase in baseline

weight of the patients reduces the risk of death. Similarly, the study revealed missing the followup due unknown reasons were higher in smoker patients group in comparison with none smoker patients group and it was lower in working functional status group in comparison with ambulatory patient group at baseline. Whereas,transferring out of the patients to another Hospital were lower in working functional status of the patients in comparison with ambulatory patient group and it was higher in unemployment patient group in comparison with not working patients due to medical illness from the HAART treatment followup at study area.

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