Eeffects of Socio-Economic and Health Variables on Survival Time of Hiv/Aids Patients in Manipuir

Background: The survival time of patients with human immunodeficiency virus (HIV)/ acquired immune deficiency syndrome (AIDS) is associated with many socio-economic, education, employment and socio-cultural factors. High prevalence rates of HIV/AIDS are observed in some Indian States including Manipur. Objectives: It is to examine the effects of socio-economic and health related variables on the survival time of HIV and Hepatitis-C virus (HCV) patients. Materials and Methods: Under simple random sampling without replacement (SRSWOR), it analysed a sample of 200 HIV+ patients attending the ART Centre of Jawaharlal Institute of Medical Science (JNIMS), Imphal during March – July 2016. Using multiple regression models, the significant covariates of the survival time of patients are explored. Findings: The five factors – sex of patient (P<0.05), marital status (P<0.05), family income (P<0.05), patient type (P<0.01) and CD4 count (P<0.05) are found to be significantly influencing the dynamics of survival duration of the patients. Conclusion: In Manipur, the average survival time of the HIV/ AIDS patients is observed to be about six years varying with their sex, marital status, size of family, employment and CD4 count.

Keywords: *Manipur, regression model, sex, marital status, CD4*

Introduction

The economic life of HIV/AIDS patients is influenced by various socio-economic, socio-cultural, behavioural and health care factors. In Europe and the USA, low income and low education have been associated with poorer outcomes for several diseases (1-3). In USA, in people with HIV receiving antiretroviral therapy (ART), lower education, unemployment and household poverty are associated with having poorer virological and immunological outcomes. (4-7) HIV-positive populations in UK and Europe also comprise distinct demographic groups, with substantial variation in social circumstances. The association between socio-economic factors and HIV outcomes in the USA might not be generalisable to settings with free universal health care. (7) In the Italian ICoNA cohort study (8) in individuals who had been taking ART for at least 6 months, unemployment was associated with double the risk of virological failure compared with working full-time. The findings of some European studies (7, 9-11) have also shown that lower socio-economic status measured by education, employment, and social support is associated with ART non adherence, but a minority of studies found no evidence. (12)

In this new millennium, HIV/AIDS has become a serious socio-economic and health problem with 33 million people living with HIV virus in glove and 2.4 million people in India in the year 2007. (13) In 2009, the National AIDS Control Organization (NACO) reports that there are 4987 integrated counseling and testing centers (ICTC) and 211 ART centers where ART treatment is given free of cost to

over 2 lakh people living with HIV. (14) The quality of life (QOL) of people living with HIV has become a salient issue after increase in availability of anti-retroviral treatment and increase in average life span. The QOL is defined as individuals' perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. (15) Patients who are diagnosed late until their CD4 count fell to below 200 and also are estimated at age 20 to have a life expectancy that was at least four years less than those who had a CD4 count of 200-499. (16) When comparisons between the genders were made, it indicated that females scored lower on all the domain of QOL compared with males. (17) In India, the first HIV infection case was detected in 1986 among female sex workers in Chennai. A finding also observed four southern states – Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, and two North East States – Manipur and Nagaland were categorized as high-prevalence states. (18) In case of co-infection, IDUs residing in two districts of Manipur that among the 31% of HIV-positive IDUs, 95% were co-infected. (19) Thus, the present study aims to explore the effects of socio-economic and health related factors on the variation in the duration of survival time of patients with HIV and HCV in Manipur.

Objectives

The study is to investigate the economic life of the patients with HIV and HIV+HCV, to examine the effects of covariates influencing the survival duration of the patients after detection of the diseases and also to explore the dependence of patient's survival time on socio-economic and health related variables which are hypothesized to have significant impacts on the survival time.

Materials and Methods

A cross-sectional study was carried out through simple random sampling without replacement (SRSWOR) on 200 HIV+ patients who attended the ART Centre of Jawaharlal Nehru Institute of Medical Sciences (JNIMS), Imphal during March - July 2016. Out of these study subjects, 100 patients were HIV+ only and the other 100 patients were HIV+ with Hepatitis-C virus (HCV) co-infection. The eligibility criteria for the subjects include firstly, the HIV+ patients enrolled in ART centre; secondly, regular or 100% adherence to the program and thirdly, aged between 21-70 years. The exclusion criteria include 1) children with HIV; 2) HIV+ patients with chronic co-morbidity like cancer, diabetes etc.; 3) patients whose adherence to the program is less than 50%; and 4) HIV-patients who are on ART-II program also known as second-line treatment. After completion of each interview the fill-in questionnaire was co-signed by an attending medical officer. As an econometric tool, regression analysis infers the functional relations between patient's survival time (dependent variable) and explanatory variables say socio-economic and health indicators. It is to estimate and/or predict the average values

of the dependent variable in terms of known or fixed values of explanatory variables under analysis. Though regression analysis does not necessarily mean causation, it reveals the precise causation on the basis of relation supported by the theory. The binary dummy variables were also used to represent categorical variables such as sex of patient (male/ female), employment status (employed/ unemployed) etc. The dummy variables take on only two values, *0* and *1* for two categories. The empirical data was so analysed using SPSS.

Variables specification

The response variable is considered to be survival time duration of patient (in year). The longevity of survival time after detection of the disease (HIV/ both HIV and HCV) is assumed here to be functionally related with only eleven explanatory variables of interest. They are sex of patient (male = 1 and 0, otherwise that is female), age of patient (count in year), marital status of patient (currently married = 1 and 0, otherwise say single, widow, separated etc.), family size (count discrete number of family members), number of children (count discrete number), status of respondents employment (employed = 1 and 0 otherwise), monthly family income of the patient (in '000Rs., ordinal: 1 for <1; 2 for 1-3; 3 for 3-5 and 4 for 5+), type of patient (patient with HIV = 1 and 0 otherwise that is with both HIV and HCV), mode of transmission of the disease (sexual = 1 and 0 otherwise – IUD, blood, vertical, unknown etc.), CD4 count (ordinal: below 200 = 1, 200-500 = 2 and above 500 = 3) and application of supplementary medicine (yes = 1 and 0 otherwise – no).

Functional Relationship and Hypothesis

In case of functional relationship, the patient's survival time after detection of HIV/HCV (*Y*) is assumed to be a function of eleven variables namely sex of patient, age, marital status, family size, number of children in the family, respondents employment, family income, type of patient, mode of transmission of the disease, CD4 count and application of supplementary medicine. The null hypothesis (H_0) of the present investigation may be spelt out as $H_0: \beta_i = 0$, each regression coefficient is zero indicating that the survival time period of the patients is not influenced by their socio-economic and health related factors as against the alternative hypothesis (H_1), pronounced by $H_1: \beta_i \neq 0$, that is the survival time is significantly influenced by the socio-economic and health related factors under study.

Analysis and Results

To quantify some qualitative variables, binary dummy variable (0, 1) and ordinal scale techniques are used and 0.40 was also taken as a cut off zero-order

correlation value for scanning the multi-collinearity problems among the explanatory variables. While interpreting the findings measuring the effects of the independent variables on duration of survival time of the patients, the regression coefficient (β) with its 95% confidence interval (CI) and P-values of the t-test for β are used. The probability levels of significance of the effects of independent variables have been advocated by 5% (P<0.05) as statistical significance and 1% (P<0.01) as highly significance. It is evident that the null hypothesis is rejected in the sense that all regression coefficients (β_i) can not be zero indicating that some of the explanatory variables had significant impacts on the survival time of the patients. It is evidenced by F-value of the regression model, say 3.02 (P<0.01) shown in Table - 1. Here, the total variation in the survival time is explained about 25% (R^2=0.251) by the independent variables in the model. Out of eleven variables only two were observed to have their statistically significant contributions on the variation of patient's survival time in the population. They were patient type that is patients with HIV and that of both HIV and HCV (P<0.01) and CD4 count (P<0.05). Each statistically significant variable is observed only when adjusted the joint effects of ten remaining variables under investigation. Despite, five independent variables could be detected to have their significant effects on the survival time of the patients in the step-wise regression models.

It is observed that the mean patient's survival time is found to be nearly 7 years irrespective of effects of the independent variables. The survival time of patient with HIV can extend at least 3 year 5 months (β = 3.44) from that of the patients with HIV+ and HCV while controlled the joint effect of other ten variables say sex of patient, age of patient, marital status of patient, family size, number of children, status of respondents employment, monthly family income of the patient, mode of transmission of the disease, CD4 count and application of supplementary medicine. This positive effect of type of patient is highly significant as evidenced by the value of t-statistics, 4.28 (P<0.01). In the similar manner, the survival time may enhance 2.5 years corresponding to each advancement of one level in CD4 count say from below 200 to 200-500 and again to above 500 when adjusted the joint effects of other ten variables. This increment in the patient's survival time is statistically significant as witnessed by t-statistics (1.99, P<0.05). Apart from the statistical significance, the survival time may also visibly enhance 1.5 years in male patient than those in female (β =1.55). While controlled the joint effects of ten variables, the survival time may be reduced by eight and half months (0.7 year) in sexual transmission of the disease than those of IUD, blood, vertical, unknown etc. (β = -0.71). The fitted regression model so obtained is given by the Model - 1 with model diagnostics.

To identify more influencing factors on the variation in patient's survival time, backward stepwise regression analysis is again applied. Screening of significant covariates or explanatory variables to the response variable (patient's survival time) has been performed through seven steps (Table - 2). The 1st model is same as above regression model in which the effects of independent variables are explained. The last, 7th model is achieved with five covariates indicating that

the patients' survival time is significantly varied with sex of patient, marital status of patients, family income, patient type (HIV/ HCV) and CD4 count. Age of patient is screened out to be lowest insignificant effect in the 2nd model from the 1st model carrying the β-value of -0.002 with absolute t-value, 0.02 (P>0.05). The transition of 3rd model from 2nd model can screen out the number of children in the family with β- value of -0.029 (t= 0.34, P>0.05) along with patient's age (β = 0.003, t = 0.04, P>0.05). In this advancement of each model the amount of covariates' effects on survival time duration are also changes. In this way, six less influencing independent variables can be screened out in the last fitted 7th model.

In the best fitted 7th model, the duration of patient's survival that is the time duration from date of detection of HIV/AIDS to the survey date is estimated to be at least six years (β = 6.23) assuming constant the joint effects of five covariates – sex of patient, marital status, family income, patient type (HIV/ both HIV and HCV) and CD4 count. In the similar way, the survival time of male patient can extend about two years (β = 1.99) from that of female while controlled the joint effects of other four covariates. It means that duration of survival time is significantly influenced by the sex of patient as witnessed by statistics value (t = 2.39, P<0.05). While controlled the joint effects of four variables the survival duration of currently married patient may be reduced by 1 year and 3 months from those of others say single, widow, separated etc. (β = -1.24). Keeping constant the joint effects of sex of patient, marital status, type of patient and CD4 count, the survival time is also reduced by seven months while increasing of one member in the patient's family (β = -0.59). This reduction is found to be statistically significant (t= 2.37, P<0.05). It is noted that the survival time of patient with HIV can extend at least 3 years (β = 3.19) from the patient with both HIV and HCV while controlled joint effect of four other covariates. This enhancement of survival time is highly significant as witnessed by t - statistics, 4.29 (P<0.01). Lastly, the survival time may also be increased by 2 years 5 months (β = 2.42) to each increment of one level in CD4 count when adjusted the joint effects of four other variables – sex of patient, marital status of patient, family size and type of patient.

Discussion

In the multiple regression models, out of eleven variables only two were found to have their significant influences on patient's survival time. They were patient type that is patients with HIV and the patients with both HIV and HCV (P<0.01) and CD4 count (P<0.05) when the joint effects of ten remaining variables are controlled. Despite statistically insignificance, the patients' survival time may also visibly enhance 1.5 years more in male patient than those of female irrespective of joint effects of other ten variables. This view is in association with findings of previous study. (18) In the same manner, the survival time may be reduced eight and half months (0.7 year) in sexual transmission of the disease than those of IUD, blood, vertical, unknown etc. In the last regression model in 7th step, the duration of patient's survival is estimated to be at least six years keeping

constant the joint effects of five covariates namely sex of patient, marital status of patients, family income, patient type and CD4 count. The survival time of male patient is extended to two years from that of female while controlled the joint effect of other four covariates – marital status of patient, family size, type of patient and CD4 count. It means that survival time of the patient after detection of disease is significantly influenced by the sex of patient. While controlled the joint effects of four variables, the survival duration of currently married patient may be reduced by 1 year and 3 months from those of others say single, widow, separated etc. Keeping constant the joint effects of sex of patient, marital status, type of patient and CD4 count, the survival time is also significantly reduced by seven months when increasing of one member in the patient's family. It is incorporated with the past findings. (1-3, 11) In this analysis, the survival time of the patient with HIV can extend at least 3 years from the patient with HIV+HCV in the same manner. As similar as in previous findings (16), the survival duration of patients may also be increased by 2 years 5 months corresponding to each increment of one level in CD4 count when adjusted the joint effects of four other variables.

Conclusion

To the present authors' knowledge, these effects of socio-economic and health and allied factors on duration of survival time after HIV diagnosed patients have not been previously provided in India's North Eastern Region particularly in Manipur, the easternmost state internationally bordering with Myanmar. Considering the eleven explanatory variables, the present findings could have health practitioners' prediction to patients about their life expectancies after detection of HIV/AIDS and also policy makers to estimate expenses and allocate government funds thereon. Besides, the present results can be helpful for patients planning and establishing general norms of their expectations or so called survival duration of time after diagnosis.

Table 1. *Regression coefficients on patient's survival time after detection of HIV/ HCV*

Factors	β	t	P-value	95%CI for b	
				Lower	Upper
(Constant)	6.912	2.18	0.031	0.652	13.172
Sex of patient	1.545	1.46	0.147	-0.546	3.636
Age of Patient	-0.001	-0.02	0.982	-0.106	0.103
Marital status of patient	-1.167	-1.55	0.123	-2.652	0.319
Family size	-0.553	-1.74	0.083	-1.179	0.074
Number of children	-0.107	-0.34	0.736	-0.735	0.521
Respondents employment	-0.363	-0.39	0.696	-2.189	1.464
Monthly income	-0.129	-0.45	0.657	-0.702	0.443
Type of patient	3.439	4.28	0.000	1.854	5.023
Mode of transmission	-0.713	-0.69	0.489	-2.743	1.316
CD4 count	2.531	1.99	0.040	-0.004	5.066
Supplementary medicine	0.425	0.54	0.587	-1.116	1.966

Model diagnostics: Model F=3.02, P<0.001; Durbin-Watson=1.95; R^2=0.251

Table 2. *Step-wise regression coefficients of on patient's survival time*

Model	Factors	β	t	P-value	95%CI for b	
					Lower	Upper
1	Constant	6.912	2.178	0.031	0.652	13.172
	Sex of patient	1.545	1.458	0.147	-0.546	3.636
	Age of Patient	-0.001	-0.022	0.982	-0.106	0.103
	Marital status of patient	-1.167	-1.549	0.123	-2.652	0.319
	Family size	-0.553	-1.740	0.083	-1.179	0.074
	Number of children	-0.107	-0.337	0.736	-0.735	0.521
	Respondents employment	-0.363	-0.391	0.696	-2.189	1.464
	Monthly income	-0.129	-0.445	0.657	-0.702	0.443
	Type of patient	3.439	4.281	0.000	1.854	5.023
	Mode of transmission	-0.713	-0.693	0.489	-2.743	1.316
	CD4 count	2.531	1.996	0.040	-0.004	5.066
	Supplementary medicine	0.425	0.544	0.587	-1.116	1.966
2	Constant	6.866	2.866	0.005	2.140	11.592
	Sex of patient	1.545	1.461	0.146	-0.540	3.629
	Marital status of patient	-1.169	-1.575	0.117	-2.633	0.295
	Family size	-0.553	-1.755	0.081	-1.175	0.069
	Number of children	-0.106	-0.339	0.735	-0.723	0.511
	Respondents employment	-0.364	-0.395	0.693	-2.181	1.453
	Monthly income	-0.128	-0.447	0.655	-0.695	0.438
	Type of patient	3.437	4.315	0.000	1.866	5.008
	Mode of transmission	-0.712	-0.695	0.488	-2.735	1.310
	CD4 count	2.529	1.997	0.040	0.006	5.052
	Supplementary medicine	0.423	0.547	0.585	-1.103	1.948
3	Constant	6.992	2.961	0.003	2.335	11.650
	Sex of patient	1.556	1.477	0.141	-0.523	3.635
	Marital status of patient	-1.218	-1.676	0.095	-2.651	0.215
	Family size	-0.616	-2.416	0.017	-1.119	-0.113
	Respondents employment	-0.384	-0.418	0.676	-2.193	1.425
	Monthly income	-0.125	-0.438	0.662	-0.691	0.440
	Type of patient	3.416	4.312	0.000	1.853	4.978
	Mode of transmission	-0.738	-0.723	0.471	-2.750	1.275
	CD4 count	2.580	2.036	0.043	0.080	5.080
	Supplementary medicine	0.412	0.534	0.594	-1.109	1.932
4	Constant	6.725	2.965	0.003	2.251	11.200
	Sex of patient	1.489	1.433	0.154	-0.561	3.538
	Marital status of patient	-1.231	-1.699	0.091	-2.660	0.198
	Family size	-0.604	-2.390	0.018	-1.103	-0.106
	Monthly income	-0.136	-0.478	0.633	-0.698	0.426
	Type of patient	3.395	4.303	0.000	1.839	4.951
	Mode of transmission	-0.731	-0.718	0.473	-2.739	1.277
	CD4 count	2.570	2.033	0.043	0.077	5.064
	Supplementary medicine	0.408	0.531	0.596	-1.109	1.925
5	Constant	6.337	2.997	0.003	2.167	10.508
	Sex of patient	1.531	1.482	0.140	-0.507	3.569
	Marital status of patient	-1.214	-1.681	0.094	-2.638	0.210
	Family size	-0.594	-2.362	0.019	-1.089	-0.098

	Type of patient	3.425	4.364	0.000	1.877	4.973
	Mode of transmission	-0.733	-0.721	0.472	-2.736	1.271
	CD4 count	2.515	2.002	0.047	0.037	4.994
	Supplementary medicine	0.408	0.531	0.596	-1.106	1.922
6	Constant	6.832	3.606	0.000	3.096	10.569
	Sex of patient	1.463	1.429	0.155	-0.556	3.481
	Marital status of patient	-1.267	-1.774	0.078	-2.675	0.142
	Family size	-0.586	-2.339	0.020	-1.080	-0.092
	Type of patient	3.401	4.349	0.000	1.858	4.943
	Mode of transmission	-0.870	-0.887	0.376	-2.804	1.064
	CD4 count	2.404	1.944	0.053	-0.035	4.843
7	Constant	6.226	3.525	0.001	2.743	9.709
	Sex of patient	1.989	2.388	0.018	0.346	3.633
	Marital status of patient	-1.237	-1.735	0.048	-2.643	0.169
	Family size	-0.594	-2.374	0.019	-1.087	-0.101
	Type of patient	3.188	4.286	0.000	1.721	4.655
	CD4 count	2.423	1.961	0.041	-0.014	4.860

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