Journal of Tropical Diseases

Tekle, J Trop Dis 2019, 7:2
DOI: 10.4172/2329-891X.1000303

Research Article Open Access

# Assessment of Socio-Economic, Demographic and Health Factors That Influences the Survival/Death Status of HIV Positive People under Art Follow-Up at Wolaita Sodo Referral Hospital (Ottona), Ethiopia

**Getachew Tekle***

*Department of Statistics, College of Natural and Computational Sciences, Wachemo University, Ethiopia*

***Corresponding author:** Getachew Tekle, Department of Statistics, College of Natural and Computational Sciences, Wachemo University, Ethiopia, Tel: 0932566372; E-mail: getch.55tekle@gmail.com

**Received date:** December 17, 2018; **Accepted date:** January 19, 2019; **Published date:** January 22, 2019



## Abstract

Human Immunodeficiency Virus (HIV) is the virus that causes Acquired Immune Deficiency Syndrome (AIDS). HIV attacks and destroys certain types of white blood cells that are essential to the body's immune system, the biological ability of the human body to fight infections. The main aim of this study was to find out some socio-economic, demographic and health factors that influence the survival/death status of HIV positive people under ART follow-up. It is a cross sectional study based on data from the ART clinic in Ottona Hospital, south Ethiopia. The analytical methodologies Descriptive analysis and Binary Logistic regression were employed to identify the covariates that have a statistically significant effect on the survival time of HIV infected patients. The logistic regression analysis of the study from ART clinic of Wolaita Sodo University referral hospital gave results confirming that the factors age, weight, CD4 level, functional status, TB treatment and sex use have statistically significant effects on the survival of patients. Researchers should focus on this field of study i.e. in the medical area of health centers and ART program.

**Keywords:** Survival status; Binary Regression model; HIV/AIDS; ART

## Introduction

The Human Immunodeficiency Virus (HIV) has created an enormous challenge worldwide. Since its recognition, HIV has infected close to 70 million people, and more than 30 million have died due to Acquired Immune Deficiency Syndrome (AIDS) more than 66% of the 40 million people living with HIV/AIDS are in Sub-Saharan Africa, where AIDS is the leading cause of death [1-3].

Since the first evidence of the HIV epidemic was detected in Ethiopia in 1984, AIDS has claimed the lives of millions and left behind an estimated 744,100 orphans. In 2003, the government of Ethiopia introduced its ART program with the goal of reducing HIV related morbidity and mortality, improving the quality of life of people living with HIV and mitigating some of the impacts of the epidemic [4,5].

In 2005, Ethiopia launched free ART: over 71,000 were initiated on ART by the end of November 2006 and some 241 Hospital and health centers are now providing HIV care and treatment services in all regions of the country. In ORH, this free ART program also attends to increase access by taking service closer to more people, recording transport and related costs for patients and families, resulting in improving adherence and enrolment in care and treatment services early in the course of the disease [6-9].

### The objective of the study

**General objective:** To study some socio-economic, demographic and health factors that influence the survival/death status of HIV positive people under ART follow-up.

**Specific objective:**

- To develop a statistical model that predicts the chance of survival/death status among HIV positives taking ART to follow up
- To get some information on the relative importance of ART to follow up
- To provide an estimate of the probability of dying under certain predictor variables
- To provide information for policy-makers

### Statement of the problem

Most of the researches in our country focused on the prevention of the virus before a person is HIV positive. However, all prevention program will not realize their targets unless otherwise, we give due consideration to people living with HIV/AIDS. It is the fact that little has been done on the factors that influence the survival/death status of person given he/she is already HIV positive and is under the follow-up of ART that motivates this study.

In this context one should ask the following questions to modify the study:

- Which social, wealth and demographic variables, affect the chance of survival or death status of HIV positive people under the ART program in ORH?
- Which form of independent variables has a positive/negative correlation with the dependent variable (the survival or death status of HIV positive peoples)?

In attempting to answer the above questions, a study is conducted on the chance of Survival/death status of HIV positive under the ART program in ORH with the aim of:

**Identify the socio-economic factors such as:**

- Educational level
- Access to nutrition
- Psychological support
- Treated with respect and with complete considerations of human rights, privacy, and confidentiality
- Stigma and discrimination
- Functional status

**Explore the variables among the demographic ones:**

- Marital status
- Age
- Sex
- Residence
- And others

**Finally predict the health factors such as:**

- CD 4
- Drug abuse and drug misuse
- Smoking cigarette and taking alcohol
- TB treatment
- Use Anti-virus drugs like AZT (zidovudine)
- WHO clinical stage

### The significance of the study

The relevance and significance of the study pointed out like:

- To make inferences, prediction and making decisions about the cause of survival or death states of HIV positive people under the ART program based on the information contained in a random sample taken from the entire population
- It provides the knowledge and skill to interpret and use the statistical technique involuntary of health centers that follow-up ART program
- To identify the factor which influences the chance of survival death/status of HIV positive people?
- To examine the nature of relation or association between socio-economic, demographic, health and the chance of survival or death status of HIV positive people
- To measure the proportion of the chance of survival or death status of HIV positive people about its mean that is explained by the predictor variables
- To investigate the impact of TB on the HIV positive people
- It paves a way for researchers to conduct further research

## Materials and Methods

### Data type and source

In our project, the information that has been collected from patient charts under the ART program about HIV positive peoples in ORH has a secondary data type.

### Sampling design

**Sampling frame:** Intending our objective of the research project leads to the area of HIV positive patients who are found in Wolaita Sodo university referral hospital under the ART follow up. Considering all things on the ART program, the study focused or generated on the patients who are regularly registered, transferred in, transferred out, died, lost and dropped out in the program from October1995-March 2001 E.C.

**Sample size determination:** Preliminary sample size determination is obtained by the collected information from the given population of HIV positive patients. So that the sample size determination is manipulated and retrieved by population proportion of HIV positive patients who follow up under ART program and service still now.

Sample size determination using population proportion: It takes as a basic requirement the total population size (N), the margin of error (E) and the tabulated value for 95% confidence coefficient ($z_{\alpha/2}$),

Let p=sample proportion of survival

$\theta$=population proportion of survival If $p \sim N(\theta, \text{var}(p))$,then $100\%(1-\alpha)CI$ for θ is$p \pm z_{\alpha/2} S.E(P)$

$E = z_{\alpha/2} S.E(P)$is the margin of error$S.E(P) = \frac{E}{z_{\alpha/2}}$ is the standard errorIn this study the statistical level of significance ($\alpha$=0.05) and margin of error (E=0.1). We chose the margin of error E=0.1 because the collected data is the secondary type and there may be a mistake in the recording. The population proportion is estimated using the total of survival patient=1743 and a total of dead patients=770 in the given total population size of N=2513 is calculated as $\theta = \frac{1743}{2513} = \frac{249}{359} 1-\theta = \frac{770}{2513} = \frac{110}{359}$

$$Var\,(P) = \left(\frac{E}{z_{\alpha/2}}\right)^2$$

$$\frac{\theta(1-\theta)}{n} = [\frac{[N-n)]}{N-1}] = \left[\frac{E}{Z_{\alpha/2}}\right]^2$$

$$\frac{\theta(1-\theta)}{n}[\frac{N}{N-1} - \frac{n}{N-1}] = \left[\frac{E}{Z_{\alpha/2}}\right]^2$$

$$\frac{\theta(1-\theta)N}{n(N-1)} - \frac{\theta(1-\theta)}{(N-1)} = \left[\frac{E}{Z_{\alpha/2}}\right]^2 \frac{\theta(1-\theta)N}{n(N-1)} = \left[\frac{E}{Z_{\alpha/2}}\right]^2 + \frac{\theta(1-\theta)}{N-1}$$

$$\frac{N\theta(1-\theta)}{n(N-L)} = \frac{(N-1)E^2 + Z_{\alpha/2}\theta + (1-\theta)}{(N-1)(z_{\alpha/2}{}^2)}$$

$$\frac{N\theta(N-1)}{n\theta(1-\theta)} = \frac{(N-1) + Z^2{}_{\alpha/2}}{(N-1)E^2 + z_{\alpha/2}{}^2\theta(1-\theta)}$$

$$n = \frac{N\theta(1-\theta)Z^2{}_{\alpha/2}}{(N-1)E^2 + Z^2{}_{\alpha/2}\theta(1-\theta)}$$

$$n = \frac{\theta(1-\theta)Z^2{}_{\alpha/2}}{\frac{(N-1)}{N}E^2 + \frac{Z^2{}_{\alpha/2}\theta(1-\theta)}{N}}$$

**Citation:** Tekle G (2019) Assessment of Socio-Economic, Demographic and Health Factors That Influences the Survival/Death Status of HIV Positive People under Art Follow-Up at Wolaita Sodo Referral Hospital (Ottona), Ethiopia. J Trop Dis 7: 303. doi:10.4172/2329-891X.1000303



$$n = \frac{N\theta(1-\theta)(Z_{\alpha/2})^2}{\frac{(N-1)}{N} + \frac{1}{N}\left[\frac{Z_{\alpha/2}}{E}\right]^2 \theta(1-\theta)}$$

Where N=2513

$$\Rightarrow n = \frac{\frac{249}{359}\left[\frac{110}{359}\right]\left[\frac{1.96}{0.1}\right]^2}{\frac{2512}{2513} + \frac{1}{2513}\left[\frac{1.96}{0.1}\right]^2 \frac{249}{359}\left[\frac{110}{359}\right]} = 79.10380 \approx 80.$$

Thus, a total of 80 patient charts have been visited in the data collection.

Let the number of survival in the sample(s=49) and sample size (n =80), then$p = \frac{s}{n} = \frac{49}{80} = 0.6125.$

**Systematic sampling:** Systematic random sampling method is adopted as a sampling design for collecting a sample of patients based on their ART identification number and using the following procedures.

- Taking a simple random sampling from the given frame of the sample only for the first unit
- Taking the total population and the sample size. Find the k value, k=N/n
- After such calculation for k, automatically select the remaining units in a definite sequence at equal spacing k. (i.e. choose the 1st element and next to the (k+1)$^{th}$ element)

Where n-is sample size taken

N is population size

K is the constant for equal sampling

$n = 79.103\ 80 \approx 80$

$K = N/n = 2513/80 = 31.4125 \approx 32$

First, we choose the 1$^{st}$ person next to the 33$^{rd}$ person, 65$^{th}$ person, and so on. Finally, we put the person with HIV positive following up ART program.

## The variables included in the study

From the way of classifying data based on the association of the variables, our project includes both independent and dependent variables. The related dependent variable is the chance of survival or death status of HIV positive people is a measure of the behaviors of the subject that reflects the effects of the independent variables which are listed as follows:

The dependent variable: The response variable, chance of survival/death status has a binary assumption of two values (0) and (1) i.e. if the response is "1", the individual patient is survive, and if it is "0",the individual patient is dead, under the ART program (Table 1).

| No | Description and name | Category |
|---|---|---|
| 1 | Age of patients (age) | (0)>30 |
| | | (1)<=30 |
| 2 | Sex of patients (sex) | (0) for female |
| | | (1) for male |
| 3 | Weight of patients (weight) | (0)<=45 Kilogram |
| | | (1)>45 kilogram |
| 4 | WHO clinical stage (clinical stage) | (0) for stage one and two |
| | | (1) for stage three and four |
| 5 | Functional status (fan status) | (0) for bedridden and ambulatory |
| | | (1) for workers |
| 6 | CD4 level (CD4 ) | (0) for <200/mm$^3$ |
| | | (1) for >=200/mm$^3$ |
| 7 | TB treatment (TB treat) | (0) for not user |
| | | (1) for user |

**Table 1:** Explanatory variables.

## Methods of analysis

Gezahegn [10] applied Cox proportional-hazard regression to calculate the bivariate and adjusted hazard rate and then determine independent predictors of time to death in CD4 cell counts data in Durame and Hosanna hospital.

Ketema [11] conducted a retrospective cohort study in Armed Forces General Teaching Hospital (AFGTH) located in Addis Ababa, Ethiopia and applied Kaplan-Meier survival curves and Log-Rank test to compare the survival experience of a different category of ART patients, and employed proportional hazards Cox model to identify independent predictors of mortality.

Earlier studies applied different statistical methods of data analysis for the same topic, but here in this study, the author interested to see in the different approach of the previous studies that seen as below sections.

The study of this project stands to use both the descriptive and inferential analysis by incorporating the relevant software MINTAB in the whole work.

## Logistic regression

Logistic regression analysis method can be considered in a situation where the predictor variables some or all of the predictor variables are discrete or categorical and for binary data response variable.

Consider the collection of "k" independent variable in the logistic regression equation is given by

$$p(x_i) = \frac{e^{\beta_0 + \sum_{i=1}^{k} \beta_0 x_i}}{1 + e^{\beta_0 + \sum_{i=1}^{k} \beta_0 x_i}}$$

Logit

$$(P\ (xi)) = \log\left[\frac{p(x_i)}{1 - p(x_i)}\right] = B0 + B1X1 + B2X2 + \ldots\ldots\ldots + BkXk \qquad i = 1,\ 2 \ldots k$$

Where:

- $B_o$,$B_i$ are parameters or coefficients of the regression for explanatory variables
- $X_i$ is the explanatory variables
- $P(x_i)$is the success/survival probability or chance when $X_i$ takes a value
- $1-p(x_i)$ is the failure/death probability or chance when $x_i$ takes a value

Generally, we use this non-linear regression model since it does minimize the error and it is best in medical researches.

## Chi-square test

It is used to test the hypothesis of independence of two attributes. For instance may be interested:

- Whether the presence or absence of TB treatment is independent of the survival/death status of a patient or not and other tests may be considered
- To assess the goodness of the test

The $X^2$ -statistics is given by

$$X^2{}_{cal} = \sum_{i=1}^{r} \sum_{j=}^{c} \left[ \frac{(o_{ij} - e_{ij})^2}{e_{ij}} \right] \approx x^2(r-1)(c-1)$$

Where

$O_{ij}$=the number of unites that belongs to category i of A and j of B.

$e_{ij}$=Expected frequency that belongs to category i of A and j of B.

r=the number of rows

c=the number of columns

$$e_{ij} = \frac{R_i + C_i}{n}$$

Where

- $R_i$=the $i^{th}$ row total
- $C_j$=the $j^{th}$ column total
- N=total number of observations

$$n = \sum_{i=1}^{r} \sum_{j=1}^{c} O_{ij} = \sum_{i=1}^{r} \sum_{j=1}^{c} e_{ij}$$

The null and alternative hypothesis may be stated as:

$H_0$: there is no association between the two variables

$H_1$: not $H_0$

## Decision rule

Reject $H_0$ for independence at $\propto$-level of significance if the calculated value of $x^2$-exceeds the tabulated value with a degree of freedom equal to (r-1) (c-1).

## Analysis and interpretation

**Descriptive analysis:** Starting from the definition of descriptive statistics, the data obtained as a quantitative and qualitative form are described, summarized and distributed in different ways of frequency distributions. The independent variable like weight, age, and CD4 level, which are quantitative data, are described by the graph of Histogram that describes the frequency of patients in each group. Entering the sampled data as the coded form into the MINITAB gives the following summarized Table 2.

| Variable | N | Mean | Median | TrMean | StDev | SE Mean |
|---|---|---|---|---|---|---|
| Age | 80 | 32.30 | 30.50 | 31.93 | 13.99 | 1.56 |
| Weight | 80 | 46.07 | 48.50 | 46.98 | 12.80 | 1.43 |
| CD4 level | 80 | 161.20 | 174.50 | 161.50 | 79.81 | 8.92 |
| Variable | | | Minimum | Maximum | Q1 | Q3 |
| Age | | | 2.00 | 97.00 | 25.00 | 40.00 |
| Weight | | | 5.00 | 72.00 | 40.25 | 53.75 |
| CD4 level | | | 7.00 | 325.00 | 79.75 | 231.50 |

**Table 2:** Descriptive Statistics for age, weight and CD4 level.

## Mean

The mean (also called the average) is a measure of where the center of the distribution lies. It is simply the sum of all observations divided by the number of observations. For the precipitation data such as given in the above descriptive statistics, the mean for the age of a patient is 32.30 implies that the patients considered in the sample have an average of 32.3 years.

The mean is strongly influenced by extreme values like the age of 97 years old. Even though there is age like this, the mean is lowered to the 32.3. The extreme value of age is affecting the mean quite a bit. In addition to age, the weight and CD4 level have the mean of 46.07 and 161.2 respectively.

## Median

The median (also called the $2^{nd}$ quartile or $50^{th}$ percentile) is the middle observation in the data set. For manual use, it is determined by ranking the data and finding observation number [N+1]/2. If there are even numbers of observations, the median is extrapolated as the value midway between that of observation numbers N/2 and [N/2]+1. Since in the study, there are 80 observations, finding median is calculated by the above formula.Therefore, age, weight and CD4 level have a median of 30.50, 48.50 and 174.5.

The median is less sensitive to extreme values than the mean. For example, the median of age would be 30.5 even if there were a value of 97. Therefore, the median is often used instead of the mean when data contain outliers or it is skewed.

## Trimmed mean

The trimmed mean (Tr Mean) is like the mean, but it excludes the extreme values in the data set. The highest and lowest 5% of the values (rounded to the nearest integer) are dropped, and the mean is calculated for the remaining values.

Thus, 31.93, 46.98 and 161.5 are the trimmed mean of the age, weight and CD4 level. Like the median, the trimmed mean is less sensitive to extreme values than the mean.

**Citation:** Tekle G (2019) Assessment of Socio-Economic, Demographic and Health Factors That Influences the Survival/Death Status of HIV Positive People under Art Follow-Up at Wolaita Sodo Referral Hospital (Ottona), Ethiopia. J Trop Dis 7: 303. doi:10.4172/2329-891X.1000303



### Comparing standard deviations

The standard deviation is a measure of dispersion. The more dispersion there is in a data set, the higher it's standard deviation. A measure of dispersion tells you how much variation or spread there is in a data set.

The standard deviation (StDev) is a measure of how far the observations in a sample deviate from the mean. It is analogous to an average distance (independent of direction) from the mean. The standard deviation is the most commonly reported measure of dispersion. It also serves as an estimate of the dispersion in the broader population from which a sample is taken. The standard deviation for the age, weight and CD4 level data are 13.99, 46.98 and 79.81 respectively. This tells that on average, the values in the data set tend to differ from the mean by ± 13.99, ± 46.98 and ± 79.81 with their respective data (Figure 1).

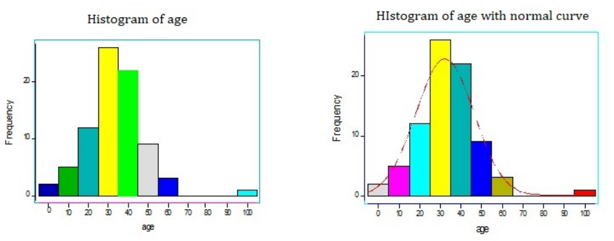


**Figure 1:** Describing the age of patients.

A histogram displays data that have been summarized into intervals. It can be used to assess the symmetry or skewness of the data. To construct a histogram, the horizontal axis is divided into equal intervals, and a vertical bar is drawn at each interval to represent its frequency (the number of values that fall within the interval).

Given the above graph obtained from the age of patients, the virus called HIV/AIDS who are the productive persons for their own country affects the age group from 45-50 years. Therefore, that in order to survive and to carry out the responsibility from their own country and for themselves, everyone should participate under the anti-retroviral therapies.

The independent variable i.e. CD4 level has the above-summarizing information about its distribution on the HIV positive patients under the ART program in ORH. Since the histogram obtained from the data of this variable has fluctuated in different patients which implies the patients can have different CD4 levels measured by CD4 count machine (Figure 2).

In addition to the above explanatory variables that can maintain the chance of survival/death status of HIV positive patients, the weight is summarizing in the above graph. The weight of patients observed in the given sample has the highest frequency with weight group of 45-55 kg (Figure 3).

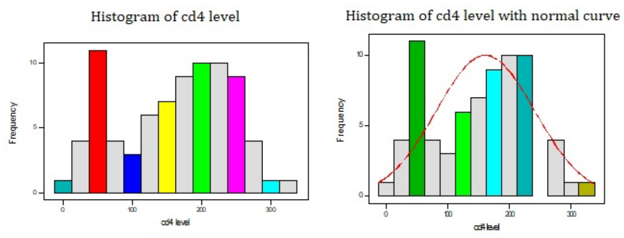


**Figure 2:** CD4 level of patients.

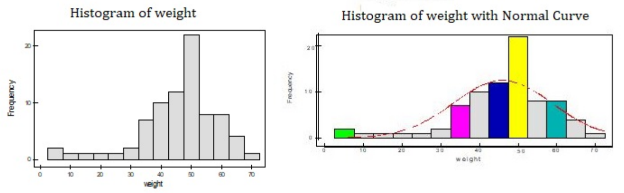


**Figure 3:** Weight of patients.

### Inferential analysis

This part of the analysis is employed by the use of logistic regression which allows the binary response variable under categorical data. Binary Logistic regression analysis is the way of analyzing the information obtained from the medical world like in the sectors of the hospital, clinics, and other health centers. From our research perspective, the data obtained from the ART program about the HIV positive patients is implemented by Minitab to run the binary logistic regression.

### Link function

A link function in logistic regression maps the interval (0,1) onto the whole real line. This guarantees that the predicted probability of an event using the logistic regression model will produce a number between 0 and 1.

### Binary logistic regression: life status versus age, weight

**Logistic model:** Logistic regression examines the relationship between one or more predictor variables and a binary response. The logistic equation can be used to examine how the probability of an event changes as the predictor variables change (Table 3).

| **Odds 95% CI** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Predictor** | **Coef** | **SE Coef** | **Z** | **P** | **Ratio** | **Lower** | **Upper** |
| Constant | -13.965 | 4.966 | -2.81 | 0.005 | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Age | 5.492 | 1.959 | 2.80 | 0.005 | 242.75 | 5.22 | 11293.81 |
| Weight | 4.159 | 1.527 | 2.72 | 0.006 | 64.03 | 3.21 | 1277.87 |
| CD4 level | 4.199 | 1.910 | 2.20 | 0.028 | 66.64 | 1.58 | 2813. 41 |
| functional | 3.946 | 1.749 | 2.26 | 0.024 | 51.75 | 1.68 | 1593.43 |
| who clin | 1.868 | 1.059 | 1.76 | 0.078 | 6.48 | 0.81 | 51.59 |
| tb treat | 4.921 | 1.776 | 2.77 | 0.006 | 137.15 | 4.22 | 4454.74 |
| sex | 6.554 | 2.415 | 2.71 | 0.007 | 702.36 | 6.18 | 79787.94 |

**Table 3:** Logistic regression.

Standing on the above result, the fitted model for logistic regression is stated out in following form

$$P(X_i) = \frac{\exp(-13.965 + 5.493X_1 + 4.159X_2 + 4.199X_3 + 3.946X_4 + 1.868X_5 + 4.921X_6 + 6.554X_7)}{1 + \exp(-13.965 + 5.493X_1 + 4.159X_2 + 4.199X_3 + 3.946X_4 + 1.868X_5 + 4.921X_6 + 6.554X_7)}$$

Or$$Logit(P(X_I)) = -13.965 + 5.493X_1 + 4.159X_2 + 4.199X_3 + 3.946X_4 + 1.868X_5 + 4.921X_6 + 6.554X_7$$

Interpretation of coefficients of independent variables

MINITAB needs to assign one-factor level as the reference level, meaning that the interpretation of the estimated coefficients is relative to this level. For the given factors, the reference level is the level with the least numeric value or the lowest value as set by Value Ordering of coefficients which is the WHO clinical stage.

The positive coefficient for age (5.492) implies that the age of patients is more likely to describe survival or death status of patients. Similarly, the positive coefficient for weight, CD4 level, functional status, TB treatment and sex (4.159, 4.199, 3.946, 4.921, and 6.554) respectively implies that these explanatory variables are more likely to describe the survival or death status of patients than the reference factor.

## Interpretation about the significance of variables

**P-value:** The p-values test whether or not an observed relationship is statistically significant.

This p-value tells if there is a significant association between at least one predictor and the response by testing whether all slopes are equal to zero.

Compare this p-value to your a-level. If the p-value is less than or equal to the a-level you have selected, the association is significant. A commonly used a-level is 0.05.

- If the p-value is less than or equal to the A-level, then the association is significant, and conclude that at least one predictor is significantly associated with the response
- If the p-value is greater than the A-level, then conclude that there is no significant association and the interpretation ends

For the given data for patients, the p-value for testing that all slopes are zero is 0.000. Because 0.000 is less than 0.05, we conclude that there is a significant relationship between the response and at least one of the predictor variables.

Identify the p-value for each term in the model. These p-values tell that whether or not there is a statistically significant association between a particular predictor variable and the binomial response.

Compare the individual p-values to a-level: If a p-value is less than or equal to the A-level, the association is significant. Now look at the p-values for each predictor, since all of the variables included in the model have a value less than or equal to 0.05 except the WHO clinical stage, they are significant at the 95% confidence level. But WHO clinical stage of patients has a p-value (0.078) greater than 0.05 conclude that there is no significant association between it and the response variable life status.

## Odds ratio

The odds ratio is equal to 1 when no association exists. It is the odds of success given a certain condition exist divided by the odds of success given that same condition does not exist.

One advantage of the logit link function is that it provides an estimate of the odds ratio for each predictor in the model.

Therefore, the odds ratios can be interpreted as:

- The odds of surviving to be dead among patients with the age of fewer than 30 years old has an odds 242.7 times an odds of those who have greater than or equal to 30 years old
- The odds of surviving to be dead among patients with the weight of less than or equals to 45 Kgs has an odds 64.03 times an odds of those who have greater than 45 Kgs
- The odds of surviving to be dead among patients with the CD4 level of greater than or equal to 200/mm$^3$ has an odds 66.64 times an odds of those who have less than 200/mm$^3$
- The odds of surviving to be dead among patients with the ambulatory and bedridden has an odds 51.75 times an odds of those who are under working conditions
- The odds of surviving to be dead among patients with the first and second clinical stage has an odds 6.48 times an odds of those with third and fourth clinical stage
- The odds of surviving to be dead among patients with TB treatment user has an odds 137.15 times an odds of those who are not the user
- The odds of surviving to be dead among patients who are male have an odds 702.36 times an odds of those who are female

**Citation:** Tekle G (2019) Assessment of Socio-Economic, Demographic and Health Factors That Influences the Survival/Death Status of HIV Positive People under Art Follow-Up at Wolaita Sodo Referral Hospital (Ottona), Ethiopia. J Trop Dis 7: 303. doi:10.4172/2329-891X.1000303



## Assessing the fit of the model

Once the model has developed, we would like to know how effective the model is in the describing the outcome variable. This is what is called goodness of fit. In testing the hypothesis that model fits the data, two common approaches are Pearson's chi-square test statistics and the likelihood ratio statistics ($G^2$) which are based on the comparison of the fitted and the observed counts. The larger values of $X^2$ and $G^2$ indicate lack of fit of the model. For this study, $X^2$ statistics is used for checking model fitness.

By default, MINITAB provides three goodness-of-fit tests: Pearson, Deviance, and Hosmer-Lemeshow. The Hosmer-Lemeshow test assesses the model fit by comparing the observed and expected frequencies. The test groups the data by their estimated probabilities from lowest to highest, and then performs a Chi-square test to determine if the observed and expected frequencies are significantly different (Table 4).

| Group | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Value** | 1 | 2 | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Total |
| **1** | | | | | | | | | | | |
| **Obs** | 0 | | 0 | 0 | 4 | 8 | 12 | 8 | 9 | 8 | 49 |
| **Exp** | 0 | | 0 | 1 | 4.7 | 6.5 | 11 | 7.8 | 10 | 8 | |
| **0** | | | | | | | | | | | |
| **Obs** | 9 | | 8 | 8 | 5 | 0 | 0 | 0 | 1 | 0 | 31 |
| **Exp** | 9 | | 8 | 7 | 4.3 | 1.5 | 1 | 0.2 | 0 | 0 | |
| **Total** | 9 | | 8 | 8 | 9 | 8 | 12 | 8 | 10 | 8 | 80 |
| **Goodness-of-Fit Tests** | | | | | | | | | | | |
| **Method** | **Chi-Square** | **DF** | **P** | | | | | | | | |
| **Pearson** | 621.942 | 42 | 0 | | | | | | | | |
| **Deviance** | 24.352 | 42 | 0.987 | | | | | | | | |
| **Hosmer-Lemeshows** | 45.1 | 7 | 0 | | | | | | | | |

**Table 4:** Chi square of observed and expected frequencies.

When fitting a logistic model and want to choose a model (link function and predictors) that result in a good fit for the given data. Goodness-of-fit statistics can be used to compare the fits of different models. A low p-value indicates that the predicted probabilities deviate from the observed probabilities in a way that the binomial distribution does not predict.

For the given data, the relatively smallest p-value (0.000) implies that the predicted probabilities deviate from the observed probabilities in a way that the binomial distribution does not predict.

Pearson and Deviance are both types of residuals for logistic models. They are useful measures for evaluating how well the selected model fits the data. The higher the p-value, the better the model fits the data.

For the given data, the Pearson test has p-values (0.00) that are less than 0.05 and deviance test has p-value (0.987) that is highly greater than 0.05 indicating that there is insufficient evidence for the model not fitting the data adequately when the A-level is less than or equal to 0.1

## Conclusion

Since the aim of ART is to improve the health status of HIV positive individuals, it could be essential to study the factors that can improve the performance of ART. The people who are responsible care and treatment providers and policymakers in the ART programs service have been confronted with the question of how to reduce and eliminate the death of HIV positive patients.

The paper analyzed the effect of age, weight, CD4 level, functional status, and WHO clinical stage, and TB treatment, sex and life status of HIV positive patients on their survival. Using binary logistic regression analysis, two dimensions of the survival (death status) of patients is extracted from the variables of patient's indicator.

The logistic regression analysis of the study from ART clinic of Wolaita Sodo University referral hospital gave results confirming that the factors age, weight, CD4 level, functional status, TB treatment, and sex use have statistically significant effects on the survival of patients. On the other hand, the WHO clinical stages were found to have no impact on the survival of patients.

With regard to age those who were less than 30 years old HIV positive patients survive for a long period of time than those who were greater than or equal to 30 years old. Concerning weight of HIV positive patients who had greater than 45 kgs have better chance to survive than those who had less than or equal 45 kgs. In addition, it was found that HIV positive patients those who have greater than or equal to 200 cells/$mm^3$ CD4 level, were workers in their job area, user of TB treatment and male in sex lived longer than those patients who have less than 200 cells/$mm^3$, CD4 level, were ambulatory and bedridden, un-user of TB treatment and female in sex.

## Recommendation

To recommend for the statistician who is the researchers in this area of study it is better to include the other variables that may be observed and recorded under the ART program in order to give the decision about the chance of survival of HIV patients. Finally, I would like to recommend researchers should focus on this field of study i.e. in the medical area of health centers and ART program.

Moreover, interventions need to be designed to promote early HIV testing and early enrollment of HIV infected individuals into ART services. As socio-demographic factors and lack of awareness about ART services, fear of stigma and discrimination compromise the utilization of ART program, improving public awareness through advocacy and social mobilization should be included in the ART service.

It is strongly recommended that underline the need for anti-retroviral therapy in HIV infected patients for immune reconstitution.

## References

1. Bijaria S (2008) Dynamics of naïve and memory CD4+ T Lymphocytes in HIV-1 disease Progression. J Acquir Immune Defic Syndr 30: 41-58.
2. Sethi E (2009) Factors affecting CD4+T-lymphocyte count response to HAART in HIV patients. HIV Medicine Journal 8: 141.
3. Palella FJ, Delaney KM, Moorman AC, Loveless MO, Fuhrer J, et al. (2005) Declining morbidity and mortality among patients with advanced human immune deficiency virus infection. N Engl J Med 338: 853-860.
4. WHO (2007) Report on the global AIDS epidemic, treatment and care.
5. Johannessen A, Naman E, Ngowi BJ, Sandvik L, Matee MI, et al. (2008) Predictors of mortality in HIV-infected patients starting antiretroviral Therapy in a rural hospital in Tanzania. BMC Infect Dis 8: 52.
6. Yibeltal A, Eleni S, Achamyeleh A, Abinet A, Belen K, et al. (2010) HIV/AIDS prevention and control office (HAPCO) monthly HIV and ART.
7. Elke K, Yirga A, Katherine D, Peter G, Tesfaye A, et al. (2011) Implications of adopting new WHO guidelines for antiretroviral therapy initiation in Ethiopia. Bull World Health Organ 90: 659-663.
8. Françoise R, Chris D, Stephen K, Sigrid T, Joseph P (2006) Use of antiretroviral therapy in resource-limited countries: distribution and uptake of First and second line regimens. Department of HIV/AIDS, World Health Organization, Switzerland.
9. Bayeh A, Fisseha W, Tsehaye T, Atnaf A, Mohammed Y (2010) ART-naive HIV patients at Feleg-Hiwot Referral Hospital Northwest, Ethiopia. Ethiop J Health Dev 24.
10. Gezahegn A (2011) Survival Status among patient living with HIV AIDS who are on ART treatment in Durame and Hossana Hospitals.
11. Ketema K (2011) Determining factors that affect the survival rate of HIV-infected patients on ART: The case of Armed Forces General Teaching Hospital, Addis Ababa, Ethiopia. Ethiop J Health Dev 22.