



Statistical Analysis of Cardiovascular Disease and Associated Risk Factors among Patients in Western Ethiopia

Gemechu Bekana Fufa^{1*}

¹*Department of Statistics, College of Natural and Computational Sciences, Wollega University, Nekemte, Ethiopia.*

Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Cardiovascular disease (CVD) is the major non-communicable disease-causing higher proportions of morbidity and mortality, impacting both in the rural and urban populations of Ethiopia. The aim of this study was to analysis the Cardiovascular disease and associated risk factor of patients in Nekemte Specialized and Gimbi Comprehensive Hospitals, western Ethiopia. A sample of 950 Cardiovascular patients at selected hospitals were selected using purposive sampling from the study area, from June 2018 to September 2019. Survival and Hazard functions, Kaplan-Meier Estimator, Cox Regression model, Logistic regression models, and tests methods of data analysis were used in this study. The study variables: Age, Sex, Residence, Tobacco use, Alcohol use, Obesity (BMI) in kg/m^2 , Physical Activity, Khat Use, Diabetes Status, Family History of HTN, circumference, using fruit, educational level are the main variables included in the study. The result of the study shows that age of patients, smoking tobacco, drinking alcohol, practicing physical exercise, body mass index, having diabetes mellitus and having a family history of hypertension were among the factors that were highly significant to determine the censored and death patients, but the residence of patients has less significant effect on the censored of patients at study area. The result of the study also shows that, Cardiovascular Disease risk factors are highly prevalent among the hypertensive patients, older age, smoking tobacco, drinking alcohol and not practicing

*Corresponding author: E-mail: gemechu.bekana@yahoo.com;

of physical exercise in this study. Finally, the researcher recommends that, to increase the compliance of the cardiovascular patients, not drink alcohol, not use tobacco, not chew chat, doing physical exercise and eating fruits were the main recommended activities for this study.

Keywords: Cardiovascular disease; cox regression model; patients; hospitals and censored.

1. INTRODUCTION

A noncommunicable disease (NCD) is a medical condition or disease that is by definition non-infectious and non-transmissible among people. NCDs have long been the leading causes of death in developed and developing countries [1,2]. The World Health Organization (WHO) reports and many international statistics indicate that NCDs are the global leading cause of death. According to the WHO's Global Health Observatory data, NCDs resulted in 36 million deaths (63% of 57 million deaths total) in 2008 [3]. Alarming, NCDs are now the leading causes of death in most low-income and middle-income countries. More seriously, NCD burden is increasing more rapidly in lower income countries and populations.

Non-communicable diseases are the leading causes of death globally, killing more people each year than all other causes combined. Contrary to popular opinion, available data demonstrate that nearly 80% of deaths due to non-communicable diseases occur in low- and middle-income countries [4]. Of the 57 million deaths that occurred globally in 2008, thirty-six million were due to non-communicable diseases comprising mainly cardiovascular diseases, cancers, diabetes, and chronic lung diseases. The combined burden of these diseases is rising fastest among the lower-income countries, populations, and communities [5]. Some noncommunicable diseases are more common than others. The four main types of noncommunicable diseases include cardiovascular disease, cancer, chronic respiratory disease, and diabetes [5].

Cardiovascular disease (CVD) remains a global major cause of death and represents a significant disease burden in populations around the world. The global burden of disease studies reported an estimated 422.7 million cases of CVD, causing 17.92 million deaths worldwide in 2015 [6]. Developing countries are facing a high burden of CVD whilst awareness of disease and associated risk factors is limited [7,8]. Those living in poverty and especially those in low-income countries are significantly more impacted by CVD [8].

Moreover, findings show that the prevalence of CVD is increasing and posing a public health challenge in developing countries [9,6]. High blood pressure is of major influence in the increasing CVD burden in these countries [6]. For most patients with hypertension, it is uncontrolled which causes further cardiovascular (CV) complications [10]. Hypertension affects more than 1.3 billion people worldwide and one third of adults have the condition [5,11]. The number of adults with hypertension in 2025 is predicted to increase by about 60% [12]. Moreover, the total number of individuals with hypertension is increasing rapidly to epidemic levels with a projected 125.5 million individuals affected by 2025 in Sub-Saharan Africa [13].

From an epidemiologic view on disease prevalence, Ethiopia is in epidemiologic transition from predominantly infectious diseases to chronic diseases. CVD is a major public health challenge in Ethiopia. The overall prevalence of hypertension among the Ethiopian population is 19.6%, and is higher among the urban population (23.7%) [14]. In 2015, ischemic heart disease was the first leading causes of age standardized death rates and fourth leading causes of age standardized disability adjusted life years with rates of 141.9 and 2535.7 per 100,000 population respectively [15]. The increasing prevalence of CVD in developing countries is related to unhealthy lifestyle behaviors. Except few region-based studies, evidence on CV risk behaviors is scarce in Ethiopia. Findings from the Southern part of the country show that 10.8% of CV patients smoke cigarettes, 12.1% drink alcohol and 73.9% don't do any physical activity [16]. A study performed in the capital of Ethiopia reported 68.6% of hypertensive patients don't exercise, 14.1% smoke cigarette, 25.2% drink alcohol and 30.9% don't adhere to healthy diet [17,18].

Cardiovascular disease (CVD) is the leading cause of mortality globally. The Global Burden of Disease study estimated that about 32 % of all deaths worldwide in 2013 were caused by CVD [19,20], with about 80 % of these deaths occurring in low-and middle-income countries (LMIC) [19,3]. Approximately 9 % of all deaths in

Ethiopia in 2016 were caused by CVD according to World Health Organization (WHO) estimates [21,22]. Small-scale local studies also reported an increasing burden from CVD and its risk factors, especially in urban settings in Ethiopia [23,24]. In a systematic review of studies conducted in Ethiopia between 1960 and 2015, CVD was reported to be among: (a) the prevalent causes of morbidity (range 4–24 %); (b) the main causes of hospital admission, especially among those older than 60 years (range 3–31 %); (c) the leading causes of medical intensive care unit admission (range 8.9–9.8 %); and (d) among the major causes of mortality (range 6.5–24 %) [24]. In Ethiopia's capital, Addis Ababa, an estimated 25 % of all household deaths between 2012 and 2016 and 11 % of all hospital deaths between 2014 and 2017 were attributed to CVD [25]. Myocardial infarction, stroke and hypertensive heart disease accounted for about 75 % of CVD deaths [13,26,27,28]. Modifiable risk factors like smoking, high cholesterol and high blood pressure explain the major share of the CVD burden [17,23,29]. The prevalence of hypertension in Ethiopia is estimated to range from 16 to 30 % [30,31,32].

Cardiovascular conditions, which include coronary heart disease, cerebrovascular disease, peripheral vascular disease, heart failure, rheumatic heart disease (RHD), congenital heart disease and cardiomyopathies, are becoming the leading cause of death in the world [33]. According to the 2017 World Health Organization global estimate, each year 17.9 million people die from cardiovascular diseases (CVDs) and >75% of these deaths occur in low and middle-income countries (LMICs) [34]. In low-income countries, CVD mortality and morbidity have become the leading cause of disease burden, overtaking the burden due to infectious diseases such as human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS), tuberculosis (TB), respiratory infections, diarrhoea and malaria [35,36]. Despite this change in the disease landscape, communicable diseases still have the biggest portion of health budgets in most sub-Saharan countries [3].

Ethiopia is one of the countries in the sub-Saharan Africa region making remarkable progress in tackling priority communicable diseases and maternal, newborn, and child health threats. The country has achieved most of the Millennium Development Goals (MDGs), including reducing the mortality of children < 5 years of age by two-thirds, lowering maternal

mortality by three-quarters and significantly lowering HIV and TB incidence and mortality [37,38,39]. In contrast, little effort has been made to address the challenges of CVDs as a disease priority for public health [40].

Ethiopia has been one of the fastest-growing economies in East Africa for the past 20 years [41]. Currently the country is undergoing an epidemiologic transition mainly driven by demographic and lifestyle changes. Rapid urbanization has attracted a large population from rural areas to cities [42]. Urban life naturally promotes a sedentary lifestyle and increases the chance of CVDs. Considering these facts, the burden of CVDs in Ethiopia might be even higher than anticipated.

Ethiopia ten years report of CVD increased by half from the previous that indicated highly alarming of CVD [37]. Other study done in Addis Ababa showed that 51% deaths were due to non-communicable diseases [23,43]. In the same study, amongst the non-communicable diseases, cardiovascular disease was the leading cause of death (24%). Study conducted in Ayder comprehensive specialized hospital shows that the leading cause of intensive care unit admissions was patients with cardiovascular diseases (26%). Other study in the same area revealed that the prevalence of stroke among hypertensive patient who were on treatment of anti-hypertensive was about 38%. About 66.2% of patients were hypertensive at hospital arrival [44].

Investigating the risk factors of cardiovascular disease among patients is very important for prevention and control of CVD. Ethiopia was signed to achieve sustainable development goal (SDG) from 2016 to 2030 and to reduce by one third premature death from non-communicable diseases [17]. In addition to SDG, the five-year transformation plan of Ethiopia shows that there is focus on comprehensive prevention and control of NCD including CVD and other risk factors. The plan also indicates that about three-quarters (73%) of all health facilities provide services for cardiovascular diseases including hypertension [45,46]. Therefore, knowing the magnitude of cardiovascular disease risk factors can help to control premature death from CVD. In addition, this research helps to prepare prediction model and used as a baseline for future researchers and other concerned bodies. Different studies shows that the high burden of CVD and stroke in the Ethiopian population is

attributable to preventable vascular risk factors, particularly hypertension, obesity, dyslipidemia and active tobacco use [45,47,48]. Data from the 2012 Ethiopian Family Life Survey (EFLS4), found that less than one-third of Ethiopians with moderate to high cardiovascular risk were not receiving appropriate treatment [49]. Individuals with higher per capita expenditure have a higher probability to meet their cardiovascular care needs. Marked geographical disparities were revealed, with rural residents being much less likely to receive CVD care. The absence of a universal healthcare insurance scheme is one possible explanation for the demonstrated inequality in cardiovascular care.

Cardiovascular disease (CVD) is one of a major non-communicable disease that affecting the population in Ethiopia. It is the main causes for the deaths of people in Ethiopia [19] and the risk factors were not well addressed. There is limited research regarding the status of CV risk factors in Ethiopia, particularly in western Part. The majority of adults in Ethiopia fail to name even one CV risk factor [49]. Nevertheless, in Ethiopia, most adults are aware that cigarette smoking and excessive alcohol consumption are risk factors for CVD [50]. The level of education and place of residence has a significant influence on health literacy. It has been reported that higher education levels correlate with a better knowledge of CVD, a smaller number of risk factors and changes in health-related behavior [49,50,51].

The overall of different study showed that there is increment of CVD from year to year and that initiate me to do this research. In addition, there is a little research done Ethiopia related to magnitude of CVD risk factors specifically among patients. So, the purpose of this study was to analysis the cardiovascular diseases and its associated risk factors among patients attending at Gimbi Comprehensive and Nekemte Specialized Hospitals, West Wollega, Ethiopia.

2. METHODOLOGIES

2.1 Study Area, Study Period and Sampling

A cross-sectional survey was conducted in two main referral hospitals in West- Ethiopia, Nekemte Specialized Hospital and Gimbi Comprehensive Hospital. This study was conducted in chronic follow up units of the two hospitals. The chronic follow up unit provides

regular outpatient care for patients with chronic conditions such as hypertension, heart failure, myocardial infarction and diabetes mellitus. The clinic specifically focusses on providing follow up services which include treatment of CVD and counselling of patients to achieve healthy lifestyle behaviors. During the study period (June 2018 to September 2019), a total of 950 patients with CVD attended the follow up care in the two participating hospitals.

The sample size was determined using single population proportion formula with the following assumptions: 95% confidence level, 1.96 ($Z_{\alpha/2}$), 50% proportion, 5% degree of precision (d), and N (950) total CVD patients attending chronic follow up units of the two hospitals. Based on this assumption and using finite correction, the sample size was 455, and predicting a 10% nonresponse rate, the final sample size was 495. The total 485 calculated sample was allocated for the two hospitals proportional to their total number of patients attending each chronic follow up unit. A convenience sampling was used to select study participants.

Participants were given overview of the study by nurse or physician who were working in follow up unit, then, they were referred to poster information which was posted outside the follow up unit. The poster information contained title of the study, researchers name, eligibility criteria and contact address (mobile phone and email) of data collector. Voluntary participants contacted data collector through phone address or the data collector approached the patients and provided additional information using participant information sheet upon their exit from follow up unit. Recruitment of the patients took place from June 2018 to September 2019.

2.2 Data Collection and Tools

Data were collected using three validated tools, the World Health Organization (WHO) STEPs instrument, face to interviews, documented data from patients' card, physical activity questionnaire and the Heart Disease Fact Questions. The WHO STEPs instrument follows a stepwise approach to chronic disease risk factor surveillance in individuals aged 18–64 years. Ethiopian Public Health Institute adapted the WHO STEPs instrument to Ethiopian context by including khat chewing and the use of local alcohol and cigarette products in the risk behaviors assessment. Locally adapted version of WHO STEPs instrument was translated and

used to assess sociodemographic variables and CV risk behaviors including cigarette smoking, alcohol consumption, khat chewing and fruit and vegetable consumption. The international physical activity questionnaire was used to assess physical activity.

2.3 Study Variables

The response variable in this study was the time period (in months) of cardiovascular patients until they experience death or censored from June 2018 to September 2019. Censoring is defined as when the exact surviving time of patients under investigation is unknown due to some reasons like end of the study time, lost to follow up or die by other cause not related to cardiovascular disease. The covariates are the independent variables that can affect the survival time of patients. These variables include Age, Sex, Residence, Tobacco use, Alcohol use, Obesity (BMI) in kg/m², Physical Activity, Khat Use, Diabetes Status, Family History of HTN, circumference, using fruit, educational level and other independent variables with their codes were stated in the analysis part.

2.4 Methods of Data Analysis

2.4.1 Survival and hazard functions

Survival time can be estimated as a variable which calculates the time between the starting point and ending point of event of interest or time of interest. In medical field, it is termed as the period elapsing between the completion or institution of any procedure and death. The survival time and event data are collected on practical grounds which is either censored or truncated.

The survival function can be expressed with help of another distribution used commonly in statistical techniques; namely cumulative probability function CDF denoted as F(t). The survivor function [26] is defined as the complement of the CDF which is formulated in the relationship below

$$S(t) = (T > t) = 1 - (t) \quad (1)$$

Similarly Hazard function [15] is an alternative representation of the distribution of T or the instantaneous occurrence of the event and is defined as.

$$(t) = \lim_{dt \rightarrow 0} \frac{Pr(t < T \leq t + dt | T > t)}{dt} \quad (2)$$

The above expression is termed as the instantaneous rate of occurrence for the conditional probability that the event will occur in the time interval between t and $(t+dt)$ as it has not occurred before [33]. By the prior computation of the conditional probability in the numerator and application of limits gives the hazard function as

$$(t) = \frac{f(t)}{s(t)} \quad (3)$$

In other words, the hazard function [11] can be stated as the rate of the occurrence of the event at time t equals to the probability density at time t divided over the probability of the surviving to that duration without experiencing the event. The above formula can be expressed using the relation between density and survival function as follows

$$(t) = \frac{-d}{dt} \log S(t) \quad (4)$$

The above expression of hazard function is integrated using limits 0 to t and applying the boundary condition $S(0) = 1$ (which implies event not occurred at time 0) to obtain relation between hazard and survival function.

2.4.2 Kaplan-Meier estimator

The Kaplan-Meier estimator originally was derived as an NP maximum likelihood estimator of F(t). Because of the latter method of derivation, it is also called as the product-limit (PL) estimator [52]. If the data was not censored then the empirical survival function is given by:

$$S(t) = \frac{1}{n} \sum_{i=1}^n I\{t_i > t\} \quad (5)$$

Where I is termed as the indicator function which takes a value of one if the condition $t_i > t$ is true or zero otherwise [44]. The estimator is simply the proportion alive at t . For the censored data, assume the ordered times of death as $t_1 < t_2 < t_3 < \dots < t_m$ and d_k be the death occurred at t_k . Let n_k be the number of persons alive just before t_k . This is the number exposed to risk at that time. The Kaplan-Meier (KM) or product limit estimate of the survivor function is

$$\hat{S}(t) = \prod_{i: t(i) < t} (1 - \frac{d_i}{n_i}) \quad (6)$$

The justification of the estimate is explained as follows. In order to survive until the time t one must first survive until the time t_1 . And the conditional probability of surviving from t_2 to t_1

given already survived t_i is to be satisfied. The Kaplan-Meier (KM) is a step function with jumps at the observed times.

2.4.3 Logistic regression

Logistic regression is mostly used to predict a categorical (usually dichotomous) variable from a given set of independent variables. If all the independent variables are continuous, we usually employ discriminant analysis for modeling the data. In case if all or few independent variables are categorical, logistic regression analysis is the best choice.

In this study, for identifying the cardiovascular diseases of patients. 1 = if censored and 0 = if death. In logistic regression analysis, it is assumed that the explanatory variables affect the response through a suitable transformation of the probability of the success. This transformation is a suitable link function of P , and is called the logit-link, which is defined as:

$$\text{logit}(P) = \ln\left(\frac{P}{1-P}\right) = \beta_0 + \beta X \quad (7)$$

Where $\beta_0, \beta_1, \beta_2, \dots, \beta_p$ are the model parameters and X will the predictor/independent chosen variables. The transformed variable, denoted by $\text{logit}(P)$ is the log-odds and is related to the explanatory variables.

Other methods like Cox Regression model are used for data analysis in this study. The model has no particular form of probability distribution assumed for the survival times, and henceforth, it referred to as a semi-parametric model. A Cox regression model is a statistical technique for exploring the relationship between the survival time of a patient and several explanatory variables. A Cox model provides an estimate of the treatment effect on survival after adjustment for other explanatory variables. In addition, it allows us to estimate the hazard (or risk) of death for an individual, given their prognostic variables.

3. RESULTS AND DISCUSSIONS

3.1 Descriptive Analysis

This part of the paper discusses the major findings of the study. It begins with analysis of the descriptive result on the cardiovascular patients of study area followed by discussion of results obtained from estimation methods used under each objective of the study. The descriptive statistics about categorical covariates

that registered to be a risk factors in cardiovascular patients are given Table 1 below. In this table the total number of censored subjects and those subjects experienced death is computed with their respective percentages. The total number of patients included in this study was 950. The covariate variables were coded for detail analysis. Accordingly, the age of patients was categorized in to four groups and the percentages were stated in table 1. In the case of gender, 112 (54.2%) of them were females and 96 (44.8%) were males. The death proportion of females is 22.5% which is higher than that of males (17.5%). Out of the entire patients integrated to this study, 81(47.7%) are rural residents and 122(61.3%) are urban residents. The death proportion of rural residents is 16.5% is lower than that of urban residents 23.1%.

By considering the behavioral related variables, the proportion of death of patients do not smoke tobacco is 61.3% and of the smokers is 37.7%, in non-alcoholic beverages users 21.8% of them were died, while among 83(51%) alcohol drinkers 19.8% were died. The death proportion in patients do not do physical exercise is 23.8% which is greater proportion of death in the doer of physical exercise (12.3%) and in those do not chew khat is 21.0% died while in that of chewers death proportion is 16.1%. By considering the body mass index factor in those patients, underweight, normal weight, overweight and obese are 61(26.6%), 56(26.4%), 54(23.9%) and 36(16.9%) respectively. The death proportion of those patients having this body mass index is 6.6%, 14.3%, 25.6% and 42.6% respectively for underweight, normal weight, overweight and obese patients (see Table 1).

3.2 Analysis of Cox Regression Model

Variables like age, blood pressure, Protein urea, CKD, BMI, Sex, alcohol, Smoking, High salt intake, less physical activity and others was found to have relatively strong association with cardiovascular risks among hypertensive patients. From the table of multiple covariates analysis, as the age of patients increased by a year the risk of death in cardiovascular patients is increased as age groups < 34, 35 – 44, 45 – 54 and > 54 by 4%, 6%, 7.1% and 7.2% respectively. This shows that as the age of the patients increases by year, the associated risk factor of cardiovascular also increases by number by fixing other covariates constant. This indicates the survival time of older age is decreased.

A resident of patients is one of the prognostic factors for death in cardiovascular patients. When all other factors held constant, the risk of death of cardiovascular of urban residents are 1.518 higher than that of rural residents. That means, the surviving time of urban residents is reduced by 51.8%. This reduction is as high as 31.3% (HR=1.518, CI = (1.003, 1.313). By keeping other variables fixed, the hazard of death in hypertension patients those tobacco smokers are 3.681 times higher than that of non-smokers (HR=3.681, CI= (1.010, 6.708)). It means that the survival time of smokers is

reduced by 1.68, and this reduction is as low as 1.01 and as high as 5.708. The risk of death of cardiovascular patients in alcohol drinkers is as twice as in nondrinkers, when other effects are remaining the same (HR =1.063, CI = (1.3013, 3.1693)).

Those patients who do physic activity, the risk of cardiovascular is decreased by 71.3% (HR=0.176) when compared with those who do not do exercise, by keeping other factors constant. This reduction is as low as 39.7% and as high as 83.8%. Those patients who do not do

Table 1. Descriptive analysis covariate variables using categorical variables

Variables	Status		Total (%)
	Censored	Deaths	
Age			
<34	72 (74.5%)	14 (21.23%)	73 (72.22%)
35 – 44	72 (54.5%)	15 (19.23%)	78 (81.22%)
45 – 54	69 (52.41%)	29 (23.56%)	79 (82.22%)
>54	67 (50.52%)	31 (27.29%)	79 (85.24%)
Sex			
Female	76(75.5%)	26(22.5%)	112(54.2%)
Male	70(77.5%)	16(17.5%)	96(44.8%)
Residence			
Rural	66(72.5%)	14(16.5%)	81(37.7%)
Urban	113(77.1%)	29(23.1%)	122(61.3%)
Tobacco use			
No	114(71.1%)	26(21.1%)	131(61.3%)
Yes	65(79.3%)	17(21.7%)	72(37.7%)
Alcohol Use			
No	96(89.3%)	25(21.8%)	121(58.1%)
Yes	83(51.2%)	18(19.8%)	91(42.9%)
Physical activity			
No	112(86.2%)	35(23.8%)	148(69.3%)
Yes	58(88.8%)	8(12.3%)	65(31.8%)
Obesity (BMI)			
Underweight	56(93.4%)	4(6.6%)	61(26.6%)
Normal	56(26.4%)	6(14.3%)	56(26.4%)
Overweight	43(65.4%)	14(25.6%)	54(23.9%)
Obese	21(55.3%)	16(42.6%)	36(16.9%)
Chewing chat			
No	143(69.1%)	36(21.1%)	161(65.4%)
Yes	26(63.9%)	5(16.1%)	31(14.6%)
Diabet MEL			
No	139(64.2%)	26(15.6%)	165(66.6%)
Yes	31(65.6%)	16(36.2%)	46(22.2%)
Family Hist HTN			
No	66(64.6%)	31(25.4%)	116(55.6%)
Yes	61(66.2%)	13(13.6%)	94(44.3%)
Waist circumference			
Raised	45(61.4%)	16(22.6%)	56(26.9%)
Normal	46(22.2%)	16(36.2%)	39(65.6%)

physical activity reduces their survival time by 17.6% times that of exercise doers. After adjusting for other covariates, patients who had normal BMI were found to be associated with lower survival time, whose hazard rates is 1.399 times that of underweight patients (HR= 1.399, CI=(0.316, 3.591)) which means the survival time of patients who had normal BMI was decreased by 0.399 times and this decrement could be as low as 0.573 and as high as 3.591. Similarly, the hazard rates of patients who were overweight is 1.791 times that of patients who had been underweight (HR= 1.791, CI = (0.761, 3.110)). Again, the hazard of death in patients whose BMI is categorized under obese level is increased by 1.133 times than that of patients of BMI is underweight, (HR=1.133, CI= (1.330, 3.711)).

3.3 Logistic Regression Analysis

From above analysis, almost all covariate variables had the effect on the censored and death of the patients. To analysis the effects of

covariates variables on the censored of the patients, logistic regression analysis was applied. Table 3, below shows the result of logistic regression on the censored status of the patients.

Cardiovascular disease is highly prevalent and causing higher proportions of morbidity and mortality, impacting both in the rural and urban population of Ethiopia. Their impact varies with different covariate variables. As we see from Table 3, censoring of the patient has a positive significant with the Physical activity, BMI, Educational level and negatively with using tobacco, chewing chat, using alcohol and age (see Table 3).

When no event times are censored, a non-parametric estimator of S(T) is $1 - F_n(t)$, where $F_n(t)$ is the empirical cumulative distribution function. When some observations are censored, we can estimate S(t) using the Kaplan-Meier product-limit estimator. The Kaplan-Meier

Table 2. Cox regression analysis

Variables	$\hat{\beta}$	SE	Z	DF	Sig.	HR	95 CI (HR)
Age							
<33	0.030	0.011	3.63	1	0.000	1.031	(1.018, 1.063)
35 – 33	0.060	0.011	3.69	1	0.000	1.051	(1.011, 1.083)
35 – 53	0.071	0.013	3.71	1	0.001	1.061	(1.013, 1.086)
>53	0.071	0.015	3.83	1	0.000	1.066	(1.013, 1.093)
Sex							
Female							
Male	0.173	0.118	1.15	1	0.111	0.761	(0.396, 1.168)
Residence							
Rural							
Urban	0.313	0.113	1.98	1	0.038	1.518	(1.003, 1.313)
Tobacco use							
No							
Yes	1.303	0.306	3.16	1	0.000	3.681	(1.010, 6.708)
Alcohol use							
No							
Yes	0.713	0.135	3.08	1	0.001	1.063	(1.303, 3.169)
Physical activity							
No							
Yes	-1.186	0.306	-3.103	1	0.000	0.176	(0.151, 0.503)
Obesity (BMI)							
Underweight			9.838	3	0.010		
Normal	0.336	0.606	0.555	1	0.580	1.399	(0.316, 3.591)
Overweight	0.583	0.336	1.337	1	0.181	1.791	(0.761, 3.110)
Obese	0.803	0.161	3.077	1	0.001	1.133	(1.330, 3.711)
Chewing chat							
No							
Yes	-0.116	-0.115	0.516	1	0.607	0.891	(0.573, 1.385)

method is based on individual survival times and assumes that censoring is independent of survival time (that is, the reason an observation is censored is unrelated to the cause of failure). The Kaplan-Meier estimator of survival at time t is shown in Equation 6. Here $t_j, j = 1, 2, \dots, n$ is the total set of failure times recorded (with t^+ the maximum failure time), d_j is the number of failures at time t_j , and n_j is the number of individuals at risk at time t_j . The Kaplan-Meier survival estimates as a function of time was as follows.

From the survival function and hazard function analysis, the survival probability of surviving past time t , is 0.96 (survival value) and the relative likelihood of the event occurring at time t , $f(t)$, conditional on the subject's survival up to that time t , $S(t)$. The hazard rate thus describes the instantaneous rate of failure at time and ignores the accumulation of hazard up to time t is 0.95.

4. DISCUSSION

This study tried to analysis the cardiovascular diseases and associated risk factors among patients. In this study, the socio-demographic and clinical characteristics of 950 patients who had follow-up in Nekemte specialized hospital and Gimbi comprehensive hospital over a given period were analyzed. From the total patients' 950 (69.9%) with 95% CI (54.35-94.35) were had cardiovascular risk factors in the study period. This result was higher than study done in Bahirdar(33%) [44] its difference may be due the difference in study design, study population, follow-up period. On the other hand, study conducted in Kenya also show that the prevalence of CVD was 33.4% [44] which is in line with our study. Our study also higher than with systematic review done in Spain that was (9%) [53,54]. The difference may be socio-demographic characteristics, living standards and qualities of the service provided and follow up period.

Table 3. The logistic regression analysis

Production (Variables)	Coeff.	Odds ratio	Marginal effect	Std. error
Age	- 0.61	0.23	126	0.382
Sex	0.23***	1.26***	0.03**	0.038
Residence	1.32***	0.221	0.122***	0.036
Tobacco use	- 0.161	0.133	0.01	0.382
Alcohol use	- 0.282***	0.62***	0.28***	0.320
Phsical activity	0.62	0.122	0.21	0.68
Income level	0.22	0.022	0.163	0.22
Educational level	0.51	0.223	0.132	0.26
Bmi	0.26***	0.22***	0.212***	0.326
Chewing chat	- 0.22	0.268	0.221	0.268
Circumference	0.33***	16.22***	0.23**	0.630
Marital status	0.162	0.162	0.268	0.222
Number of fruit use/week	0.222	0.23	0.621	0.331
Constant	2.223			
Lr $\chi^2=112.2$				
Prob > $\chi^2 = 0.001$				

Table 4. Kaplan-Meier survival estimates as a function of time

Time	Subject at risk (n _i)	fail (d _j)	Censored	Surv. prob P _i = (1-d _j /n _i)	Cumulative survival S _i = P _i xP _{i-1}
0	596	3	6	0.99	0.99
1	599	5	9	0.96	0.96
3	595	3	4	0.99	0.99
3	569	4	9	0.95	0.95
4	565	3	6	0.96	0.96
5	556	3	5	0.99	0.99
etc	-	-	-	-	-

This study revealed that age is the most important risk factor for the development of cardiovascular diseases. Several studies conducted in Ethiopian, and 13 SSA countries and India showed that there is strong relationship between age and cardiovascular diseases [13,55]. However, this study is inconsistent with the finding from India with the same study design [52]. The difference may be due to the aging of the population which makes people vulnerable to chronic diseases at older age in our study setting and increased vulnerability due to lifestyle changes.

Smoking increases the risk of atherosclerosis, platelet aggregation, and vascular occlusion [56]. Accordingly, in our study, being a smoker is one of the strongest predictors of CVDs. This was in line with a study done in India [7,52] which reported the association of smoking with the component of CVD, which was coronary artery disease compared to a nonsmoker [57]

Regarding physical activity level, patients whose physical activity intensity is low (<600 MET-minute per week) were two times more likely to develop CVD than those who had a high level of physical activity (>3000 MET-minute per week). This finding is consistent with studies conducted by WHO (3011) in the Horn of Africa including Ethiopia, which stated that daily physical activity minimizes the emerging and development of CVDs and its sequence through its effect on body weight, insulin sensitivity, and blood pressure control [44,57].

A study conducted in Kenya explains that males had the highest (49.9%) occurrence of CVD outcomes compared to females (33.3%). The sex of study participants was significantly associated with CVD outcomes. Females were less likely to develop a CVD compared to males. This study is lower than with our study that was about 53.1% and 46.9% males and females were develop cardiovascular complications respectively [44]. The difference may be due the study design and sample size difference.

Based on study conducted in Kenya behavioral factors including cigarette smoking and alcohol consumption significantly associated with CVD which is similar with my study. It may be due to similar living standard and characteristics of the study population. On contrary, systematic review conducted Spain showed that based on binary logistic regression model smoking status, the relative risk of cardiovascular events was two

times higher in hypertension. The same study in Spain showed that based on binary logistic regression model two to three times and one and half times among hypertension with diabetes and high BMI and hyperlipidemia respectively [44]. This study is similar with our study with high BMI and hyperlipidemia and diabetic. The study conducted in Japan; protein urea had a significant association with the risk of cardiovascular disease which is in line with this study this may be due to the nature of the study design.

5. CONCLUSION

The aim of this study was to analysis the cardiovascular diseases and risk factors in the western Ethiopia. The result of the study shows that age of patients, smoking tobacco, drinking alcohol, practicing physical exercise, body mass index, having diabetes mellitus and having a family history of hypertension were among the factors that were highly significant to determine the censored and death patients, but the residence of patients has less significant effect on the censored of patients at study area. The result of the study also shows that, Cardiovascular Disease risk factors are highly prevalent among the hypertensive patients, older age, smoking tobacco, drinking alcohol and in practicing of physical exercise in this study. Finally, the researcher recommends that, to increases the censored of the cardiovascular patients, not drink alcohol, not use tobacco, not chew chat, doing physical exercise and eating fruits were the main recommended activities for this study.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard guideline participant consent and ethical approval has been collected and preserved by the author.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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