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Analysis of Survival Time and Prognostic Factors for Death in Hypertension Patients: A Case Study

[1] R. Ramakrishna, [2] K. Madhusudhan Reddy, [3] M. P. Molimol, [4] M. Ramesh, [5] R. Ashok,
[6] Keebeek Hailu Gemechu, [7] Mamo Worku Belay

ABSTRACT: Hypertension is a major concern for the Ethiopian people since it is a frequent and potentially fatal public health issue. The purpose of this research is to determine the overall survival rate of hypertension patients treated at Nekemte Specialist Hospital by analyzing medical data from 2019–2023. Three models were used to examine the data: the Kaplan-Meier estimate, the Cox proportional hazards model, and the Weibull regression model. Numerous factors, including a patient's age, smoking history, alcohol use, lack of physical activity, obesity, diabetes, and a family history of hypertension, may significantly impact their prognosis. Additionally, the research discovered that the risk of mortality for those with high blood pressure increased during the course of the follow-up period (0 to). When it came to estimating the distribution of deaths and life expectancy in this patient population, the Weibull regression model performed the best.

Keywords:: Hypertension, cox regression, Kaplan–Meier method, Weibull model, log-rank test, risk ratio.

Contents

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1. Introduction

The increased prevalence of noncommunicable diseases (NCDs) has elevated them to the status of a major public health concern on a worldwide scale. In 2022, roughly 71% of the 57 million deaths globally were attributed to noncommunicable illnesses, with diabetes, cancer, heart disease, and long-term lung difficulties continuing to be the leading causes. Because it increases the likelihood of cardiovascular disease and adds significantly to the overall illness burden, hypertension is among the most pressing issues in public health today. The World Health Organization (WHO) states that hypertension is present when the systolic blood pressure is at least 90 mm Hg and the peak blood pressure is 140 mm Hg or above.

The ”silent killer” moniker for hypertension comes from the fact that the condition typically worsens behind the scenes. A large number of individuals go undiagnosed and untreated because of this. The most common cause of mortality globally is cardiovascular disease (CVD), which is strongly related to heart disease. Globally, 17.9 million people—or roughly 31% of the total—died in 2016 due to cardiovascular diseases. Countries with low or medium incomes accounted for more than 75% of these fatalities. There has been a dramatic increase in the prevalence of hypertension over the last few decades, with 5.94 million cases in 1975 and more than 1.13 billion cases in 2015. Especially in areas with limited resources, this demonstrates that the health situation is worsening.

Research shows that the prevalence of diseases associated with hypertension has increased dramatically, rising from 4.5% in 2000 to 7% in 2010 and 22% in 2014. In 2016, hypertension was responsible for almost 900,000 fatalities in Africa, an increase of 82% over 1990 levels. About 9.4 million people die each year from high blood pressure, making it the leading cause of mortality globally in 2013. An important modifiable risk factor for dementia, stroke, and other cardiovascular issues is hypertension. Disease prevalence in Sub-Saharan Africa is estimated to be at 30.8%, with an additional range of 30 to 31%. Among the seven leading causes of mortality in Ethiopia in 2000 and 2001, hypertension accounted for about 1.4% of all fatalities [5, 6, 12, 20, 21].

The percentage of Ethiopians diagnosed with hypertension has increased dramatically over the last three decades, rising from 3.6% in 1983 to 11.8% in 2002 and finally to more than 29.6% in 2006. A major public health concern in the nation is high blood pressure. It mostly affects individuals less than 65 years old, affecting over one-third of Nekemte's adult population. The high prevalence of hypertension among pregnant women in the region highlights the severity of an already serious health concern. Various regions of Ethiopia have been the subject of many research about hypertension. Nevertheless, there is a lack of recent comprehensive research on the prevalence and impact of hypertension in Nekemte. It is more difficult to comprehend the spread of illnesses in a particular region and develop targeted therapies when there is a dearth of fresh research. This research examines the medical records of patients treated for hypertension at Nekemte Specialized Hospital in Oromia Regional State in an effort to address this information gap. The study's objectives are to identify the primary risk factors for hypertension and determine the survival rate [11, 13, 16].

2. Data and Methodology

2.1. Data

Data from patients with high blood pressure who were registered at Nekemte Specialised Hospital between September 2019 and August 2023 served as the basis for this investigation. This study covered all hypertension patients that were tested and then followed up with. Between September 2019 and August 2023, 212 people with hypertension were diagnosed and less closely monitored.

2.2. Variables of the Study

The period (months) that passed between the patients' events (death) was the variable in this study's response. A censor occurs if a patient continues to live through the study's conclusion or withdraws to continue. Patients' survival was examined using the following explanatory variables: age (life expectancy), sex, residence type (urban or rural), smoking habit (yes; no), alcohol use (yes; no), physical activity (yes; no), body mass index classification (underweight; normal; overweight; obese), khat usage (yes; no), diabetic condition (yes; no), and hereditary history of hypertension (yes; no).

2.3. Survival Models

Collette describes a survival model as a statistical method used to look at data gathered over a certain amount of time that ends with a certain event or conclusion. The death rate in people who have been identified with high blood pressure is being looked into in this study.

2.3.1. Kaplan-Meier (KM) Method. The percentage of individuals likely to remain alive for a specified period under comparable conditions can be determined from a series of recorded survival times (including observation intervals) within a single sample.. It determines the probability of surviving past the designated time t *i.e.* $\hat{S}(t) \quad P(T > t)$

The KM scale of survival function, which was proposed by Kaplan and Meier, is explained as $\hat{S}(t)$ given that

$$\hat{S}(t) = \prod_{t_i \leq t} \left(1 - \frac{d_i}{n_i}\right)^{\delta_i} \tag{2.1}$$

assigned a value of 0 for censored cases and 1 for uncensored cases, d_i represents the number of patients which passed away during the time of t_i , n_i represents number of the patients at risk prior to t_i and where $\delta_i$it is an indicator variable [17].

2.3.2. Comparison of the Survival Time.

Log-rank Test: Peto R. and Peto J. proposed the log-rank test as a method for comparing k survival outcomes and establish a suitable risk profile, which is applied when $k \geq 2$ in order to compare where$O_i and E_i$ are the number of fatalities in group I that were seen and the number of deaths that were anticipated.

$$\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{\text{Var}(O_i - E_i)} \approx \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i} \tag{2.2}$$

Wilcoxon test: This test is applied to test the null hypothesis, which asserts that there is no significant difference in the survival patterns among the groups, which is also referred to as the Breslow-Gehan test. Its test results are given by

$$W = \frac{\left[\sum_{j=1}^{k} n_j (d_j - e_{ij})\right]^2}{\sum_{j=1}^{k} n_j^2 \, u_{ij}} \tag{2.3}$$

where $u_{ij}$is the variance of death in a group at that time is taken as the total count of groups, represents, the total count of individuals exposed to risk at that specific time is the total count of individuals who represent the deaths within the group r at that time and which is the estimated death rate from group r at that period calculated as $e_{ij} = \frac{n_{ij} d_j}{n_j}$

2.3.3. Cox Regression Model. To investigate the association between certain risk variables and the duration of a patient's survival, statisticians utilize the cox regression model, which was developed by Cox. Assuming that the study's the count of covariates is the model of Cox proportional hazards model is expressed as

$$\lambda(t \mid X) = \lambda_0(t) \, \exp(\beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p) \tag{2.4}$$

where $\lambda_0(t)$ is the hazard baseline [7].

To determine the risk group, the assessment is carried out by comparing the risk function of the study group with that of the reference group. This comparison produces a metric known as the hazard ratio, which is expressed as

$$HR = \exp(\beta) \tag{2.5}$$

2.3.4. Parametric Models of Regression. Similar to Go and Lee, it is highly satisfying to analyze survival time using various models because it typically follows a skewed distribution. The following are a few examples of parameter survival models:

Exponential Regression Model. The survival time corresponding to the group of covariates in the right-skewed data with an exponential time distribution is defined as follows:

$$T = \exp(\beta' X + \varepsilon) \tag{2.6}$$

where is a word for random error. The natural log for either side of the computation can be used to configure this model as follows:

$$\ln T = \exp(\beta_0 + \beta_1 X + \varepsilon) \tag{2.7}$$

There is a constant or time-varying risk associated with this exponential model, which is a basic parameter model. The exponential regression model is specified as follows for each ith and covariates:

$$\lambda(t; X_i, \beta) = \lambda_0 \exp(\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_p x_{ip}) \tag{2.8}$$

Weibull Regression Model. The probability density function is defined as follows when the survival time t follows a Weibull distribution, defined by two parameters: the scale parameter (μ) and the shape parameter (α).

$$f(t; \mu, \alpha) = \frac{\alpha}{\mu}\left(\frac{t}{\mu}\right)^{\alpha-1} \exp\left[-\left(\frac{t}{\mu}\right)^{\alpha}\right], \qquad \mu > 0,\ \alpha > 0 \tag{2.9}$$

and the hazard function of the distribution becomes

$$h(t; \mu, \alpha) = \frac{\alpha}{\mu}\left(\frac{t}{\mu}\right)^{\alpha-1} \tag{2.10}$$

(10) by model substitution considering$\lambda = \mu^(- \alpha)$ then the hazard baseline function will be $\lambda_0(t) = \lambda\alpha t^(\alpha - 1)$

$$\lambda_0(t) = \lambda\, \alpha\, t^{\alpha-1} \tag{2.11}$$

X variables will now be included in the hazard function, making the Weibull regressive model;

$$h(t \mid X) = \lambda \alpha t^{\alpha-1} \exp(X^\top \beta) \tag{2.12}$$

Log-logistic Regression Model. One way to express the covariate log-logistics instantaneous failure time is as follows:

$$\ln T = \beta_0 + \beta_1 X + \varepsilon \tag{2.13}$$

The model's survival function is

$$S(t; X, \beta, \sigma) = [1 + \exp(z)]^{-1} \tag{2.14}$$

The standardized log-time outcome variable z is as follows:

$$z = \frac{y - \beta_0 - \beta_1 X}{\sigma} \tag{2.15}$$

(15) wherey = ln(t), which is an error that is standard of The likelihood of survival rate for at least t is given by

$$OR = \frac{S(t; X, \beta, \sigma)}{1 - S(t; X, \beta, \sigma)} = \exp(-z) \tag{2.16}$$

Lognormal Regression Model. The lognormal regression model of a random variable, defined by parameters μ and σ^2, has its probability density function represented as

$$f(t;\mu,\sigma) = \frac{1}{\sigma\sqrt{2\pi}}\, t^{-1} \exp\left\{-\frac{1}{2}\left(\frac{\ln t-\mu}{\sigma}\right)^2\right\} \tag{2.17}$$

where This model's survival function is described as follows:

$$S(t) = 1-\Phi\left(\frac{\log(t)-\mu}{\sigma}\right), \qquad \text{where } \Phi(t) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{t} \exp\left(-\frac{u^2}{2}\right) du \tag{2.18}$$

At every covariate value the log-hazard function of can be written as follows:

$$\ln\big[h(t \mid X)\big] = \ln[\lambda_0\{t\exp(-X'\beta)\}] - X'\beta \tag{2.19}$$

Regression Model of Gamma. When possesses the major positive parameters which are and during survival, its gamma density function is defined as follows:

$$f(t;\rho,\lambda) = \frac{\lambda^{\rho}\, t^{\rho-1}\exp(-\lambda t)}{\Gamma(\rho)} \tag{2.20}$$

The related survival function is defined as follows

$$S(t) = 1-\Gamma_{\lambda t}(\rho) \tag{2.21}$$

2.3.5. Model Selection. Finding the model that best matches the data is the goal of model selection. The AIC statistic is information criterion that was introduced by Akaike for comparing various models and is given by

$$\text{AIC} = -2(L-p-s) \tag{2.22}$$

where p and s are represent the model's parameters and the count of covariates, and L denotes the log-likelihood ratio function. Among the models evaluated, the one with the smallest AIC value is considered the most appropriate

3. Results and Discussions

3.1. Results

A total of 212 patients diagnosed with hypertension were included in this study from Nekemte Special Hospital. Of these, 43 patients (20.3%) died, whereas 169 patients (79.7%) survived during the study period. The study population comprised 45.8% males and 54.2% females. The mortality rate among female patients (23.5%) was notably higher than that observed among male patients (16.5%).

3.1.1. Estimation Survival Probability and Comparison of Survival Time. The Kaplan–Meier (KM) estimator was employed to determine the survival probabilities of hypertensive patients. As depicted in the overall survival curve (Figure 1), the probability of survival remains relatively high during the initial month following diagnosis but gradually declines, reaching approximately 0.325 by the 34th month. Results from both the Wilcoxon and Log-rank tests revealed no statistically significant differences in survival outcomes when patients were compared by sex or place of residence (Table 2). In contrast, analysis based on tobacco use showed a notable variation: non-smokers exhibited substantially higher survival probabilities than individuals who smoked, as confirmed by both the KM curve and the Log-rank test

3.1.2. Analysis of Cox Regression Model. After controlling for other variables, the analysis of multiple predictors revealed that those with hypertension had a 4.1% increased risk of mortality for every additional year of age (Table 3). The results of this research indicate that the probability of survival declines with the passage of time. Moreover, the findings highlight the significant impact of a patient's residence on their prognosis. There was a 1.528-fold increase in the risk of death from hypertension among city dwellers

riables		Status		Total (%)
		Censored (%)	Deaths (%)	
Sex	Female	88(76.5%)	27(23.5%)	115(54.2%)
	Male	81(83.5%)	16(16.5%)	97(45.8%)
Residence	Rural	66(82.5%)	14(17.5%)	80(37.7%)
	Urban	103(78.0%)	29(22.0%)	132(62.3%)
Tobacco	No	104(80.0%)	26(20.0%)	130(61.3%)
	Yes	65(79.3%)	17(20.7%)	82(38.7%)
Alcohol	No	96(79.3%)	25(20.7%)	121(57.1%)
	Yes	73(80.2%)	18(19.8%)	91(42.9%)
Physical Activity	No	112(76.2%)	35(23.8%)	147(69.3%)
	Yes	57(87.7%)	8(12.3%)	65(30.7%)
Obesity	Underweight	57(93.4%)	4(6.6%)	61(28.8%)
	Normal	48(85.7%)	8(14.3%)	56(26.4%)
	Overweight	43(75.4%)	14(24.6%)	57(26.9%)
	Obese	21(55.3%)	17(44.7%)	38(17.9%)
Khat	No	143(79.0%)	38(21.0%)	181(85.4%)
	Yes	26(83.9%)	5(16.1%)	31(14.6%)
Diabetes Mellitus	No	139(84.2%)	26(15.8%)	165(77.8%)
	Yes	30(65.8%)	17(36.2%)	47(22.2%)
Family History of HTN	No	88(74.6%)	30(25.4%)	118(55.7%)
	Yes	81(86.2%)	13(13.8%)	94(44.3%)

Table 1: Overview of the impact of socioeconomic factors on hypertensive deaths

compared to rural residents after controlling for all other variables. People who reside in urban areas have a life expectancy that is 52.8% lower, as shown in this research.

Smokers have a 3.681-fold increased risk of dying from high blood pressure compared to non-smokers when certain factors are controlled. This indicates a 2.68 reduction in smokers' survival time. While exercise lowers the risk of the disease by 72.4%, Individuals who consume alcohol face twice the risk of death from hypertension compared to non-drinkers with no other consequences. Patients with a BMI of 2.233 times higher than those who were underweight were demonstrated to have a lower survival time after correcting for other factors. Alternatively, when the influence of other factors is considered, hypertensive patients with diabetes face a 2.81-fold higher risk of death, whereas individuals with a hereditary history of hypertension have a 2.282-fold greater likelihood of death.

3.1.3. Parametric Regression Models Analysis. The survival duration of high blood pressure patients is examined using several parametric regression models. However, the model of Weibull regression is chosen as one of the most effective methodology for appropriately balancing data using AIC out of all of these models.

3.1.4. Analysis of Weibull Regression Model. Estimates were made for each covariate, and variables were considered significant if their values were less than 0.05. The Weibull model was applied to evaluate the survival time of hypertensive patients by considering the influence of significant variables. Findings from both Cox and Weibull regression analyses identified age, place of residence, alcohol consumption, smoking habits, The Weibull model was applied to evaluate the survival time of hypertensive patients by considering the influence of significant variables as the principal factors influencing survival. Results revealed that the likelihood of death from hypertension rises by 4.10% with each passing year of age, translating to a 41.0% increase over a decade. In addition, the mortality rate among urban patients was found to be 64.48% higher than that of rural patients, even after accounting for residential differences where adjustments did not alter the outcome.

According to covariate BMI, patients with an obese BMI have a higher risk level than those with a fat BMI or a normal weight. Furthermore, the risk of death among patients with hypertension was

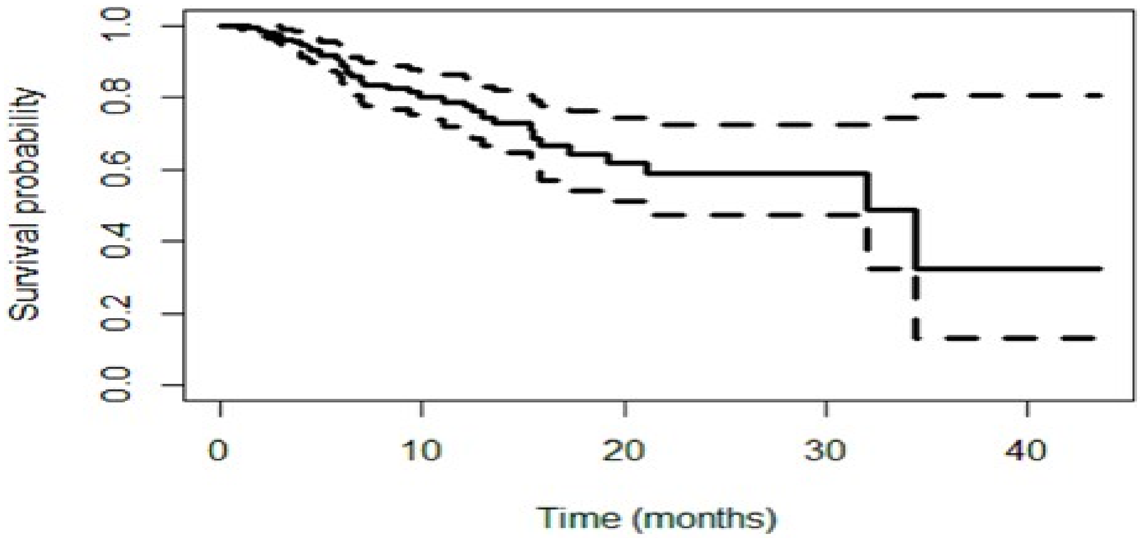

Figure 1: Estimated survival probability curve for patients

Variables		Mean S(t)	Log-rank			Wilcoxon		
			Chisq	DF	Sig.	Chisq	DF	Sig.
Sex	Female	16.7	0.022	1	0.883	0.335	1	0.563
	Male	17.4						
Residence	Rural	18.3	0.062	1	0.803	0.702	1	0.402
	Urban	16.2						
Tobacco	No	20.5	12.8	1	0.000	8.6	1	0.003
	Yes	11.6						
Alcohol	No	23.6	25.3	1	0.000	21.0	1	0.000
	Yes	11.9						
Physical Activity	No	9.4	71.5	1	0.000	55.9	1	0.000
	Yes	29.7						
Obesity	Underweight	37.4						
	Normal	29.7	41.3	3	0.000	22.8	3	0.000
	Overweight	13.6						
	Obese	10.5						
Khat	No	21.8	18.4	1	0.000	16.3	1	0.000
	Yes	11.4						
Diabetes Mellitus	No	31.5	26.6	1	0.000	19.8	1	0.000
	Yes	13.2						
Family History of HTN	No	26.8	37.6	1	0.000	23.9	1	0.000
	Yes	10.7						

Table 2: Findings from the Wilcoxon and Log-rank Tests for Categorical Variable Equality

found to be 2.449 times greater compared to individuals without these specific contributing factors when adjustments were made more stable [1].

Variables	Category	$\hat{\beta}$	SE	Z	DF	Sig.	HR (95% CI)
Age	–	0.040	0.011	3.640	1	0.000	1.041 (1.018, 1.064)
Sex	Female (R)	–	–	–	–	–	–
	Male	-0.273	0.218	-1.25	1	0.212	0.761 (0.496, 1.168)
Residence	Rural (R)	–	–	–	–	–	–
	Urban	0.424	0.214	1.98	1	0.048	1.528 (1.004, 2.324)
Tobacco	No (R)	–	–	–	–	–	–
	Yes	1.303	0.306	4.26	1	0.000	3.681 (2.02, 6.708)
Alcohol	No (R)	–	–	–	–	–	–
	Yes	0.724	0.235	3.08	1	0.002	2.063 (1.301, 3.269)
Physical Activity	No (R)	–	–	–	–	–	–
	Yes	-1.286	0.306	-4.20	1	0.000	0.276 (0.165, 0.503)
Obesity	Underwgt (R)	–	–	–	–	–	–
	Normal	0.336	0.606	0.555	1	0.580	1.399 (0.426, 4.592)
	Over wgt	0.583	0.436	1.337	1	0.182	1.791 (0.762, 4.210)
	Obese	0.803	0.261	3.077	1	0.002	2.233 (1.337, 3.722)
Khat	No (R)	–	–	–	–	–	–
	Yes	-0.116	0.225	-0.52	1	0.607	0.891 (0.573, 1.385)
Diabetes Mellitus	No (R)	–	–	–	–	–	–
	Yes	1.033	0.351	2.943	1	0.003	2.810 (1.418, 5.567)
Family History HTN	No (R)	–	–	–	–	–	–
	Yes	0.825	0.253	3.261	1	0.001	2.282 (1.390, 3.745)

Table 3: Results from the Cox Regression Analysis

Table 3's test study of log-likelihood demonstrates that the model outperforms the null model by a significant margin (p-value = 0.000).

The Weibull distribution of hypertension patients' life times, as determined by the equation regression model and the parameters acquired, can be written as with parameters

$\mu = e^{v} = e^{5.24} = 188.7$ and $\alpha = \frac{1}{\sigma} = \frac{1}{0.647} = 1.5456$

$\therefore\ t \sim W(188.7,\ 1.5456)$

As a result, the curve value is 1.5556 and the rate of survival for patients under the Weibull distribution show a survival scale of 188.7. The final Weibull model's parameters can be changed by substituting that $\lambda = \mu^{-\alpha} = 0.0003$

Consequently, the hazard regression model baseline was developed by Weibull was given by $\lambda_0(t) = \lambda\alpha t^{\alpha-1} = 0.0003\, t^{0.5456}$

Model	AIC	Log-likelihood
Weibull	690.1	-331.1
Exponential	715.1	-344.6
Log-logistic	696.2	-334.1
Lognormal	708.5	-340.3
Gamma	768.7	-370.4
Extreme	797.0	-384.5

Table 4: AIC Values for Parametric Regression Models

With comparable data sets, the Weibull hazard model forecasts the survival time for hypertension patients $h(t \mid X, \beta) = 0.0003\, t^{0.5456}\, e^{X^{\top}\beta}$

4. Discussion

The outcomes of this research were obtained through the use of both the Cox proportional hazards model and the Weibull survival model, and these results align with established evidence in the literature. Age emerged as a major determinant of mortality among individuals with hypertension. According to

Variables	**Category**	γ_i	$\hat{\beta}$	SE	Sig.	HR	95% CI (HR)
Age	–	-0.026	0.040	0.011	0.000	1.041	(1.019, 1.064)
Sex	Female (R)	–	–	–	–	–	–
	Male	-0.161	0.249	0.216	0.247	1.282	(0.839, 1.959)
Residence	Rural (R)	–	–	–	–	–	–
	Urban	-0.322	0.498	0.211	0.018	1.645	(1.087, 2.489)
Tobacco	No (R)	–	–	–	–	–	–
	Yes	-0.848	1.311	0.302	0.000	3.709	(2.051, 6.706)
Alcohol	No (R)	–	–	–	–	–	–
	Yes	-0.468	0.724	0.233	0.002	2.062	(1.305, 3.257)
Physical Activity	No (R)	–	–	–	–	–	–
	Yes	0.853	-1.319	0.309	0.000	0.268	(0.146, 0.491)
Obesity	Underwgt (R)	–	–	–	–	–	–
	Normal	-0.140	0.217	0.627	0.730	1.242	(0.363, 4.242)
	Overwgt	-0.015	0.361	0.239	0.141	1.361	(0.892, 2.070)
	Obese	-0.346	0.535	0.169	0.001	1.708	(1.227, 2.378)
Khat	No (R)	–	–	–	–	–	–
	Yes	-0.072	0.111	0.226	0.624	1.117	(0.718, 1.738)
Diabetes Mellitus	No (R)	–	–	–	–	–	–
	Yes	-0.711	1.099	0.354	0.001	3.000	(1.499, 6.005)
Family History HTN	No (R)	–	–	–	–	–	–
	Yes	-0.579	0.896	0.256	0.000	2.449	(1.483, 4.042)

Table 5: Outcomes of the Weibull Regression Model Analysis

the Cox model, the probability of death rises by 41.0% over a ten-year increase in age, while the Weibull model estimates this increase at 26.3%. This finding is consistent with research that categorises age into distinct groups and shows that adults' or older ages' risk of harm rises with age [19].

This contradicted the results of Cameroonian research that indicated gender had a little role in determining patients' subjective well-being. This might be due to several environmental factors. The length of time a person with hypertension has to manage their condition could vary depending on where they live. According to the Cox intermediate hazard model and the Weibull survival model, the greater likelihood of mortality is 52.8% for city dwellers and 37.97% for rural residents. City dwellers' incomes increased by 63.2% when Cox's regression model was used [8, 23]. The outcomes of this research are comparable to the outcomes of that study. Tobacco users also tend to have longer life expectancies. In both the Cox and Weibull regression models, the primary risk of smoking is 2.3347 times greater for smokers compared to nonsmokers [14, 22].

Alcohol use is acknowledged as a significant contributor to hypertension-related deaths, as people who consume alcohol are more prone to developing high blood pressure. In contrast, consistent physical exercise serves as a protective factor, greatly reducing the risk of mortality among individuals with hypertension. Those who engage in consistent exercise demonstrate notably longer survival compared to inactive individuals. The chance of reducing health complications through regular physical activity is approximately 72.4% higher than in those who do not exercise [9,10,18]. A significant inverse relationship was identified between hypertension and regular physical activity, indicating that exercise serves as an effective preventive measure. Body mass index (BMI) was also found to be a critical determinant of survival. The analysis revealed that patients with a body mass index (BMI) above 30 kg/m^2 had a markedly higher risk of death than those with lower BMI values [24]. In addition, the results established that excess weight and obesity are strongly linked to an increased occurrence of hypertension.

The Cox regression analysis indicated that khat chewing was linked to an 11.70% higher risk of death in hypertensive patients; however, this association was not statistically significant. Therefore, the findings do not validate the claim that khat use contributes to increased hypertension-related mortality. In contrast, diabetes mellitus emerged as a major factor influencing survival, as hypertensive patients with diabetes faced a 2.81-fold an elevated risk of death compared to those without the disease [2, 4]. Likewise, a family history of hypertension emerged as an important prognostic factor, with individuals carrying such a background being 2.282 times more likely to die from the condition than those without hereditary predisposition [3, 13, 15].

5. Conclusion

Data from patients with high blood pressure who were hospitalized to Nekemte Specialized Hospital were used to achieve the study's goal. Several model experiments were used in the analysis of this study. The Log-rank and Wilcoxon tests were employed to see whether patients' experiences of survival varied depending on their degree. These tests have a connection to Kaplan-Meier diagrams. According to these findings, individuals with diabetes, a positive family history of high blood pressure, alcohol consumption, tobacco use, khat chewing, and non-physical exercise all have shorter lifespans than patients with a higher BMI. Elderly individuals should have adequate access to antihypertensive medication, as the likelihood of developing high blood pressure increases with age. It is recommended that individuals living in urban areas regularly monitor their blood pressure through routine check-ups at healthcare facilities.

Exercise, alcohol use, and smoking were some of the most significant behavioural factors that predicted how long patients would live. Health officials should make an effort to teach and/or promote quitting smoking, quitting drinking, and engaging in regular exercise in schools, hospitals, and other organizations. Hypertensive patients with diabetes should receive appropriate anti-diabetic treatment, while individuals with abnormal BMI levels should undergo interventions aimed at reducing obesity. Additionally, consideration of family history is essential when diagnosing hypertension. Additionally, the general population should have access to various forms of information regarding preventing high blood pressure.

The Weibull survival model was identified as the most accurate predictor of survival among patients with hypertension. Therefore, it is advised that researchers who wish to do additional research on hypertension prevalence, awareness, and this model should be applied in managing risk factors linked to hypertension as well as other chronic diseases.

6. Conflict of Interest

There are no reported conflicts of interest involving any of the authors of this research.

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[1,2] *Department of Mathematics, Vidya Jyothi Institute of Technology, Hyderabad, 500075, Telangana, India.*

[3] *Department of Mathematics, Geethanjali College of Engineering and Technology, Hyderabad, Telangana 501301, India.*

[4] *Department of Mathematics, Matrusri Engineering College, Hyderabad, 500059, Telangana, India.*

[5] *Department of Mathematics, School of Engineering, Anurag University, Hyderabad, 500088, Telangana, India.*

[6] *Department of Statistics, College of Natural and Computational Science, Dambi Dollo University, Dembi Dolo, Ethiopia.*

[7] *Department of Statistics, College of Natural and Computational Science, Asossa University, Asossa, Ethiopia.*

E-mail address: mmolimol@gmail.com