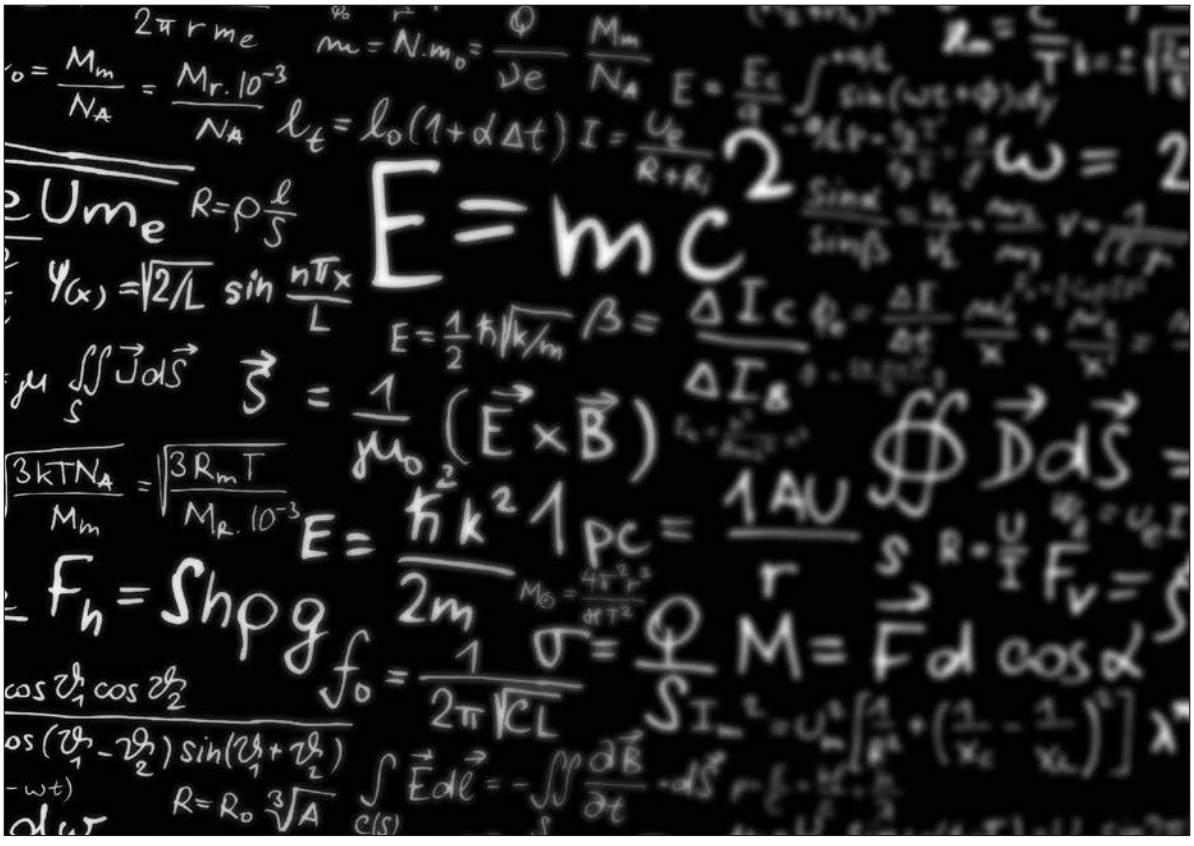

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Research Article
Survival Modelling of Haemodialysis Patients on Covariates of Clinical and Demographic Factors

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Abstract

Background and Objective: Most of the patients of CKD in Tanzania due to lack of knowledge and fear of the treatment cost keep away from modern medicine and are trapped to death even in younger years. The aim of this study was to develop survival models for hemodialysis patients by determining cofactors influencing the mortality of dialysis patients. **Materials and Methods:** A sample of 171 dialysis patients admitted to Muhimbili Hospital in 2015 and followed up to 2018 were studied. Basic prevalence was determined and the survival model on parametric semi-parametric and non-parametric methods was found. The Cox CPH and Kaplan-Meier model are used in analysis to identify the significant survival curves on smoking, alcohol habit and HIV status. **Results:** Out of 171 patients, 148 survived between 0-500 days, 20 survived between 501-1000 days and only 3 patients survived in 1000+ days. Factors affecting survival are sex, increased number of dialysis, blood transfusion and alcohol consumption. Log-normal distribution was the best parametric fit for the data and the average survival time was 268 days, while the CPH model exhibits alcohol habit and the number of dialysis as significant covariates. The KM curve and rate of mortality curve depict the significant difference under smoking, alcohol consumption and HIV-infected patients and log rank tests validated it. **Conclusion:** The CKD and dialysis treatment are more common in males in Tanzania and few survive after three years of treatment and follow-up. Increased number of dialysis, lack of hygienic blood transfusion and alcohol intake are leading many CKD dialysis patients to death.

Key words: Detection of covariates, survival modeling, mortality factors, binary logistic regression, food habits, parametric survival models

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Competing Interest: The author has declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Kidney diseases (Nephrosis) started to be counted as a problem at the beginning of 1920s[1]. In 1950, a committee to emphasis nephrosis research was developed as it was reckoned as a threat to human life. To put more focus on the disease, the National Nephrosis Foundation (NNF) was born in USA[2]. The NNF became the National Kidney Foundation later in 1964. In 1960s, medical scientists introduced dialysis as a treatment for kidney diseases and saved thousands of lives. Kidney transplant is a milestone in nephrology as the most effective treatment and brought new hope[3]. The availability of donors, matching the patient's conditions, health condition of the donor and the patient, cost of transplantation and synchronising time etc are still an obstruction on wide use of this treatment[4].

In recent years, the causes, symptoms and treatment of kidney disease or kidney failure (also known as renal diseases) are well known. Some causes of renal failure include diabetes, high blood pressure, genetic diseases (diseases a person born with), food habit including alcohol, smoking, restless and sleepless tire and wear etc. Janmaat *et al.*[5] studied the total score of 33 symptoms and models were fit to address Chronic Kidney Disease (CKD). If a person's kidney starts to fail, the following symptoms can be observed, muscle cramps, nausea and vomiting, not feeling hungry, swelling in the feet and ankles, too much urine (pee) or not enough urine, trouble sleeping, etc. At the time of failure of kidney, the person can show symptoms like abdominal pain, back pain, diarrhoea, fever, vomiting, etc.[6]. If the kidney fails, there is no cure to the patient and it is a great suffering leading to death. But proper detection of symptoms and avoiding the life irregularities with medication and dialysis a patient can prolong his/her life for very long years. Symptom burden for patients not required replacement of kidney is well described by Brown *et al.*[7]. The transplantation is advised to patients of young age so that they can easily retrieve their juvenile life.

The statistics of CKD on global regional and national burden is introduced by the Lancet journal till 2017 in collaboration with GBD chronic kidney disease[8]. In 2018, more than 13 million people suffered from acute kidney disease which can develop to chronic kidney disease. The risk of developing kidney disease is higher to women compared to men in which, kidney disease is reported to cause approximately 600,000 women deaths all over the world in 2018. It is due to lack of awareness, due health care for female, bearing the difficulties of family burden in the third world, as well as sleepless intimidations. 10% men and 12% women were reported to have chronic kidney disease all around the world in 2018[9]. In Africa, West African countries reported to have large number of chronic kidney diseases patients (about 19.8%) followed by middle African countries (about 16.0%). East Africa is at third with 14.4% of prevalence[10].

The response of dialysis processes is directly related with the survivor time of haemodialysis patients. Different studies were conducted explaining renal failure patients (patients with end stage kidney failure) with the span of treatment and survival time[11]. Some studies elicited the covariates and survival probabilities of the patients on this factors[12]. Studies on End Stage Renal Disease (ESRD), it is found that the complications are erupting the regular treatment and dialysis become impractical leading to death of patients. The probability of failure is much more in ESRD giving a caution for early detection and treat the renal disease. The family history of experiencing ESRD is critical and eye opener for regular life. Female patients had greater risk of death as the blood count and health parameters are awry among them[13]. The study of the survival times of dialysis patients and its probability distribution is a phase opening to surgeons, physicians', health and social auditors and policy makers for appropriate actions. In Tanzania, such studies on an analytical basis and preparing a survival model is few so that this will encourage and develop models on patient groups of early detection, undergoing treatments for years, male, females and children as well as rural and urban categories[14].

Objective of this study was to find the covariates among the 12 known influencing factors affecting the mortality of dialysis patients. Also to identify the three types of survival model as to understand average and quantile survival times as well as identifying the important covariates leading to mortality. This study is a pioneer step to educate patients on developing their habits to avoid mortality among the CKD and dialysis patients. Also this study is intended to analyse the demographic characters prominent among the CKD patients leading to dialysis.

MATERIALS AND METHODS

Sample: The source of data was the medical records (secondary data) on haemodialysis patients admitted in 2015 and their follow-up till 2018 at Muhimbili National Hospital (MNH) Dar Es Salaam, Tanzania where many undergo haemodialysis including transplantation and the data on dialysis procedures and their long follow up were subtle. Using WHO manual for sample size determination on medical researches with survival rate 74%, anticipated survival rate 83%, at 5% level of significance and 90% power of the test, a sample of 171 patients were collected. Sample size is determined by Lwanga *et al.*[15] on right tail probability:

$$n = \left[\frac{z_{1-\alpha}\sqrt{P_0(1-P_0)} + z_{1-\beta}\sqrt{P_a(1-P_a)}}{(P_0 - P_a)} \right]^2$$

Information gathered from the files include: Age, sex, place of residence, religion, weight, eight, BMI, blood group, diabetes, BP, HIV/AIDs, temperature in each dialysis session, alcohol consumption status, cigarette smoking status, patient status (dead, alive, lost), blood transfusion, number of dialysis, complications. The following methods were adopted for the inferences.

Logistic regression method: Logistic regression model is used to analyse data with categorical response variable. If p is a probability of an event to occur, (1-p) is the probability that will not occur so that the odds ratio is given by P/1-P. The joint effect of exploratory variables to odds ratio is given by Fisher and Taylor[16]:

$$\text{Odd} = \frac{P}{1\text{-}P} = \text{Exp}\ (\alpha+\beta_1X_1+\beta_2X_2+\cdots+\beta_kX_k)$$

In this study, logistic regression was used to assess the probability of an event to occur (failure) due to multiple risk factors. Some of the significant risk factors were identified as severe old age, lower income and hospitalized in the past year, habitual smoking, diabetes reported for10 years, hypertensive also with clinical findings macro-albuminuria, high cholesterol with low high-density lipoprotein, high C-reactive protein. (Predictor variables).

Cox proportional hazard regression method: Semi parametric cox proportional hazard model (CPHM) is very effective compared to other survival models as it can accommodate covariates directly on the model. If the detection of covariates were accurate the survival is better identified and predicted by this model. It makes no assumptions about the shape of the baseline hazard function. The PH model only assumes that, the hazard of dying of two or more groups is always constant over time. The Cox PH regression model expresses the risk of dying in association to the risk factors (covariates). A model has the following form:

$$h\ (t|X) = h_0\ (t)\ \exp\ (X^T\beta)$$

whereby, $h_0(t)$ is initial line hazard when all values of $X^T = 0$, β is a set of unknown regression coefficients (to be estimated). While, X^T is a p-dimensional vector of covariate. The survival function can be written as:

$$S\ (t|X) = [S\ (t)]\ \exp\ (X^T\beta)$$

where exp ($X^T\beta$) is the proportional hazard function[17]. In this study, Cox proportional hazard model can be used to study the hazard of patient groups to die by adjusting set of covariates.

Stepwise model selection is a procedure was adopted to find the best model starting on constant and it is improved by adding one variable and examine the increase of R square and the process is repeated by adding new variables even removing some variables which is insignificant so as to get a maximum R square for the set of given predictors. Variable are maintained only if the entered variable had a p-value less than the cut-off value set at 5% level of significance.

Kaplan-Meier estimator and log-rank Test: Kaplan-Meier curves were used to compare survivals for class of variables and estimate mean and median survival of haemodialysis patients[18]. Along with Kaplan-Meier curve, log-rank Test was used to test a null hypothesis that survival is equal within the group against alternative hypothesis that survival is not equal.

log-rank's test statistic is:

$$X^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

approximately a Chi-square distribution with 1 degree of freedom. Where, O_i is observed number of observations in ith group (non-censored), E_i is expected number of deaths in group. Null hypothesis is rejected if $X^2_{cal} > X^2_{tab}$ at $\alpha = 0.05$ level of significance.

Parametric survival function: The survival time (censored) of the dialysis patients were fitted on six distributions and the best distribution with minimum Akaike information criteria (AIC) and Bayes information criterion (BIC) is determined. Akaike information criteria and Bayes information criteria are two measures based on log likehood of the probability function and is efficient to predict the veracity of survival function suggested for the data. It is effectively used based on comparison of the values of each model and observing the minimum value ensuring the best fit model.

Lognormal distribution: A variable X is log-normally distributed if Y = ln(X) is normally distributed. A probability density function of log-normal distribution is given by:

$$f(X) = \frac{-\left(\ln(x-\theta)/\mu\right)^2/\left(2\sigma^2\right)}{(x-\sigma)\sigma\sqrt{2\pi}} \quad x > \theta,\ \mu,\ \sigma > 0$$

where by, σ is a shape parameter (and is the standard deviation of a distribution), θ is a location parameter and μ is a scale parameter of a distribution.

Statistical analysis: The basic demographical analysis, smoking and alcohol intake habits were done on percentage occurrences sex-wise. Survival data at a glance give some results from histogram leading to parametric survival function and Kaplan-Meier curves was used to show the difference of survival at different predictors. In logistic regression 5% level of significance is adopted to elicit the insignificant factors.

RESULTS

Descriptive statistics: The study considered 171 haemodialysis patients from Muhimbili Hospital with their dialysis initiated from January, 2015 to December, 2015 and the patients were followed up to December, 2018. Among them, 80 (46.78%) were female and 91 (53.22%) were male. Among female patients 44 (25.73%) were from Dar es Salaam and 36 (21.05%) from other regions and Zanzibar and within male patients 55 (32.16%) were from Dar es Salaam and 36 (21.05%) were from other regions and Zanzibar. 65 (39.63%) females and 76 (46.34%) males needed blood transfusion while only 13 (7.93%) female 10 (6.10%) male not required blood transfusion. In the end of the study, 13 (9.7.60%) female and 16 (9.36%) males were alive. 46 (26.90%) females and 44 (25.73%) males were died. 21 (12.28%) female and 31 (18.13%) males were lost to follow-up.

Alcohol intake and smoking history of patients: Out of 90 males, only 19 (11.38%) had a smoking history. No female confirmed to have a smoking history. Out of 19 males with a smoking history, 13 (14.44%) were confirmed to die at the end of the study and 6 (6.67%) lost to follow-up. Out of 74 females, 32 (19.88%) had alcohol intake history. As 60 (37.27%) out of 87 males had alcohol intake history. At the end of the study, 22 (29.73%) of females with alcohol intake history were confirmed to be died, 1 (1.35%) was alive and 9 (12.12%) lost to follow-up. As 34 (39.08%) of males with alcohol intake history were confirmed to be died, 2 (2.30%) were alive and 24 (27.59%) lost to follow-up.

Survival time of patients: The survival time of dialysis patients was recorded in days. The average survival time was 221 days and medium survival time was 206 days. Minimum and maximum survival time was 28 and 1139 days, respectively. Out of 171 patients, 148 (86.55%) had their survival duration between 0-500 days, 20 (17.00%) survived between 501-1000 days and only 3 (1.75) patients had 1000+ days survival duration. Also survival times (given in days) of dialysis patients was positively skewed as in Fig. 1.

Kaplan-Meier's estimates: Kaplan-Meier along with log-rank's test was used to compare the survival probabilities of patients for binary explanatory variables. Significant variation in survival time was observed for patients with alcohol intake history, cigarette smoking and having HIV/AIDs. The HIV/AIDs positive patients show fast failure compared to patients with

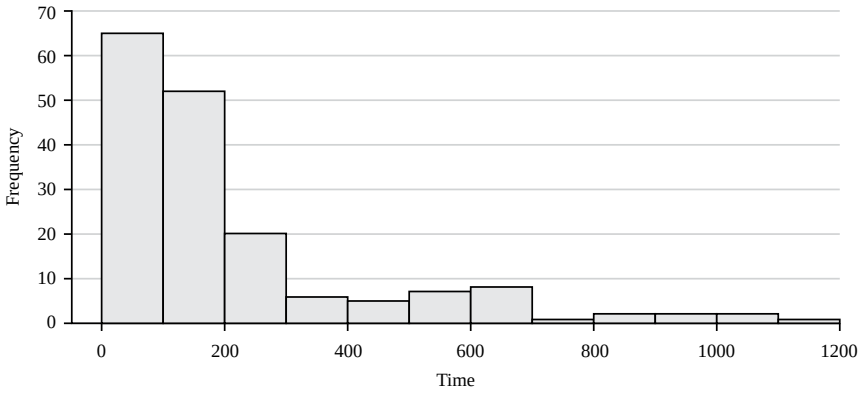

Fig. 1: Histogram of survival of patients over days

X axis: Survival days 1 unit = 100 days, Y axis: Number of patients 1unit = 3 patients

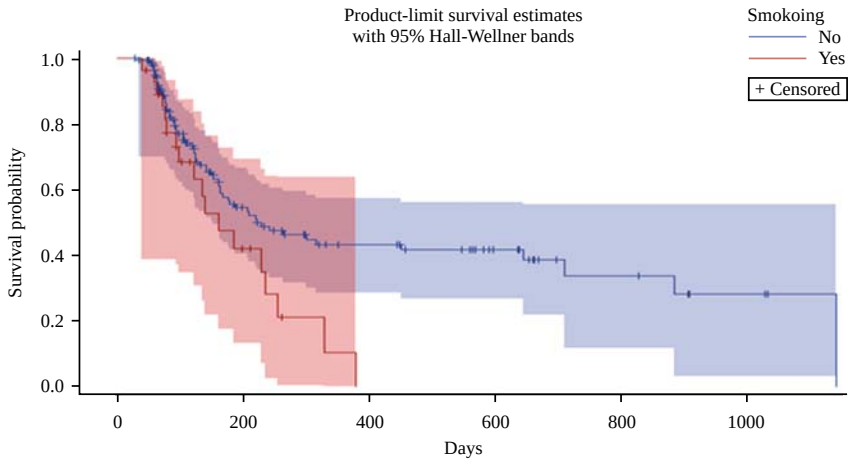

Fig. 2: Survival function on smoking

X axis: Survival time in days 1 unit = 200 days, Y axis: Probability of survival 1 unit = 0.2 probability

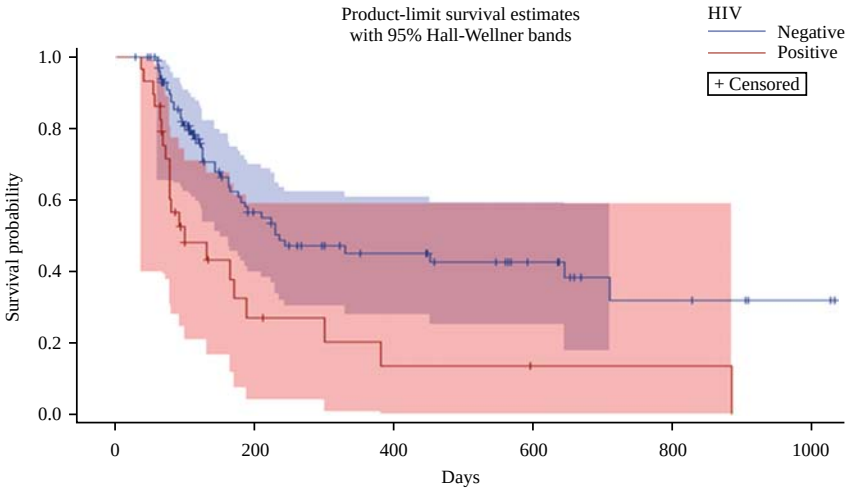

Fig. 3: Survival function on HIV

X axis: Survival time in days 1 unit = 200 days, Y axis: Probability of survival 1 unit = 0.2 probability

negative status. No patient survived beyond 900 days with positive status as shown in Fig. 2. There is a significant survival difference between the positive and negative HIV/AIDS patients established by log-rank test giving p-value 0.0013<0.05. Also patients with cigarette smoking history failed fast compared to non-smoker patients (Fig. 3) (p-value from log-rank's test was 0.0172<0.05).

Significant covariates for failure of patients: Binary logistic regression performed to assess the significant covariates for the failure of haemodialysis patients. The analysis shows that four variables were significant. The number of dialysis that a patient had undergone, sex of a patient, alcohol intake history and blood transfusion status of patients were significant variables. The p-value for number of dialysis of patients, sex of patients, alcohol intake history and blood transfusion status were 0.0465 <0.05%, 0.0345 <0.05, 0.0243>0.05 and 0.0548<0.10, respectively. The odds ratio for the number of dialysis of patients was 0.939 and the parameter was estimated to be -0.063 which implies that, for one increase in the number of dialysis, possibility of failure of a patient reduces by an amount of 0.0465. Male patients hold more failure probability of 0.267 compared to female patients. The odds for the variable alcohol intake history of patients were 0.248 and its parameter was -1.393 indicating that, patients without alcohol intake history reduce the failure possibility by the factor of 0.248. Patients with blood transfusion in their dialysis process, reduced the hazard by a factor of 0.17 compared to patients without blood transfusion.

Table 1: Significant covariates for failure of haemodialysis patients

		Covariates for failure of haemodialysis patients					
Variable		B	SE	Wald	df	Sig	Exp (B)
Sex	Male	-1.319	0.625	4.452	1	0.035	0.267
Number of dialysis		-0.063	0.032	3.807	1	0.047	0.939
Blood transfusion	Yes	-1.774	0.928	3.654	1	0.055	0.17
Alcohol intake	No	-1.393	0.614	5.151	1	0.023	0.248
Constant		7.919	10.64	0.554	1	0.457	2750.14

B: Coefficients of covariates in the model, SE: Standard error, Wald: Wald statistic computed, df: Degrees of freedom, Sig: Probability under null hypothesis, Exp (B): Exponentiated coefficient indicating significance of B

Table 2: Stepwise CPHM model for categorical variables

		Analysis of maximum likelihood estimates (CPHM)					
Parameter		df	Parameter estimation	Standard error	Chi-square	Pr>Chi-square	Hazard
Number of dialysis	A	1	2.39116	0.51074	21.9188	<0.0001	10.926
Alcohol intake	No	1	-0.97486	0.33616	8.4099	0.0037	0.377

df: Degrees of freedom

Table 3: Model fit statistics

Test	Value
Log likelihood	103.386
AIC	169.3
Wald	18.6053
Dev. Residual	81.27
G-value	102.13
Omnibus test	0.009
Hosmer and Lemeshow	0.362
Cox & Snell R Square	24.70%
Nagelkerke R Square	33.00%

AIC: Akaike information Criteria

The fitted logistic model has AIC, -2 log likelihood, Deviance statistic, G-value and Wald statistic of 169.3, 103.386, 81.27, 102.13 and 18.6053, respectively. The Omnibus Test and Hosmer and Lemeshow Test of the model observed was 0.009 and 0.362, respectively. The Cox and Snell R Square and Nagelkerke R Square which gives the amount explained by the model were 24.7 and 33.0%, respectively as shown in Table 1.

Cox proportional hazard model: As semi-parametric model, cox proportional hazard model is free from parametric assumptions that it is not necessary for data to follow any parametric distribution. The only assumption to Cox PH regression model is that, the risk of failure is constant over time. The Cox PH assumption test to each covariate in the model to assess if all covariates will be included in the model. The log of negative log of survival function (ln (-ln(S(t)))) was plotted for binary covariates. For Cox PH model assumption to hold, log of negative log of survival function graph of a binary covariate has to be almost parallel over time. The number of dialysis of patients grouped into two groups and graph of log of negative log of survival function shows that the number of dialysis does not violate the PH assumption since the graph is almost parallel over time. Alcohol intake history holds the assumption in long run as shown in Fig. 4 and 5.

The number of dialysis and alcohol intake history of patients were the only variables selected at stage one and two, respectively. Rest of variables were not eligible to be included and therefore dropped from the model. Number of dialysis had p-value of 0.0001 with hazard ratio 10.926 indicating a strong relationship with failure of patients having standard error 0.51074. Number of dialysis hold a positive coefficient 2.39116 indicating that the hazard is 2.39116 times higher for patient with16+ dialysis compared to 5-15 dialysis patients. Alcohol intake history had p-value of 0.0037 with hazard ratio 0.377 and standard error 0.33616 as shown in Table 2 and 3. As -2LL, AIC, BIC and Wald statistics of a model were 316.476, 320.476, 324.218 and 32.3662, respectively.

The cox proportional hazard model was developed finally with two variables-number of dialysis and alcohol intake history of patients. The model is given by the equation:

$$\log\left\{\frac{h(t)}{h_0(t)}\right\} = 2.39116 \times \text{No. of dial} - 0.97486 \times \text{Alcohol}$$

Parametric models: Survival time of dialysis patients was statistically analysed by fitting suitable probability distribution and lognormal distribution was found as the best among 6 theoretical survival distributions. It shows lower the -2LL, AIC and BIC and Anderson-Darling at 5% significance. Lognormal distribution has -2 log Likelihood, AIC AD and BIC of 2137, 2141, 3.65014 and 2147 as shown in Table 4. The mean survival time estimated was 268 days with median 260 days. A probability plot in Fig. 6 shows a fair fitness of lognormal distribution.

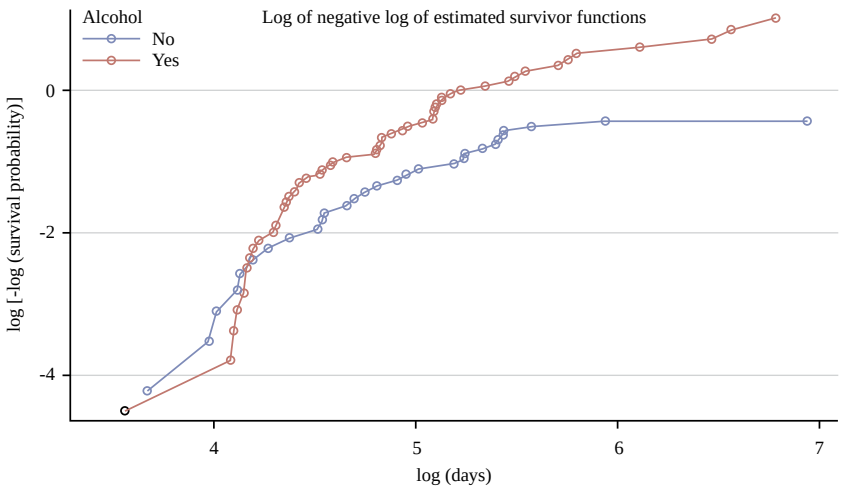

Fig. 4: Rate of risk of mortality on alcohol consumption

X axis: Survival time in logarithmic days 1 unit = log (200) days, Y axis: log [-log (Probability of survival) 1 unit = 2]

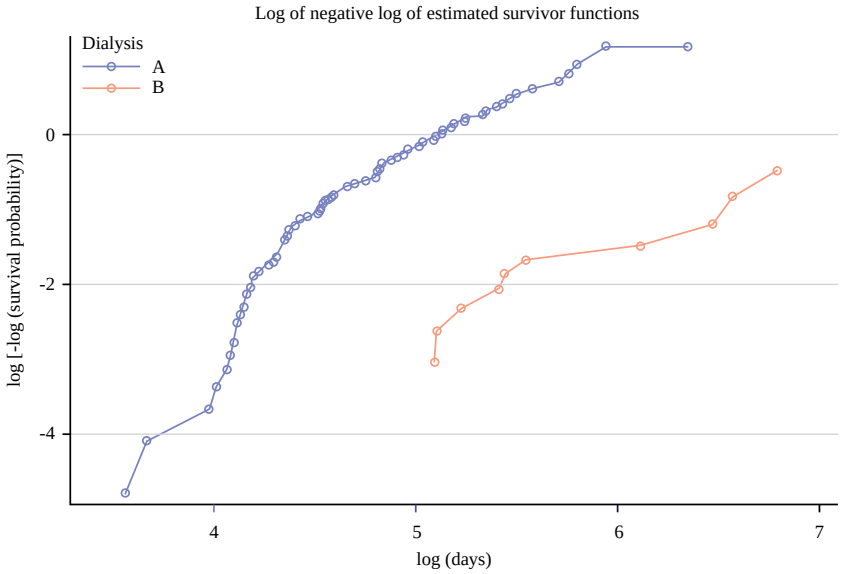

Fig. 5: Rate of mortality on HIV patients

X axis: Survival time in logarithmic days 1unit = log (200) days, Y axis: log [-log (Probability of survival) 1 unit = 2]

Table 4: Parametric distributions for survival times

		Model selection			
Distribution	Converged	-2 log likelihood	BIC	AIC	Anderson-darling
Exponential	Yes	2188	2193	2190	7.22011
Gamma	Yes	2175	2186	2179	7.51969
Lognormal	Yes	2137	2147	2141	3.65014
Pareto	Yes	2188	2198	2192	7.24324
Weibull	Yes	2183	2193	2187	7.22839

Lognormal survival model was fitted considering three significant covariates from logistic regression model. These include number of dialysis, alcohol intake history of a patients which also suggested by CPH model and blood transfusion status of a patient. Blood transfusion was not significant and dropped from the model as shown in Table 5.

Lognormal survival model is given by:

$$\Phi^{-1}[S(t|z)] = 3.974+0.0947\times\text{No. dial}+0.189\times\text{Alcohol}-2.14087\times\log(t)$$

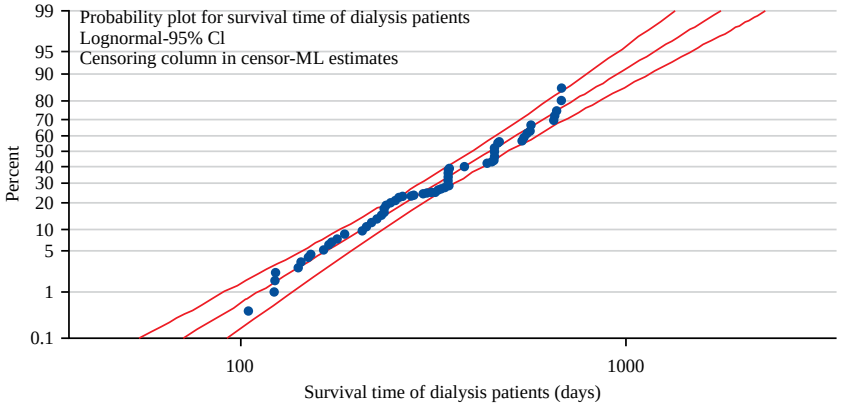

Fig. 6: Probability plot of survival time on log normal distribution

X axis: Survival time in lognormal days 1 unit = lognormal 200 days, Y axis: Percentage patients in geometric scales

Table 5: Lognormal parametric regression model

		Analysis of maximum likelihood parameter estimates						
					95% confidence limits			
Parameter		df	Estimate	Standard error			Chi-square	Pr>Chi-square
Intercept		1	3.974	0.0846	3.8082	4.1399	2205.18	<0.0001
No dialysis		1	0.0947	0.0058	0.0832	0.1061	263.74	<0.0001
Alcohol	No	1	0.189	0.0908	0.0111	0.3669	4.34	<0.0373
Alcohol	Yes	0	0					
Scale		1	0.4671	0.0363	0.4012	0.5439		

DISCUSSION

The distribution on survival time of dialysis patients displays a three parametric lognormal distribution with two covariates: Number of dialysis and use of alcohol. The CPH regression model also displays the logarithmic hazard rate in terms of these covariates. Kaplan-Meier non parametric survival displays the significant difference in the survival graph of alcohol and non-alcohol users, HIV and Non HIV patients. Number of dialysis that a patient had, sex of patient, alcohol intake history and blood transfusion status of patients were significant variables even though in some models all are not contributing. Number of dialysis and alcohol intake history of patients were the only variables selected at stage one and two, respectively. The analysis shows that, the increase in number of dialysis of a patient, the more the survival times (recorded in days). The mean survival time estimated was 268 days and the median 260 days. Number of dialysis is most important variable on survival of days by a patients depicted by both logistic regression model and Cox proportional hazard model while the history of alcohol intake of patients had a high risk of failure compared to patients without alcohol intake history. Blood transfusion variable is presented in logistic regression model as a significant variable and it prolongs the survival time.

Lognormal probability distribution was the best fit for the survival times of haemodialysis patients compared to other distributions with minimum AIC and BIC and Anderson Darling values. Lognormal parametric model considers the two predictor variables suggested by the logistic and Cox PH model with corresponding estimators significant with $p<0.0001$ for the number of dialysis and <0.0212 for alcohol intake.

There are some studies considering the covariates of this study along with other variables. Age, gender, race, body mass index (demographic factor), duration of ESRD (End Stage Renal Disease), residual renal function (absent or present based on a residual urine output of less than 200 mL/day) and dialysis access-(dialysis catheter vs. all other (Arteriovenous Fistula (AVF), grafts or other) (dialysis factor) and calcium (mg dL^{-1}), phosphorus (mg dL^{-1}), serum total cholesterol (mg dL^{-1}) and serum albumin (g dL^{-1}), Comorbidity score (clinical factor) are generally considered in the case of survival of dialysis patients[19]. Most of them consider the age of the patient as a serious comorbidity. Also, gender, Cardiovascular Disease (CVD), diabetes, BP, BMI, Race, malnutrition, etc. Prichard[20] in the study of comorbidities and impacts of ERSD patients most important is hypertension (66.4%) followed by diabetes (33.2%) and lipidemia (11.4%). Increasing age, diabetes, cardiovascular disease and poor

nutrition are significant covariates suggested by Lee *et al.*[21] and co-authors show old age, smoking and proteinuria as the multi morbidity causes in CRD. Survival analysis of patients with ESRD by Uruttia *et al.*[22] fitted a CPH model on age, pulmonary congestion and CVD. Kaplan-Meier models and Weibull distribution is used to depict the survival time. Nephrology 2019 article by Ebrahimi *et al.*[23] fitted AFT lognormal distribution considering WBC, RBC, MCHC and serum albumin. In Tanzania a few studies were conducted on chronic renal disease and risk factors. Renal dysfunction in Mwanza Region had shown old age, female sex, heart failure by history and Framingham criteria are the leading risk factors[24]. Thus comparing with other studies the time of treatment or number of dialysis, sex and alcohol consumption come as covariate in some other studies. But due to lack of proper input of data on specific diseases by the patients for the past years such covariates were not highlighted in this study model. Also, the age of patients and their BMI or malnutrition is an important factor in African countries but it is also not properly detected by the data. This model can be improved considerably by augmenting the clinical co morbidities and economic conditions of the patients.

CONCLUSION

The chronic kidney disease is prevalent about 10% in Tanzania and it is more seen in males. Patients undergoing dialysis should avoid alcohol and cigarette consumption. The number of dialysis will shorten the longitude of patients. HIV patients are more akin to death. Blood transfusion is a big threat and better arrangements should be employed to receive hygienic blood. The lack of follow up is more than in 15% dialysis patients indicating the need of financial support as well as health care centres for their successive revisits. Further study should be done taking more clinical and social covariates so that a better model can be determined and suitable financial and healthy quality of life can be initiated.

SIGNIFICANCE STATEMENT

The awareness and knowledge of affecting chronic kidney disease is seldom studied in Tanzania even though the prevalence is high. This study is an eye-opener to detect the demographic and clinical covariates influencing the survival of hemodialysis patients in Tanzania. As 12 physical and clinical covariates affecting Chronic Kidney Disease (CKD) were tested and the fittest survival models on 4 significant covariates were determined affecting the survival time of dialysis patients. The lognormal distribution is the fittest for survival time and the CPH model signifies the number of dialysis, alcohol habit and problems of blood transfusion were affecting the survival. Kaplan-Meier survival curve is explaining the higher mortality in HIV, alcohol habituated and cigarette smoking cases.

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