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Time to death and its predictors among patients with chronic kidney disease on hemodialysis at dialysis unit in Addis Ababa, Ethiopia: a retrospective cohort study

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Abstract

Background Chronic kidney disease is a progressive disease that affects more than 10% of the world's population and is also the leading cause of death in the twenty-first century. Furthermore, it imposes a significant financial burden on people undergoing hemodialysis. However, there is little research, particularly in the study area, on time to death and its predicators among hemodialysis patients in Ethiopia; therefore, knowing time to death and identifying predicators that affect survival time is crucial in order to improve survival time and enhance the prognosis of hemodialysis patients. The aim of this study was to assess time to death and its predictors among patients with chronic kidney disease on hemodialysis at a dialysis unit in Addis Ababa, Ethiopia, in 2023.

Methods An institution-based retrospective cohort study was carried out among 370 chronic kidney disease patients on hemodialysis from January 1st, 2017 to December 30th, 2022. Data were extracted from April 1st–May 20th, 2023, and each variable was coded and entered into Epi Data version 3.1 and then exported into STATA version 15 software for analysis. Kaplan–Meier and the log-rank test were done. Bivariable Cox-proportional regression was done, and a variable whose *p*-value was < 0.25 and fulfilled the proportional hazard assumption by using graphical and Shenfield residuals was entered into multivariable Cox-proportional regression. Finally, a variable whose *p*-value < 0.05 and adjusted hazard ratio with its CI were declared statistically significant predictors.

Result In this study, the overall median survival time was 47 months (95% CI: 36.7, 56), with an incidence rate of death of 16.8 per 1000 people per month of observation (95% CI: 13.8–20.3). Age 64 and above (Adjusted Hazard Ration: 2.8; 95% CI: 1.67–4.98), catheter vascular access (Adjusted Hazard Ration: 3.47; 95% CI: 2.03–5.93), cardiovascular disease (Adjusted Hazard Ration: 1.88; 95% CI: 1.15–3.07), and blood group B (Adjusted Hazard Ration: 2.07; 95% CI: 1.17–3.69) were significant predictors of time to death among hemodialysis patients.

Conclusion and recommendation The median survival time was 47 months, with an interquartile range of 40. Cardiovascular disease, older adults, central venous catheters, and blood type B were significant predictors of time to death for hemodialysis patients. Therefore, in order to improve the survival of hemodialysis patients, health professionals and concerned bodies should give concern to and work on those predictors.

Keywords Hemodialysis, Chronic kidney disease, Time to death, Cox-regression, Addis Ababa

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Introduction

The term chronic kidney disease refers to reduced kidney function that lasts for at least three months and a glomerular filtration rate (GFR) of less than 60 mL/min per 1.73 m^2, as well as the existence of signs of kidney damage [1].

In chronic kidney disease, there is a problem with the kidney filtering out and performing its activity. Due to this, dialysis can be used, whether in the form of hemodialysis or peritoneal dialysis. Hemodialysis is a type of dialysis modality used for about 90% of patients globally and the mainstay therapy for chronic kidney patients who cannot undergo renal transplantation, whereby blood is put through a filter outside the body, cleaned, and then returned to the body to perform its functions [2].

Approximately 2 million patients worldwide undergo regular renal replacement therapy in the form of dialysis to maintain their lives, with around 80% receiving hemodialysis and 15% receiving peritoneal dialysis [3]. In Ethiopia, the first dialysis was started in 1980 at Tikure Anbessa specialized hospital; later, maintenance dialysis started in a private center in 2001 at St. Gabriel Hospital; and the first transplant occurred in September 2015 at St. Paul's Hospital Millennium Medical College [4].

Currently, there are sustainable development goals (SDGs) that work toward decreasing non communicable disease and also enhancing renal disease prevention and treatment for all age groups [5].Ethiopia is also one of the countries that is striving to achieve sustainable development goals aimed at reducing non communicable-related deaths up to 2030, even if more than one-third (39%) of all annual deaths are caused by NCD [6].

According to the global burden of illness, chronic renal disease is the 12th most common cause of mortality and is responsible for 1.1 million deaths globally [7]. Additionally, it was placed 27th in the list of factors contributing to all deaths globally in 1990 but rose to 18th in 2010 [8]. Besides, it is expected to be the fifth-leading cause of death by 2040 around the globe [9].

Even if dialysis is used as a treatment modality in Ethiopia, access to it is quite limited and unaffordable to low-socioeconomic societies [10].

As far as my concerned, there is only a limited amount of information available about time to death and its predictors of mortality in our country. Additionally, evidence from previous studies indicated that there is an increasing number of hemodialysis patients. That's why studying time to death and predictors of mortality is crucial to increasing the survival time of hemodialysis patients. Furthermore, most studies are confined to a single dialysis unit, but this study tried to include both public and private dialysis units and also attempted to include some predictors. This study aimed to investigate the time to death and its predictors of mortality among hemodialysis patients in selected dialysis centers in Addis Ababa, Ethiopia.

Methods and material

Study area and period

The study was conducted in dialysis unit in Addis Ababa, the capital of Ethiopia. The total population Addis Ababa has 3,273,000 from this 1,722,000 female and 1,551,000 male [11].

There are 35 hemodialysis units found in Ethiopia from those only eleven units are government-run hospitals the rest are privately owned [12]. The study was carried out from April 1st -May 20, 2023.

Study design and population

An institution-based retrospective cohort study design was used. All patients with chronic kidney disease undergoing hemodialysis who attended dialysis units in Addis Ababa were source population and all patients with chronic kidney disease undergoing hemodialysis at randomly selected dialysis units in Addis Ababa during the period from January 1st, 2017 to December 30, 2022 were study population. On the other way study unit were those individual patient with chronic kidney patients undergoing hemodialysis attended dialysis units, who had been sampled and fulfilled the inclusion criteria, those adult patients who had hemodialysis for chronic kidney disease during the specified period and aged 18 and above were included in the study whereas Patients who received hemodialysis for acute renal failure and were transferred from other dialysis facilities or whose time from the start of hemodialysis to the end of hemodialysis was shorter than 30 days and lost medical records were excluded from the study.

Sample size determination and sampling procedures

The minimum required sample size was calculated by using a survival analysis formula. Using STATA^{TM} Version 15 statistical software to calculate the sample size by considering the following assumptions: the level of significance (α) = 5%, Zα /2 (value at 95% confidence interval =1.96), power of 80%, and hazard ratio and probability of death Table 1.

Therefore: The larger sample size was, $n=310$, and after adding a 10% for incomplete records the final sample size will be about $n=341$.

Sampling procedures

From a total of 20 dialysis units, five hospitals that provide dialysis were selected through simple random sampling methods. Within five years, a total of 545 hemodialysis patients with CKD were registered. In Zewditu Memorial Hospital, a total of 45 hemodialysis

Table 1 Sample size calculation for those hemodialysis patients who were on hemodialysis from January 1st, 2017 to December 30th, 2022, at selected hospitals giving dialysis Service, Addis Ababa, Ethiopia ($n=370$), 2023

S.N	Statistically Significant variables	CI %	Power %	Hazard ratio (HR)	Probability of an event %	Sample size	Reference
1	$3^{1/2}$ h. dialysis duration per session/hr	95	80	0.5314	0.2536	310	[13]
2	Female	95	80	0.274	0.54	302	[14]

patients were registered, but finally 20 hemodialysis patients were used according to that fulfilled inclusion criteria; in St. Paul's Hospital, Millennium Medical College, 146 hemodialysis patients were registered, but finally 60 hemodialysis patients were used; in Addis Hiwot General Hospital, 132 hemodialysis patients were registered, but 120 hemodialysis patients were used according to inclusion criteria; and in Bethzatha General Hospital, 112 hemodialysis patients were registered from the total of registered according to inclusion criteria, 90 hemodialysis patients were included, EthioTebib General Hospital 110 hemodialysis patients of CKD were registered but finally 80 hemodialysis patients were included in the study. Finally, a total of 370 hemodialysis patients with CKD met the inclusion criteria; the calculated sample size was 341. However, since it was manageable, all 370 eligible chronic kidney patients who started hemodialysis in a selected hospital were included.

Study variables

The dependent variable was Time to death whereas the independent variable were Socio-demographic factors(Age, Sex, Marital status &Residence) Clinical characteristics of the patient (Comorbidity, Charlson comorbidity index, Cause of chronic kidney disease, Family history & blood group) Biochemical parameters (Albumin, Hemoglobin, Potassium, Creatinine &Calcium level) Treatment-related factors (Types of vascular access, Dialysis duration per session, Dialysis frequency per week, adequacy of dialysis, Erythropoietin Treatment, Health facilities, Existence of infection).

Operational definitions

CKD

Gradual reduced kidney function > 3 months and a glomerular filtration rate (GFR) of less than 60 mL/min [1].

Acute kidney disease

Sudden reduction of kidney function with a duration of ≤3 months [15].

Time to death

Length of time it takes for hemodialysis patients to develop an event of interest measured in days from start of hemodialysis to the date of death.

Event

Death of patients due to chronic kidney disease on hemodialysis.

Censored

Those patients who didn't develop the outcome of interest at the end of the follow-up period or were alive; loss of follow-up; transfer to another dialysis center; or kidney transplant.

Charlson comorbidity index

An index consist 17 medical condition weighted 0–6 and weighted as mild, moderate and severe based on number of comorbidity where 1–2, 3–4 & ≥ 5 respectively [16].

Data collection tool and techniques

The data were collected by using a data extraction checklist that was adapted from different studies [17–21]. Which consist of socio-demographic-related factors, clinical characteristics of the patient**,** biochemical parameters, and treatment-related factors. Data were gathered by reviewing patients' medical records, hemodialysis charts, and registration book. A checklist with an English version was used for data collection to facilitate the extraction of data. Ten BSc nurses (two in every hospital) were involved in the data collection.

Data quality control and management

Data collectors and supervisors received one day of training on the data gathering procedure regarding to objective of the study, and the study population's eligibility criteria. The investigator and supervisors daily checked the obtained data for consistency, and completeness to

minimize the chance of loss of data and to ensure data quality.

Data processing and analysis

After the data was collected, each variable was coded and entered into Epi Data version 3.1 and then exported into STATA version 15 software for analysis. In order to handle missing values for the variables, the imputation method was used. Kaplan-Meier and the log-rank test were done. Bivariable Cox-proportional regression was done, and a variable whose p-value < 0.25 entered into multivariable Cox-proportional regression analysis. In order to check the proportional hazard assumption, the log-log plot and Shenfield residual test was used, which had a P-value >0.05 was considered as fulfill the assumptions. And multicollinearity was done by using variance inflation factor a mean VIF was 1.18. Finally, a variable whose p-value < 0.05 in multivariable Cox-proportional regression analysis was considered a statistically significant predictors for time to death among patients on hemodialysis. Overall model fitness was also checked by the Cox-Snell residual. Finally, the result was presented through tables, text, and graphs.

Result

Socio demographical characteristics of study participant

A total of 370 hemodialysis patient records were included in the study, with the mean age of the participants 46.38 ± 15.72 years. Two hundred thirty three (62.97%) participants were males, and 319 (86.45%) of the patients were residents of Addis Ababa (Table 2).

Clinical characteristics of the study participant

From a total of 370 patients, 313 (84.6%) had comorbidities, and from the comorbidities, the leading one was hypertension 208 (56.2%). The most common potential causes of chronic kidney disease were hypertension 113 (30.54%), diabetes mellitus 108 (29.19%), and both hypertension and diabetes mellitus 64 (17.3%), whereas 48 (12.97%) of patients had chronic kidney disease for which the etiology was unknown (Table 3).

Treatment related and biochemical parameters of study participant

The majority of the patients used Arteriovenous fistula for vascular access, which is 224 (60.54%), and most of the patients there hemoglobin levels were < 11mg/dl 215 (58.1%). About 123 (33.24%) patients undergo hemodialysis three times a weeks, whereas 137 (37.03%) and 110 (29.73%) used twice and once per week, respectively. Regarding blood groups, 120 (32.4%) were blood groups O, whereas, 82 (22.2%), 114 (30.8%), and 54 (14.6%) were blood groups A, B and AB, respectively (Table 4).

Time to death of chronic kidney disease patients on hemodialysis

Of the total of 370 patients who were on HD for at least one month, were followed for a total of 60 months, with a minimum and maximum follow-up time of 1 and 59 month, respectively. From the total of 370 eligible patients, 265 (71.6%) were censored and 105 (28.4%) (95% CI: 23.8-33.3) died. The study participants were followed for a total of 6245 person-month, with an incidence rate of death 16.8/1000 person-month of observation (95% CI: 13.8-20.3). The median time to survival was 47 months (95% CI: 36.7, 56). The probability of survival at 3 month, 1st, 3rd, and end of follow-up years was 92.76%, 80.1%, 58.14%, and 24.95 %, respectively (Figs. 1, 2, 3 and 4).

Table 2 Socio demographical characteristics of study participant of chronic kidney diseases patients on hemodialysis at selected hospitals giving dialysis Service, Addis Ababa, Ethiopia, 2023

Variables & There Categories	Death (n = 105) Frequency (%)	Censored (n = 265) Frequency (%)	Total (n = 370) Frequency (%)
Sex			
Male	72 (68.6)	161 (60.8)	233 (62.97)
Female	33 (31.4)	104 (39.2)	137(37.03)
Age (in years)			
18–47	36 (34.3)	160 (60.4)	196(52.9)
48–63	39 (37.1)	74 (27.9)	113 (30.5)
≥ 64	30(28.6)	31 (11.7)	61 (16.5)
Residence			
Addis Ababa	93 (88.6)	226 (85.3)	319 (86.2)
Outside Addis Ababa	12 (11.4)	39 (14.7)	51 (13.8)

Table 3 Clinical characteristics of the study participant of chronic kidney diseases patients on hemodialysis at selected hospitals giving dialysis Service, Addis Ababa, Ethiopia, 2023

Variables & There Categories	Death (105) frequency (%)	Censored ($n=265$) frequency (%)	Total ($n=370$) frequency (%)
Comorbidity			
Yes	93 (88.6)	220 (83)	313 (84.6)
No	12 (11.4)	45 (17)	57 (15.4)
DM			
Yes	58 (55.2)	139 (52.5)	197 (53.2)
No	47 (44.8)	126 (47.5)	173 (46.8)
HTN			
Yes	67(63.8)	141(53.2)	208 (56.2)
No	38 (36.2)	124 (46.8)	162 (43.8)
CVD			
Yes	25 (23.8)	26 (9.8)	51 (13.8)
No	80 (76.2)	239 (90.2)	319 (86.2)
HIV			
Yes	12 (11.4)	15 (5.7)	27 (7.3)
No	93 (88.6)	250 (94.3)	343 (92.7)
Potential cause of CKD			
DM	29 (27.6)	79 (29.8)	108 (29.19)
HTN	30 (28.6)	83 (31.3)	113 (30.54)
DM + HTN	23 (21.9)	41 (15.5)	64 (17.3)
Tubular interstitial nephritis	3 (2.8)	7 (2.6)	10 (2.7)
Cystic disease	4 (3.8)	10 (3.8)	14 (3.78)
Glomerulonephritis	5 (4.8)	8 (3)	13 (3.52)
Unknown	11 (10.5)	37 (14%)	48 (12.97)
Family History of CKD			
Yes	22 (21)	38 (14.3)	60 (16.2)
No	83 (79)	227 (85.7)	310 (83.8)
Charlson comorbidity index (CCI)			
1–2	23 (21.9)	77 (29.1)	100 (27.03)
3–4	46 (43.8)	141(53.2)	187 (50.54)
≥ 5	36 (34.3)	47 (17.7)	83 (22.43)

DM Diabetes mellitus, *HTN* Hypertension, *CVD* Cardiovascular disease

Predicators of mortality among chronic kidney disease on hemodialysis

At a p-value of <0.25 in Bivariable Cox regression analysis eleven variables were selected, those were sex, age, infection, hypertension, vascular access, CVD, blood type, hemoglobin level, adequacy of dialysis, existence of comorbidity, and the Charlson comorbidity index. The global goodness-of-fit test of Shenfield residuals was used to verify the proportional hazard assumption. Which had a global test p-value of 0.8092 >0.05 which satisfy PH assumption.

Those eleven variables from Bivariable cox regression entered to multivariable cox regression. Among the eleven variables that were entered into cox multivariable cox regression analysis, four variables became statistically significant at a p value of <0.05, those are central venous catheter, older age, CVD, and blood type B.

Those patients who used central venous catheter for vascular access were 3.47 times risk of death than those with AVF. Those patients who were aged 64 and older were 2.8 times more likely to die than those in the age group of 18–47 years. The risk of death in those hemodialysis patients whose blood group B has 2.07 times than blood type O Those patients with cardiovascular disease were 1.88 times more likely to die than those patients without cardiovascular disease (Table 5) (Fig. 5).

Table 4 Treatment related and biochemical parameters of chronic kidney diseases patients on hemodialysis at selected hospitals giving dialysis Service, Addis Ababa, Ethiopia, 2023

Variables	Categories	Death ($n=105$) frequency (%)	Censored ($n=265$) frequency (%)	Total ($n=370$) frequency %
Infection	Yes	47 (44.8)	58 (21.9)	105 (28.4)
	No	58 (55.2)	207 (78.1)	265 (71.6)
Vascular access	AVF	56 (53.3)	168 (63.4)	224 (60.54)
	AVG	21 (20)	42 (15.8)	63 (17.03)
	JVC	28 (26.7)	55 (20.8)	83 (22.43)
Dialysis duration per/hr	3 h	63 (60)	140 (52.8)	203 (54.9)
	3.5 h	36 (34.3)	102 (38.5)	138 (37.3)
	4 h	6 (5.7)	23 (8.7)	29 (7.8)
Dialysis frequency per/wk	1times	23 (22)	87 (32.8)	110 (29.73)
	2times	41 (39)	96 (36.2)	137 (37.03)
	3 times	41 (39)	82 (31)	123 (33.24)
Blood transfusion	Yes	21 (20)	78 (29.4)	99 (26.8)
	No	84 (80)	187 (70.6)	271 (73.2)
Erythropoietin treatment	Yes	36 (34.3)	96 (36.2)	132 (35.7)
	No	69 (65.7)	169 (63.8)	238 (64.3)
Blood type	A	28 (26.6)	54 (20.4)	82 (22.2)
	B	47(44.8)	67 (25.3)	114 (30.8)
	AB	15 (14.3)	39 (14.7)	54 (14.6)
	O	15 (14.3)	105 (39.6)	120 (32.4)
Adequacy of dialysis	< 1.2	18 (17.1)	22 (8.3)	40 (10.8)
	≥ 1.2	87 (82.9)	243 (91.7)	330 (89.2)
Health facility	Private	79 (75.2)	211(79.6)	290 (78.4)
	Public	26 (24.8)	54(20.4)	80 (21.6)
Hemoglobin g/dl	< 11	68(64.7)	147 (55.5)	215 (58.1)
	11–12.5	32(30.5)	92 (34.7)	124 (33.5)
	> 12.5	5(4.8)	26 (9.8)	31 (8.4)
Creatinine mg/dl	< 8	47 (44.8)	133 (50.2)	180 (48.65)
	≥ 8	58 (55.2)	132 (49.8)	190 (51.35)

AVF Arteriovenous Fistula, *AVG* Arteriovenous Grafts, *JVC* Jugular venous catheter

Discussion

The objective of this study was to assess time to death and its predictors among patients with chronic kidney disease on hemodialysis at selected hospitals giving dialysis service in Addis Ababa, Ethiopia, 2023. The incidence rate of death in this study was 16.8 per1000 person-month. which is consistent with study conducted in Tigray 1.4 per 1000 person year [18]. However lower than study conducted in Amhara 1.89 per 1000 person-days [17]. Which might be due to a variation in sample size and study setting.

The median survival time in this study was 47 months, which is higher than the study conducted in Ayder hospital in Tigray region which was 378 days [18].This might be a result of the fact that the majority of the patients in Tigray were older aged, and also it was carried out over a three-year period in a single public dialysis facility.

On the other hand the overall survival probabilities at 3 month, 1, 3, and end of follow up years were 92.76% 80.1%, 58.14%, and 24.95% respectively. The finding is consistent with study conducted in Vietnam 1st year was (85%) [22], but lower than a study conducted in china 1st year survival was 94% [20].This variation might be due to a difference in frequency of dialysis and socio demographical characteristics of participants. However, higher than study conducted in Nigeria, 90thday and 1st year survival probability were (24.86%) & (66.3%) respectively [23] and in Ethiopia, Amhara 1st year survival was (49.58%) [17] and Saint Gabriel General Hospital 90th days and 1st year survival was (62.1%) and (42.1%) respectively [10]. This might be due to variation on socio

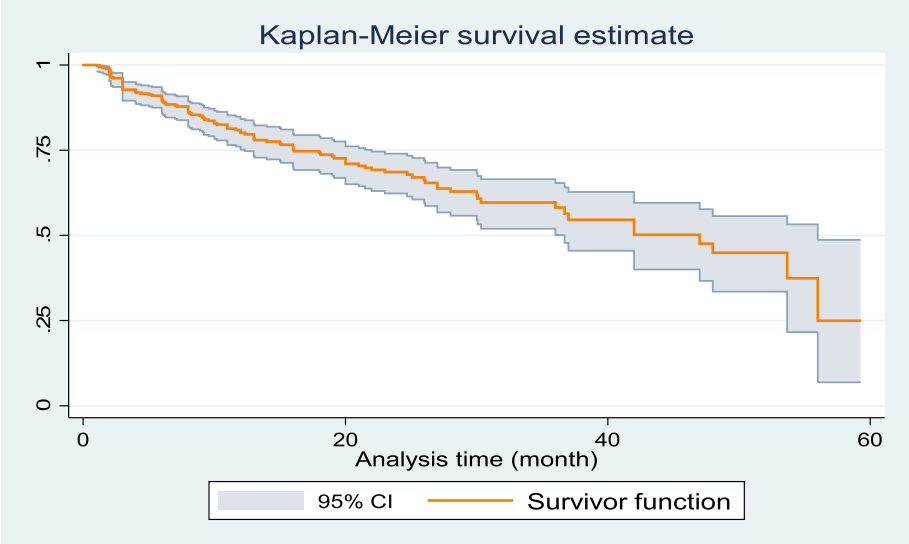

Fig. 1 Kaplan–Meier survival estimate of chronic kidney disease patients on hemodialysis at selected hospitals giving dialysis Service, Addis Ababa, Ethiopia, 2023

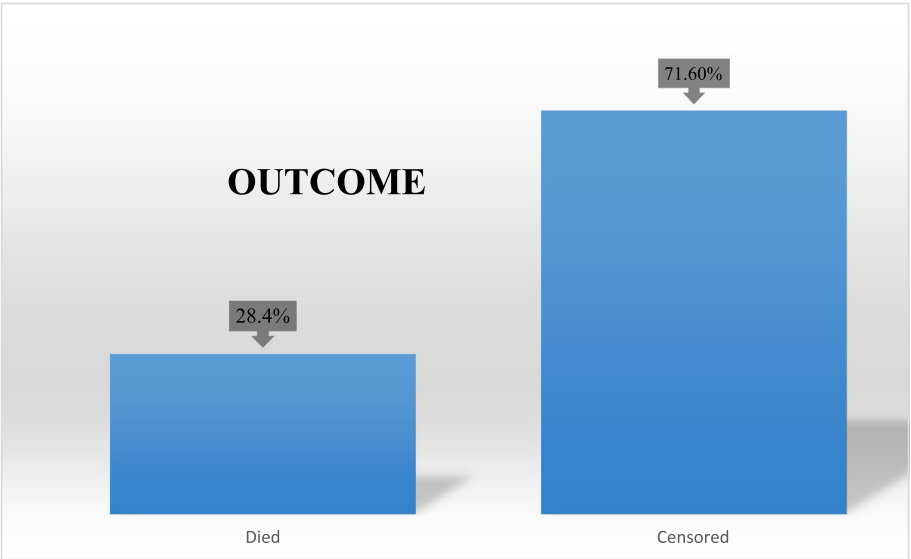

Fig. 2 The outcome of chronic kidney disease patients on hemodialysis at selected hospitals giving dialysis Service, Addis Ababa, Ethiopia, 2023

demographical characteristics of participant, study setting and study period.

Those patients whose (aged ≥64 years) had 2.8 times more likely to die than of young adults (aged 18–47 years). This finding is supported by other previous studies conducted in Vietnam [22], Iran [24] and Adama [14]. This might be due to the fact that older age is associated with lower levels of physical functioning [25] as a result it increase the risk of different comorbidities and makes them more susceptible to hemodialysis instability. However there was no significant association b/n age and mortality of hemodialysis patients in study conducted in Tigray [18]. Thus, the difference may be due to disparities among the study sample size and study period.

Patients using central venous catheters have 3.47 times higher risk of death than patients using an arteriovenous fistula as their vascular access. The result was supported by studies done in Taiwan [21], Palestine

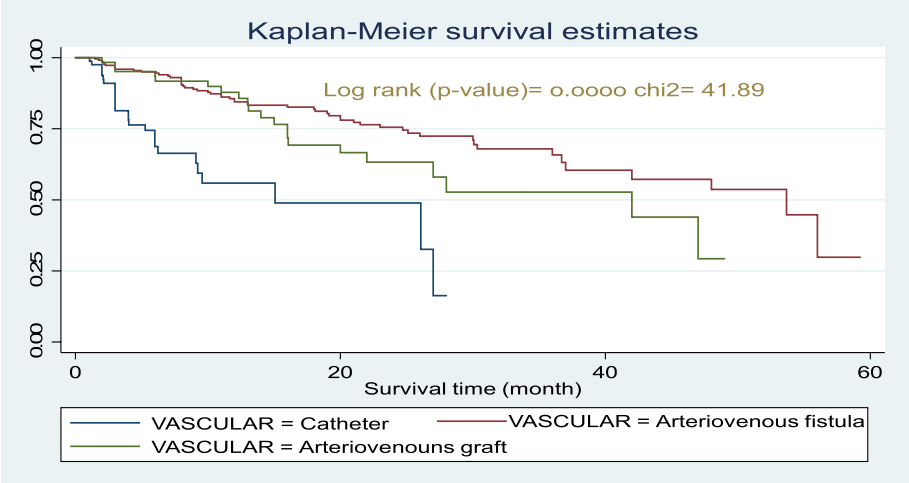

Fig. 3 There is survival difference b/n a vascular access with log rank test at *p* value of 0.0000 and chi.^{2} of 41.89. Kaplan–Meier survival curve for vascular access of chronic kidney disease patients on hemodialysis at a selected dialysis center in Addis Ababa, Ethiopia, 2023

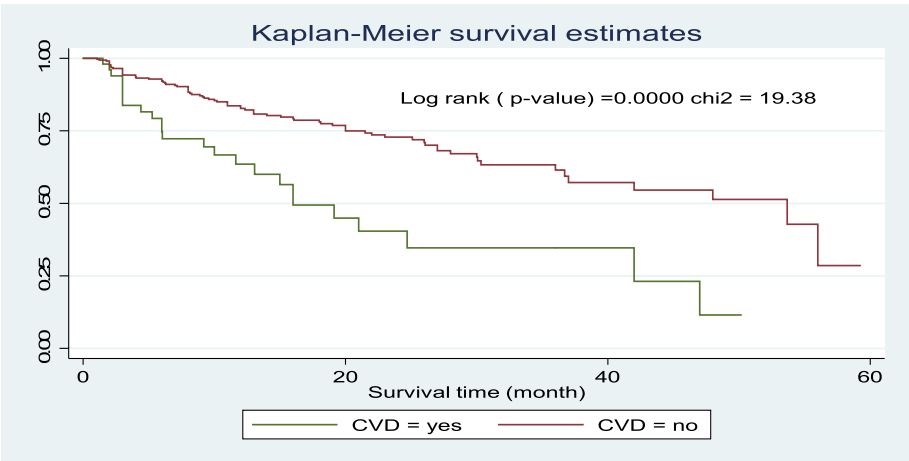

Fig. 4 It indicated that there is a difference of survival between those who had cardiovascular disease than of without cardiovascular disease at *p*-value of 0.0000. Kaplan–Meier survival curve for cardiovascular disease of chronic kidney diseases patients on hemodialysis at selected hospitals giving dialysis Service, Addis Ababa, Ethiopia, 2023

[26], Japan [27] and Amhara [17]. This could be because of central venous catheter had a high risk of infection, thrombosis and mechanical stress, which caused vein stenosis, which lowers blood flow and lowers the required dose of dialysis, as a result decreased patient survival [28]. However this finding not supported by a study conducted in china [20]. This difference could be due to low usage of central veins catheter or due to sample difference.

Hemodialysis patients with blood group B had twofold risk of death than blood group O the result of this study supported by a study conducted in china [29].This might be due to the reason that non-O blood groups had a great probability of thrombosis, due to increased amounts of von Willebrand factor (VWF) and factor VIII (FVIII), as a result it makes more susceptible to thromboembolic disorders and it affect patency and longevity of the vascular system [30]. However there was no significant association in study conducted in Iran [24].

Patients with cardiovascular disease were increase risk die by 88% than those without cardiovascular. This finding is in line with the studies carried out in Casablanca

Table 5 Cox proportional hazard model analysis for predictors of time to death among chronic kidney diseases patients on hemodialysis at selected hospitals giving dialysis service, Addis Ababa, Ethiopia, 2023

Variables	categories	Death ($n=105$)	Censored ($n=265$)	CHR (95%CI)	AHR (95%CI)	*P*-Value
Age (years)	18–47	36	160	1	1	
	48–63	39	74	2.03(1.28–3.2)*	1.5(0.91–2.48)	0.11
	≥64	30	31	4.9(2.98–8.06)*	**2.8(1.7–4.98)*** **	**0.001**
Sex	Male	72	161	1	1	
	Female	33	104	0.67(0.44–1.01)*	0.90(0.57–1.42)	0.66
Infection	Yes	47	58	2.08 (1.4–3.1)*	1.44(0.94–2.21)	0.09
	No	58	207	1	1	
Vascular access	AVF	56	168	1	1	
	AVG	21	42	1.4 (0.89–2.47)*	1.47 (0.87–2.48)	0.14
	CVC	28	55	4.5 (2.8–7.4)*	**3.47(2.1–5.9)*** **	**<0.001**
Existence of comorbidity	Yes	93	220	1.46(0.80–2.68)*	1.16 (0.52–2.57)	0.70
	No	112	45	1	1	
Charlson comorbidity index	1–2	23	77	1	1	
	3–4	46	141	1.09(0.66–1.81)	0.93(0.50–1.3)	0.82
	≥5	36	47	2.02(1.19–3.41)*	1.52 (0.82–2.82)	0.17
Cardiovascular disease	Yes	25	26	2.64(1.68–4.15)*	**1.88(1.15–3.07)***	**0.01**
	No	80	239	1	1	
Hypertension	Yes	67	141	1.54(1.03–2.30)*	1.29 (0.80–2.03)	0.28
	No	38	124	1	1	
Blood type	A	28	54	2.3 (1.28–4.12)*	1.68 (0.91 -3.07)	0.09
	B	47	67	3.15(1.83–5.41)*	**2.07(1.17–3.69)** **	**0.01**
	AB	15	39	1.72(0.87–3.39)*	1.98 (0.98–4)	0.05
	O	15	105	1	1	
Adequacy of dialysis	<1.2	18	22	1	1	
	≥1.2	87	243	0.39(0.23–0.65)*	0.58 (0.33–1.03)	0.06
Hemoglobin	<11	68	147	1	1	
	11–12.5	32	92	0.78(0.51–1.2)	0.99 (0.63–1.56)	0.98
	≥12.5	5	26	0.38(0.15–0.95)*	0.4 (0.16–1.19)	0.10

CHR Crude hazard ratio, *AHR* Adjusted hazard ratio, *CI* Confidence interval, [1]Reference

*Predictors at *P*-value < 0.05; **Predictors at *P*-value < 0.01; ***Predictors at *P*-value < 0.001. For Bivariable * predicators at $p < 0.25$

[31],China [32].This may be due to there is high risk of fluid overload due to loss of renal function as well as due to dialysis treatment, which increases the risk of the pathophysiological processes of hypertension and left ventricular hypertrophy it worsens the progression of CVD [33].

In this study there is no survival difference b/n public and private dialysis unit thus this study inconsistent with study conducted in Romanian in which those private dialysis unit have better outcome than of governmental (non-profit) hemodialysis [34]. This difference might be due to dialysis treatment protocols and practices may be standardized across public and private units, ensuring consistent care delivery regardless of the type of facility.

Conclusion

Overall, in this study show that the median survival time was 47 month and those predictors or factors cardiovascular disease, older adults (aged ≥64), catheter vascular access, and blood type B were significant predictors of mortality that affect the survival of hemodialysis patients. Therefore, every concerned bodies who works in health sectors particularly in dialysis unit must be to intervene for those predictors of mortality and create interventions accordingly in order to increase survival time hemodialysis patients. In general this study will be contribute to improving the care of dialysis patients in the country that's why nephrology policy maker also must give concern and prepared guideline for dialysis patients.

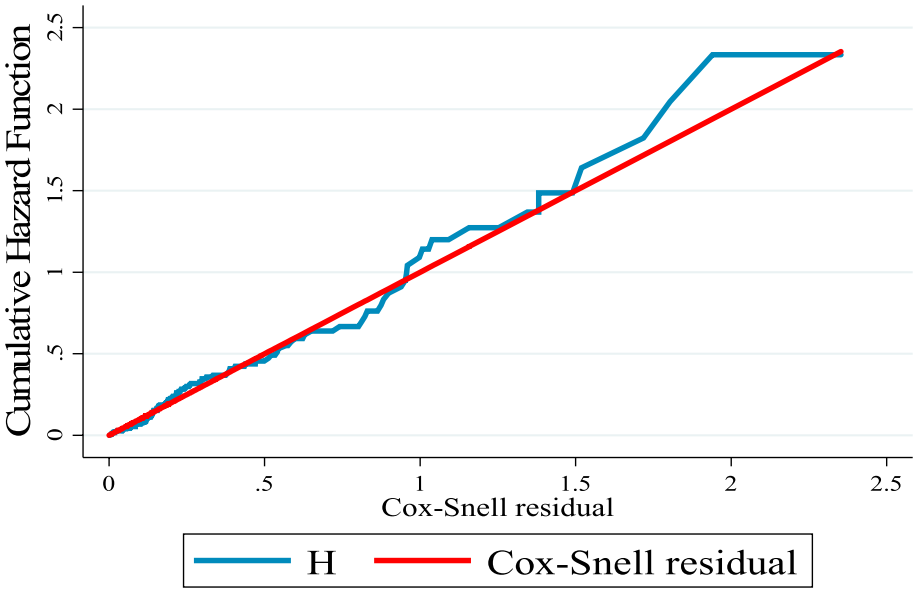

Fig. 5 Cox-Snell residual plot to test Cox regression overall model fitness test for chronic kidney disease patients on hemodialysis at selected hospitals giving dialysis Service, Addis Ababa, Ethiopia, 2023

Strengths of the study

This study collect a sample from multiple dialysis unit and in cooperate both private and public dialysis unit and its make the study more generalizable, additional to this it try to incorporate some predicators which has not address from previous study.

Limitations of the study

Due to the secondary sources used to gather the data, some crucial variables like albumin level, creatinine level, calcium and potassium level were overlooked.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12882-024-03719-3.

Supplementary Material 1.

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Authors' contributions

Azeb Haile was involved in conceptualization, design, analysis, interpretation, and report and manuscript writing; Adamu Birhanu and Tufa Kolola were involved in the design, analysis, interpretation, report writing, and review of design, interpretation, and report writing; Diriba Etana and Lenja Hamza contributed to the design and review of design, analysis, interpretation, and report writing. All authors read and approved the final manuscript.

Availability of data and materials

The datasets used or analyzed during the current study are available from the corresponding author on reasonable request. The datasets generated during and analyzed during the current study are not publicly available because the hospitals do not permit the researchers to share the datasets publicly.

Declarations

Ethics approval and consent to participate

We extracted anonymized medical records data of chronic kidney disease patients on hemodialysis from January 1 st , 2017 to December 30 th , 2022. An ethical clearance letter was obtained from the Ethical Review Board (ERB) of Ambo University, College of Health Sciences, and Referral Hospital, Ref. No. AU/PGC/620/2023. Official letters were submitted to those selected hospitals, and ethical clearance letters were also obtained from the concerned bodies of those hospitals and submitted to the respective dialysis units. Participant consent was not required as the study used secondary data. As long as the work does not violate the rights of individuals and does not include identifiable information, each hospital that give dialysis service permit researchers to access medical charts without obtaining prior consent from participants to pursue research for the common good. Informed consent was waived by Ethical Review Board (ERB) of Ambo University and the respective dialysis hospital. This decision was in accordance with the National Research Ethics Review Guideline, and was consistent with the Declaration of Helsinki.

Consent for publication

Not applicable

Competing interests

The authors declare no competing interests.

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References

1. Lukela JR, Harrison RV, Jimbo M, Mahallati A, Saran R, Annie Z. Management of Chronic Kidney Disease Key Points. UMHS Chronic Kidney Dis Guidel. 2019;1:1–27.
2. Ndahayo D, Bimenyimana Gapira E, Mbabazi T, Chironda G. Factors associated with hemodialysis adequacy among end stage renal disease patients on maintenance hemodialysis in Rwanda. Int J Adv Nurs Stud. 2021;10(1):9.
3. Rashid HU. Management of End Stage Renal Disease-Bangladesh Perspective. Open Urol Nephrol J. 2014;7(1):108–12.
4. Muleta MB, Abebe E, Tadesse M, Berhae T, Muhammed M, Woodside K, et al. Original Article Milestones of Renal Replacement Therapy in Ethiopia. Ethiop Med J. 2020;Supplement(January):5–13.
5. Luyckx VA, Tonelli M, Stanifer JW. The global burden of kidney disease and the sustainable development goals. Bull World Health Organ. 2018;96(6):414-422C.
6. Damasceno A. Noncommunicable Disease. Heart of Africa: Clinical Profile of an Evolving Burden of Heart Disease in Africa. 2016. p. 155–7.
7. Neuen BL, Chadban SJ, Demaio AR, Johnson DW, Perkovic V. Chronic kidney disease and the global NCDs agenda. BMJ Glob Heal. 2017;2(2):7–10.
8. Jha V, Garcia-Garcia G, Iseki K, Li Z, Naicker S, Plattner B, et al. Chronic kidney disease: Global dimension and perspectives. Lancet. 2013;382(9888):260–72. Available from: https://doi.org/10.1016/S0140-6736(13)60687-X.
9. Foreman KJ, Marquez N, Dolgert A, Fukutaki K, Fullman N, McGaughey M, et al. Forecasting life expectancy, years of life lost, and all-cause and cause-specific mortality for 250 causes of death: reference and alternative scenarios for 2016–40 for 195 countries and territories. Lancet. 2018;392(10159):2052–90. Available from: https://doi.org/10.1016/S0140-6736(18)31694-5.
10. Shibiru T, Gudina EK, Habte B, Derbew A, Agonafer T. Survival patterns of patients on maintenance hemodialysis for end stage renal disease in Ethiopia: Summary of 91 cases. BMC Nephrol [Internet]. 2013;14(127):1–7. https://doi.org/10.1186/1471-2369-14-127.
11. Abebe A. Federal Demographic Republic of Ethiopia Central Statistical Agency Population Projection of Ethiopia for All Regions At Wereda Level from 2014 – 2017. 2017;(August 2013).
12. Mengistu YT, Ejigu AM. Global Dialysis Perspective: Ethiopia. Kidney360. 2022;3(8):1431–4.
13. Mekonen MW, Birahan KA, Chekole DM, Derso EA. Determinants of Overall Survival of Kidney Failure for Patients Receiving Dialysis in Saint Geberial General Hospital, Addis Ababa, Ethiopia. J Kidney OPEN. 2020;6(180):1–7.
14. Hussein M, Muleta G, Seyoum D, Kifle D, Bedada D. Survival Analysis of Patients with End Stage Renal Disease the Case of Adama Hospital, Ethiopia. Clin Med Res. 2017;6(6):201.
15. Lameire NH, Levin A, Kellum JA, Cheung M, Jadoul M, Winkelmayer WC, et al. Harmonizing acute and chronic kidney disease definition and classification: report of a Kidney Disease: Improving Global Outcomes (KDIGO) Consensus Conference. Kidney Int. 2021;100(3):516–26.
16. Barış SA, Boyacı H, Akhan S, Mutlu B, Deniz M, Başyiğit İ. Charlson Comorbidity Index in Predicting Poor Clinical Outcomes and Mortality in Patients with COVID-19. Turkish Thorac J. 2022;23(2):145–53.
17. Workie SG, Zewale TA, Wassie GT, Belew MA, Abeje ED. Survival and predictors of mortality among chronic kidney disease patients on hemodialysis in Amhara region, Ethiopia, 2021. BMC Nephrol. 2022;23(1):1–9. Available from: https://doi.org/10.1186/s12882-022-02825-4.
18. Belachew AB, Mohammed AN, Kahsay AB. Determinants of Survival among Hemodialysis Patients at Ayder Determinants of Survival among Hemodialysis Patients at Ayder Comprehensive Specialized Hospital, Tigray, North Ethiopia : A Retrospective Cohort Study. 2018.
19. Ferreira EDS, Moreira TR, Gomes R, Dias G, Saraiva L, Bicalho S, et al. Survival and analysis of predictors of mortality in patients undergoing replacement renal therapy: a 20-year cohort. BMC Nephrol. 2020;21(1):1–14.
20. Sun Y, Wang Y, Yu W, Zhuo Y, Yuan Q, Wu X. Association of dose and frequency on the survival of patients on maintenance of hemodialysis in china: A kaplan-meier and cox-proportional hazard model analysis. Med Sci Monit. 2018;24:5329–37.
21. Yeh L mei, Chiu SY hsia, Lai P chin. The Impact of Vascular Access Types on Hemodialysis Patient Long-term Survival. Sci Rep. 2019;1–8. Available from: https://doi.org/10.1038/s41598-019-47065-z.
22. Nguyen B, Fukuuchi F. Survival rates and causes of death in Vietnamese chronic hemodialysis patients. Ren Replace Ther. 2017;3(1):1–10.
23. Sa D, Aj I, Aa T, Oe D, Ro A. Survival Pattern of Patients on Maintenance Haemodialysis for End Stage Renal Disease in a Nigerian Dialysis Centre. Arch Nephrol Urol. 2019;02(01):1–12.
24. Davoudi-Kiakalayeh A, Mohammadi R, Pourfathollah AA, Siery Z, Davoudi-Kiakalayeh S. Alloimmunization in thalassemia patients: New insight for healthcare. Int J Prev Med. 2017;8(113):1–5.
25. Van Loon IN, Bots ML, Boereboom FTJ, Grooteman MPC, Blankestijn PJ, Van Den Dorpel MA, et al. Quality of life as indicator of poor outcome in hemodialysis: Relation with mortality in different age groups. BMC Nephrol. 2017;18(1):1–9.
26. Hamadneh SA, Nueirat SA, Qadoomi J, Shurrab M, Qunibi WY, Hamdan Z. Vascular access mortality and hospitalization among hemodialysis patients in Palestine. Saudi J Kidney Dis Transpl. 2018;29(1):120–6.
27. Murakami M, Fujii N, Kanda E, Kikuchi K, Wada A, Hamano T, et al. Association of Four Types of Vascular Access Including Arterial Superficialization with Mortality in Maintenance Hemodialysis Patients: A Nationwide Cohort Study in Japan. Am J Nephrol. 2023;54(3–4):83–94.
28. Santoro D, Benedetto F, Mondello P, Pipitò N, Barillà D, Spinelli F, et al. Vascular access for hemodialysis: Current perspectives. Int J Nephrol Renovasc Dis. 2014;7:281–94.
29. Ye Z, Wu Y, Tu Y, Chen M, Gao Y, Shi L, et al. Blood Group O Protect End-Stage Renal Disease Patients With Dialysis From Coronary Artery Disease. Front Cardiovasc Med. 2022;8(January):1–9.
30. Hernaningsih, Yetti. ABO Blood Group and Thromboembolic Diseases; 2022. Available from: https://doi.org/10.5772/intechopen.102757.
31. Msaad R, Essadik R, Mohtadi K, Meftah H, Lebrazi H, Taki H, et al. Predictors of mortality in hemodialysis patients. Pan Afr Med J. 2019;33:1–14.
32. Tong J, Liu M, Li H, Luo Z, Zhong X, Huang J, et al. Mortality and associated risk factors in dialysis patients with cardiovascular disease. Kidney Blood Press Res. 2016;41(4):479–87.
33. Cozzolino M, Mangano M, Stucchi A, Ciceri P, Conte F, Galassi A. Cardiovascular disease in dialysis patients. Nephrol Dial Transplant. 2018;33(3):28–34. https://doi.org/10.1093/ndt/gfy174.
34. Ştefan G, Podgoreanu E, Mircescu G. Hemodialysis system privatization and patient survival: A report from a large registry Eastern Europe cohort. Ren Fail. 2015;37(9):1481–5.

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