ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF NURSING AND MIDWIFERY
POSTGRADUATE PROGRAM

SURVIVAL STATUS AND PREDICTORS OF MORTALITY ON MAINTENANCE HEMODIALYSIS AMONG END-STAGE RENAL DISEASE PATIENTS IN GOVERNMENTAL HOSPITALS DIALYSIS CENTERS AT ADDIS ABABA, ETHIOPIA: 2021.

By -Yalew Mossie (BSc)

A Thesis Submitted to the School of Nursing and Midwifery, College of Health Sciences, Addis Ababa University in partial fulfillment of the requirements for the Degree of Master of Science in Advanced Adult Health Nursing.

June, 2021
ADDIS ABABA, ETHIOPIA

ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

POSTGRADUATE PROGRAM

SURVIVAL STATUS AND PREDICTORS OF MORTALITY ON MAINTENANCE HEMODIALYSIS AMONG END-STAGE RENAL DISEASE PATIENTS IN GOVERNMENTAL HOSPITALS DIALYSIS CENTERS AT ADDIS ABABA, ETHIOPIA: 2021.

By: YALEW MOSSIE (BSc)

ADVISORS: -

1. **MR. TIGESTU GEBREYOHANNIS (MSC, ASSISTANT PROFESSOR)**
2. **MR. BOKA DUGASSA (MSC, LECTURER)**

JUNE 2021

ADDIS ABABA, ETHIOPIA

APPROVAL SHEET

APPROVAL BY THE BOARD OF EXAMINATION

This thesis was done by Yalew Mossie is accepted by the board of examiners to meet the thesis requirement for the degree of Masters of Science in Adult Health Nursing

EXAMINER:

Dr Fekadu Aga _____ _____ _____

Name Rank Signature Date

Advisors:

Name Rank Signature Date

1. Mr. Tigestu Gebreyohannis (MSc, A. Proff) _____ _____
2. Mr. Boka Dugassa, (MSc, Lecture) _____ _____

DEPARTMENT HEAD

Nigussie Tadele (MSc, A. Proff) _____ _____

Name Rank Signature Date

STATEMENT OF DECLARATION

This research is my work, as shown by my signature below. When planning, collecting data, analyzing, and completing this thesis, I followed all ethical guidelines. This article acknowledges and quotes all materials in the literature. I guarantee that all references used in this document have been cited. During the writing of this thesis, every effort has been made to avoid plagiarism.

Name of investigator: Yalew Mossie (BSc)

Signature: ----------

Date: ----------

Advisors:

	Name	Rank	Signature	Date
3.	Mr. Tigestu Gebreyohannis	(MSc, A. Proff)	_____	_____
4.	Mr. Boka Dugassa,	(MSc, Lecture)	_____	_____

ACKNOWLEDGEMENT

First of all, my gratitude goes to Addis Ababa University, College of health science, school of nursing, and midwifery for giving me this chance to conduct this research. I duly acknowledge Haramaya University for allowed attending and sponsoring me to pursue my MSc education.

My special thanks go to my advisors Mr. Tigestu Gebreyohannis (MSc, Assistant Professor) and Mr. Boka Dugassa (MSc, Lecturer), for imparting their knowledge besides systematic advice boosting morale to work hard and also for their support and enriching comments throughout to complete of this thesis. I am so kind enough to admire because of the bold and straightforward comment they delivered not only as an advisor but also as a brother.

My thanks also go to Saint Paul's hospital millennium medical college, Zewditu memorial hospital, and Minilik II hospital for all dialysis units' staff, card room officers, and data collectors for cooperation during data collection.

Finally, my special thanks go to my brother Magnesite Mossie (Ph.D. fellow) and best friend Bantalem Tilay (MSc lecture) for their moral support and constructive feedback throughout the development of research.

ACRONYMS AND ABBREVIATIONS

AAU	Addis Ababa University
AHR	Adjusted Hazard Ratio
BMI	Body Mass Index
CHR	Crude Hazard Ratio
CI	Confidence Interval
CKD	Chronic Kidney Disease
CVD	Cardio Vascular Disease
DM	Diabetes Mellitus
ESRD	End-Stage Renal Disease
HR	Hazard Ratio
MHD	Maintenance Hemodialysis
NIDDK	National Institute of Diabetes and Digestive and Kidney Disease
RRT	Renal Replacement Therapy
SSA	Sub-Saharan African

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Background- End-stage renal disease is known to have been on the rise becoming public health concern globally. The disease worsened due to the presence of comorbidities conditions. The mortality rate and the reduced survival rate caused by the disease are still the highest. Hemodialysis is a common treatment option for end-stage kidney disease in Ethiopia. It improves the quality of life, reduces morbidity, and prolongs patient survival. **Objective** -This study was aimed to determine the survival status and predictors of mortality among end-stage renal disease patients who undergone maintenance hemodialysis in Addis Ababa, Ethiopia, 2021. **Methods-** An institution-based retrospective cohort study was conducted among end-stage renal disease patients who undergone maintenance hemodialysis between January 1st, 2014 and December 31st, 2019 using census sampling. The collected data were entered into epi data 4.2 and analyzed using STATA 14. Kaplan-Meier survival curve and log-rank tests were used to estimate the survival time and the presence of differences in survival among explanatory variables. Cox regression was used at a 5% level of significance to determine the influence of each explanatory variable on outcome variables. **Result** -A total of 157 end-stage renal diseases on hemodialysis patients were included in the final analysis, of those 37(23.6%) had died. The overall mortality rate was 7.9 years per 100 person-year. The overall estimated survival rate after the start of hemodialysis was 47.6% (95% CI: 30.62-62.85%) at 72 months follow-up. Diabetes mellitus (AHR, 3.1, 95%CI: 1.13-9.73), baseline albumin level<3.5mg/dl (AHR, 3.2, 95%CI: 1.243-8.10), catheter (AHR, 3.56, CI: 1.60-7.93) were significant predictors of hemodialysis patients mortality. Whereas erythropoietin treatments were protective (AHR: 0.33). **Conclusion and recommendation:** The overall survival status of end-stage renal disease patients undergoing maintenance hemodialysis was found to be comparable with other international data.We reduced death of mortality should be emphasized to those with diabetes, low albumin level, catheter vascular type, and absence erythropoietin treatment patients.

***Key-words*:** Chronic Kidney Disease, Hemodialysis, Mortality, Survival Status Time to Death

1. INTRODUCTION

1.1. Background

Chronic kidney disease (CKD) is a heterogeneous disorder with a persistent structural or functional abnormality that reduces the glomerular filtration rate by less than 60ml/min/1.73m^2 for more than three months or evidence of kidney damage including persistent albuminuria defined as greater than 20 mg of urine albumin per gram of urine (1). According to the Kidney Outcome Quality Initiative (KDOQI) guidelines, using glomerular filtration rate, the extent of chronic kidney disease, and signs of structural kidney changes can be divided into five stages. Stage 1 is the mildest symptom and symptoms are usually seen infrequently, while stage 5 is a serious disease and, if not treated in time, the shorter lifespan (2, 3).

Globally, chronic kidney disease is the 12th common cause of death according to the global burden of kidney disease 2017, which estimated that 700 million case mortality was 41.5% such mortality was attributed to cardiovascular disease(4). The prevalence of cardiovascular disease in end-stage renal disease (ESRD) rose from 67% in individuals 45 to 64 years of age to 81.1% in those 75 years of age(5), besides around 20-40% of end-stage renal disease had diabetes complication (6).

According to the 2018 International Nephrology Society (ISN) report, the approximate prevalence was chronic kidney disease worldwide is around 10.4% among males and 11.8% females, Moreover, it is estimated that about 5.3-10.5 million people having kidney failure and need dialysis and transplantation to survive many people in developing countries die as a result of very expensive dialysis or transplantation (7).

The main treatment for end-stage renal disease is renal replacement therapy (RRT), which includes hemodialysis (HD), peritoneal dialysis (PD), and kidney transplantation. HD is the most commonly used renal replacement therapy for ESRD due to the limited availability of suitable donors, potential medical condition of recipients for kidney transplantation, and restricted application of PD (8, 9). Maintenance hemodialysis

(MHD) is carried out at regular intervals in thrice-weekly four -hours dialysis to the optimal therapeutic effect for kidney failure (10).

Hemodialysis helps in the treatment of ESRD patients by removing the excrements and toxic substances of the body and compensating for the function of failure kidneys (11). It improves the quality of life, reduces morbidity, and prolongs patient survival. However, with many practical advances, dialysis patients' morbidities, and mortality continue high and their quality of life is poor (12). The adjusted all-causes rate of mortality is 6.3-8.2-times higher for dialysis patients compared to the general population, and the 5-year survival rate for dialysis patients ranged from 42% to 74% worldwide (13, 14).

Recently, renal replacement therapy has increased from time to time in low and middle-income countries. However, there is a gap between increased end-stage renal disease incidence and access to renal replacement therapy(15). Approximately 15% of the world's population is receiving hemodialysis worldwide, with around 80% being treated in Europe, North America, and Japan only around 20% receive treatment in developing countries (16). This is due to increasing non-communicable diseases thus hypertension, diabetes mellitus, cardiovascular, together with the problem of infectious diseases such as HIV, pregnancy-related diseases, environmental toxin, and trauma-related complication, and poverty, still undeveloped such treatment of modality (17, 18).

A systematic review showed that patients with a diagnosis of end-stage renal disease in Sub-Saharan African mortality were high unable to access dialysis, even patients with initial dialysis mortality were high, after the late presentation, frequency discontinuation, and suboptimal quality dialysis. Uremia, volume overload and uncontrolled hypertension, failure of vascular access, heart failure, stroke, and very severe infections are the leading cause of mortality(19). End-stage renal disease survival status depends on the existence of elevated age, metastatic cancer, lymphoma and accessibility of renal replacement therapy and treatment modality, comorbidity complications such as congestive heart failure, hypertension, and diabetes mellitus (20).

1.2. Statement of the problem

Chronic kidney disease is a significant and growing health problem globally, with an estimated 697.5 million people treated and 1.2 million died in 2017 (21). According to the United States renal data system (USRDS), 30 million adult Americans had chronic kidney disease, with 124,111 new cases of end-stage renal disease and 500,000 patients received maintenance hemodialysis treatment(22).The same report in the European Renal Association 2017 annual report that 83,311 patients from all countries in Europe start renal replacement therapy from this more than 80% being hemodialysis (23)**.**

A study in Swedish mortality of chronic kidney disease patients on renal replacement therapy(RRT) was 3.6 times compared general population, and thus patient mortality was hemodialysis 2.6 times, and PD 1.7 times greater risk than the general population (24)**.** In African, the prevalence of chronic kidney disease 15.8% that in the West African countries about 19.8% higher in the middle African countries 16.0%, and East African countries 14.4% (7).

Patients' survival status depends on the types of medical treatment and dialysis practice, as well as the demographic, clinical, and genetic features of the patient. Significant predictors of survival in patients with hemodialysis include starting dialysis age, ethnicity, albumin, hemoglobin level, C- reactive protein induces end-stage kidney disease and raise some conditions of comorbidity, such as cardiovascular disease, diabetes, malignancy, and other risk factors at the same time(25, 26).

Despite the improvement of dialysis technology, the morbidity and mortality of hemodialysis patients remain high, multiple hospitalizations, and unique treatment complies such as vascular failure, comorbidity, and low quality of life than the general population. Cardiovascular disease (CVD) was the primary cause of death(27). In addition, other predictors that increase mortality are old age, elevated cholesterol, protein malnutrition, and infection. According to the United States Renal Data System (USRDS), pneumonia was diagnosed in 27.9% of maintenance hemodialysis patients within the first year of hemodialysis (27, 28).

In hemodialysis patients, some factors depend on the other factors the body mass index, and serum albumin was the major factor for severe malnutrition (29). However .the obese paradox reduced the risk of mortality in hemodialysis patients. It is estimated that the annual mortality rate of malnourished hemodialysis patients is close to 30%, while in the absence of malnourished patients, it is generally 10-15% (30).

The gold standard for dialysis treatment has not yet been established. Improve the quality of life, nutritional status, and control modifiable factors such as smoking, patients with symptomatic uremia before hemodialysis by a nephrologist for early care, especially for active management of anemia, close monitoring of changes in kidney function, and timely access to hemodialysis treatment has a positive impact on the survival prognosis of patients (31, 32). When the kidneys fail, another method other than dialysis is kidney transplantation. It is important, however, to find a donor with a similar tissue and blood type, which means it might still be difficult to find a kidney. Many patients who require a kidney transplant need to get dialysis as well costs a lot of money(33).

In developing countries like Ethiopia, many patients with the end-stage renal disease die due to poor financial ability for dialysis (34). The number of chronic kidney disease patients had been increasing rapidly in recent years. The exact number of patients with chronic kidney disease was not well known because of the high diagnosis cost for the general population and no national registration for this disease (12). Patients who are on dialysis also face various problems that can lead to the death of life. Few studies have been conducted in our country on survival (35), but no study has been conducted in reporting the potential factors in the death of patients with hemodialysis. Knowing the causes of the death of patients with end-stage renal disease help to take adequate care of that problem. This allows these issues to be given due consideration so that we can prolong the life of hemodialysis patients. This study was aimed to investigate the survival status and predictors of mortality among patients undergoing maintenance hemodialysis in government hospital dialysis centers in Addis Ababa, Ethiopia.

2. LITERATURE REVIEW

2.1. Introduction

End-stage renal disease (ESRD) is one of the causes of non-communicable diseases worldwide, which at the same time costs a considerable amount of both financial and human resources. The number of End-stage renal disease patients continues to increase and the need for different modalities of renal replacement therapy increases(34). The mortality of patients' commencement hemodialysis showed that 8.8 higher compared to the general population (36). The causes are cardiovascular disease, diabetes mellitus, and hypertension, and there are also other causes including chronic glomerulonephritis, interstitial nephritis, and renovascular disease. A recent report from the global burden of disease study has predicted that chronic kidney disease will be the 5th leading cause of death by the year 2040. As a result, global access to renal replacement therapy is both poor and inequitable, and the majority of people with the end-stage renal disease die prematurely due to lack of access to renal replacement therapy (37, 38).

2.2. Survival status of Hemodialysis patients

The European Renal Association reported in 2015 revealed that patients starting with hemodialysis had a 5-year unadjusted survival probability of 41.8% for patients starting with hemodialysis(23). The retrospective study in Brazil showed that the 1st, 5th, and 10th years survival was 82.3%, 49.1%, and 22.5% respectively (39). Another study in Brazil [84.7%, 78.7%, and 63.3%] at 1- 3 and 5 years (40)

The study in west Iran showed that the 1st, 5th and 10th years of survival among end-stage renal disease patients undergoing hemodialysis were 65 %, 16 %, and 5 %, respectively (41). This finding lower than the similar study done in other parts of Iran which showed 1, 3, 5, 7, and 9 years survival rate was 91.9 %, 66.0 %, 46.3 %, 35.6 %, and 28.5% respectively. Whereas the mortality rate was 34.4% for incident dialysis patients and 51.5% to prevent dialysis patients (42). In a retrospective study in China, the patient survival rate was [94%, 59%, and 27%] were 1-year, 5-year, and 10-year respectively (43). Taiwan [92.1%, 77.4 % and 66.4%] in 1-3- and 5 years (44). In the same study, Indian survival rates were at the end of 1, 3, 5, and 7 years were [87.31%, 45.52%,

21.64%, and 7.46 %] respectively (45).In another prospective study in India mortality rate was 10.24% and the median survival was 64 days (46).

In a retrospective study in Morocco the 1 -3and 5 years survival were [95%, 87.3% and 80.2%] (47) Nigeria, [25 %] (48) and South Africa [90.4%] at 1st year (49). In Ethiopia, a similar study showed that the 3 months and one-year survival was 61.5% and 42.1% respectively and the mortality rate was [45.1%] (35).In Mekel Hyder hospital, the 5 years survival was [16.5 %](50). Therefore, studies found that the survival rate was lower in African countries than in other European and Asian countries. Most patients' deaths occurred in the first 6 months to one year. This could be explained that delayed treatment patients' characteristics age and presents of comorbidity conditions.

2.3. Factors associated with survival maintenance of hemodialysis

2.3.1. Socio-demographic factors

Age, gender, employment status, and educational levels were important determinate factors for hemodialysis survival status, and other economic factors may increase the risk of treatment delays or lead to early death (51). In China, retrospective study the survival of males and females were 46.31% and 53.69% respectively and 61.90% of males died. In another study in Brazil mortality risk in women and men on hemodialysis, the death rate per 100 person-years was 6.78 in the whole cohort and slightly higher in males was 6.81 than in females was [6.73] (52).

Age at initiation of dialysis had a significant impact on early mortality. A study in Iron showed that patients who younger age had better survival, patients with age <45 years had a 5.54 higher risk of death compared to age >60 years (41, 53). Another study in Iran showed that survival rates were lower in patients age 65 years and older and mortality risk increased by 3% with each year increase in age after starting hemodialysis (42). This could be due to an increase in age increase age-related risks such as cardiovascular-related disease, inflammation, which seem to affect lower survival in older dialysis patients.

The socioeconomic status of patients is another risk factor prognosis and decrease survival end-stage renal disease. In several studies in hemodialysis patients, increased mortality was associated with a lower level of income (54).

The study revealed that a high body index batters survival than a lower body mass index in Korea. In addition, patients with a body mass index greater than 25.1 kg/m^2 had a lower mortality risk of 37% compared to those with a lower body mass. male patients with body mass index levels over 25.1 kg/m^2 had a 58% lower mortality risk compared to body mass index less than 18.525.1 kg/m^2 (55). The study in Austria revealed that overweight and obese patients had better survival (56). This due to higher body mass index took an indicator of good nutritional status better survival in hemodialysis patients.

Patients starting hemodialysis for end-stage renal disease present with one or more comorbidity. Thus it had a significant negative effect on survival status. The report from European Renal Association European Dialysis and Transplant Association Registry, 2018 common comorbidities disease was diabetes mellitus, ischemic heart disease, congestive heart failure, peripheral vascular disease, cerebrovascular disease, malignancy. These conditions were common in men and old age was more affected (57).

Comorbidity condition a major predictor for the survival of maintenance hemodialysis patients. Study in Iron Patients diabetics had 1.9 times high hazard than non-diabetic (58). A study in Taiwan showed patients who had a diabetic significant effect on mortality were increased compared to non-diabetes mellitus (44). Similar findings in Indian diabetics showed that those who had diabetic were 1.73-times more hazard die than compare non-diabetic (59). Patients' with cardiovascular disease had worse survival status in hemodialysis patients. A study in Morocco showed that hemodialysis patients who had at least one cardiovascular pathology risk of death 2.9-time greater than those without cardiovascular disease (47).In contrast, patients with hypertension patients' lower systolic blood pressure less than 110 mmHg had 3.9 high death when early mortality by contrast when late mortality was systolic blood pressure greater than 160 mmHg (60). This difference may be explained the cause of early death was withdrawn dialysis and malignancy while late mortality was mainly cardiovascular disease.

2.3.2. Clinical parameter predictors

Hypoalbuminemia is one predictor of mortality in hemodialysis patients. Several factors may contribute to hypoalbuminemia in patients with chronic kidney disease such as renal dysfunction, inflammation, and physician-prescribed dietary recommendation inadequate dietary intake with disease association (61). A study done in West Iran revealed that the mortality of patients with an albumin level of less than 3.5 g/dL was 2.05 times higher hazard compared with those with higher amounts of albumin (62).

The same study in Brazil impact on retrospective mortality in incident hemodialysis patients' serum albumin greater 3.8mg/dl and serum albumin were less than 3.8 mg/dl the mortality was significantly higher in low serum albumin 17% and 11% respectively (63). However, the study in Japan showed that albumin leakage 3 g or more per hemodialysis session provided a better prognosis than albumin leakage less than 3 g per hemolysis session (64). This due to some has been trying to remove middle-molecular-weight proteins as much as possible without loss of albumin and suggests that the removal of protein-binding uremic toxins should be investigated as a possible risk factor.

A study done in Japanese showed that hemodialysis patients who had hemoglobin concentrations of 11.0 to 11.9 g/dL had 2.11-times the lowest mortality (<9.0 g/dL) in cardiovascular-comorbid and non-cardiovascular comorbid patients, ischemic stroke respectively. Another study in Taiwan showed that in hemodialysis patients, patients with a hemoglobin level less than 10 g/dL had an increased risk of cardiovascular, ischemic stroke, and infection-related mortality, whereas a hemoglobin level of 11 g/dL was associated with a lower risk of cardiovascular mortality but not ischemic stroke or infection-related mortality (65).

2.3.3. Treatment-related predictors

Vascular access the main prediction of outcomes of hemodialysis patients such as vascular access use arteriovenous fistula(AVF), catheter, and graft (66). A retrospective study in Korea revealed that patients with arteriovenous fistula were better survival compared to catheter and graft whereas arteriovenous grafts the worst survival among other vascular access (67).In the same study patients in arteriovenous fistula had a lower mortality rate over compared with those in the central venous catheter(CVC) in contrast

those patients with a catheter placed after arteriovenous fistula as initial pre-dialysis access (AVF-CVC) also had a lower mortality rate than those with an initial central venous catheter. The mortality rate after hemodialysis initiation for patients with arteriovenous fistula had 9%,17%, and 31% at 6, 2, and 24 months respectively whereas the mortality rate in the CVC was 32%,46%, and 62% respectively (68).

A retrospective study in northern Taiwan showed that patients who started hemodialysis with central venous catheter had a significantly higher cause mortality rate compared to arteriovenous fistula and arteriovenous graft. Moreover, in the follow-up period, patients both in the catheter only and AVF/AVG plus catheter groups also had significant all-cause mortality rates (44). A similar study in Iran patients with catheter more hazard to die compared with fistula (69).

Several reasons have been proposed for patients with catheters dialysis were catheter-related bloodstream, catheters provide a lower blood flow which may lead to a lower dialysis dose and central vein obstruction, more frequent hospitalization due to dysfunction of catheter thrombosis, bleeding, and hematoma (70).

Survival in patients with ESRD is made possible by the removal of uremic solutes by dialysis. The amount of dialysis that a patient receives and the amount of uremic toxin removal can impact morbidity and mortality (71). The estimated mortality rate study in China was 72.7%of patients who had 4.26 times less chance of survival for hemodialysis twice-weekly compared to patients with three weekly hemodialysis. A higher dose of dialysis greater than 1.2 standard Kt/volume offered better survival lower dose less than 1.2 standard k t/volume (43).

A study conducted in Austria showed that 4.5% patients of received greater than 3 sessions/week and 3.1% received greater than 5 h/session. After frequency control patients on hemodialysis sessions greater than 5 h had a significantly reduced risk of death compared to patients on hemodialysis sessions less than 5h, while patients on hemodialysis sessions greater than 3 sessions/week of hemodialysis had a similar risk of death compared to patients on 3 sessions/week of hemodialysis (72).

A retrospective follow-up study initiation session of more than 4 hours and only 3 hours showed that the mortality rate among patients undergoing dialysis at 4-hour facilities was 13.1/100 person-years, compared to 20.5/100 person-years among those at 3-hour facilities (73). Another randomized clinical study in the United States compared patients who extended their hours' of hemodialysis time with those who started maintenance dialysis with traditional hemodialysis. The average duration of each cycle was 399 minutes, compared to 211 minutes for traditional therapy and 211 minutes for traditional therapy. For extended-hour hemodialysis, the mortality rate was 6.4 deaths per 100 patient-years, while the mortality rate of traditional hemodialysis was 14.7 deaths per 100 patient-years. The study found that extended-hour hemodialysis patients had a 33% lower risk of death than those with traditional hemodialysis (74). Frequent and prolonged dialysis reduces myocardial pressure by reducing weight gain inter-dialysis room, reducing blood pressure fluctuations, and lowering blood pressure, and making blood pressure more stable

Patients on maintenance hemodialysis develop anemia due to the complication of chronic kidney failure this leads to increased morbidity and mortality due to cardiovascular disease and affects the quality of life of patients. Patients with hemoglobin levels greater than 10 mg/dl compared to those with lower hemoglobin levels have a 74% lower risk of death decrease(41). Maintenance target hemoglobin is 10–12 g/d (75). Erythropoietin treatments for management anemia in hemodialysis patients better survival (35, 76).

The membrane used in dialyzer can affect the survival of hemodialysis patients. In patients with 24 hours, residual urine volume less than 100 ml but not in patients with 24 hours residual urine volume less than 100 ml, hemodialysis using high-flux dialysis membranes showed batter a survival (77).

2.4. Conceptual framework

Considering the above review of survival status and mortality predictors for maintenance hemodialysis of end-stage renal disease, the conceptual framework presented below shows the interaction between different variables with the outcome variable. It contains socio-demographic factors, clinical parameters, and treatment-related factors. It was developed from different literature works with slight modification (34, 40, 55, 78-81).

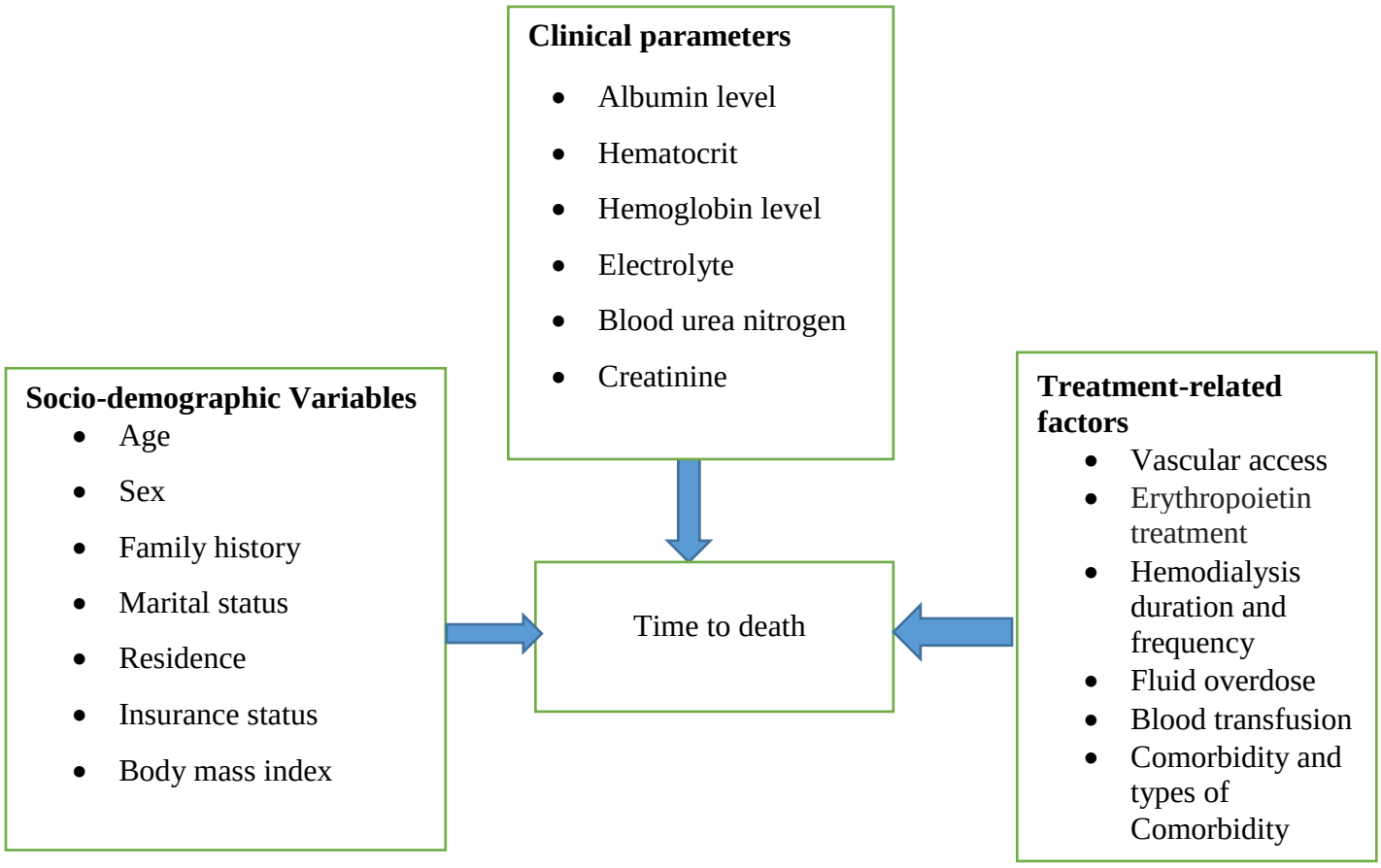

Figure 1: Conceptual framework on survival status and predictors of mortality maintenance hemodialysis among end-stage renal disease in governmental hospital dialysis centers, Addis Ababa, Ethiopia, 2021.

3. Justification

End-stage renal disease is the commonest and important public health problem both in developed and developing countries. In Ethiopia, access to dialysis services is increasing, but the survival rate of patients with this disease is still very low and the factors of death few know. There are few studies were conducted on survival status but did not touch the potential factors that cause death. Therefore, the purpose of this study was determined to the survival status and predictors of mortality among patients undergoing maintenance hemodialysis.

4. Significance of the study

End-stage renal disease is becoming a major public health problem, especially in Ethiopia, where the current prevalence and incidence are increasing day today(34). Comorbidities such as diabetes and hypertension have also led to the loss of kidney function. This research will be of important practical for patients and society as a whole to understand their prognosis over time and life expectancy based on the conditions of treatment. This study provides empirical evidence for nurses and other healthcare professionals to implement early detection, prioritize interventions, estimate the patients' survival rate, and make evidence-based decisions. Evidence of the study on patients on maintenance hemodialysis in the area can be used to help nephrology program managers develop a national strategy for the prevention and treatments of patients with end-stage renal disease. Finally, this research will be used as a baseline for future research.

.

.

5. OBJECTIVES OF THE STUDY

5.1. General objective

- To assess the survival status and predictors of mortality on maintenance hemodialysis among end-stage renal disease patients in governmental hospitals dialysis centers at Addis Ababa, Ethiopia, 2021.

5.2. Specific objectives

- To determine the survival status among end-stage renal disease undergoing maintenance hemodialysis patients in governmental hospitals dialysis centers at Addis Ababa, Ethiopia, 2021.

- To identify the predictors of mortality among end-stage renal disease undergoing maintenance hemodialysis patients in governmental hospitals dialysis centers at Addis Ababa, Ethiopia, 2021.

6. METHODS AND MATERIALS

6.1. Study Area

The study was conducted at the dialysis centers of the government hospital in Addis Ababa, the capital of Ethiopia. The city has eleven sub-cities and is located at an elevation of 7.546 feet (2300 meters) above sea level. There are twelve governmental and nine non-governmental hospitals in the city with three governmental hospitals offering dialysis services. These are Saint Paul's hospital millennium medical college, Zewditu memorial hospital, and Minilik II hospital. Currently, in governmental hospital dialysis centers, Saint Paul Hospital Millennium Medical College has 33 dialysis machines providing more than 80 patients per week, Zewditu Memorial Hospital has 6 dialysis machines and providing dialysis for about 26 Patients, Menilik referral hospital has currently 10 machines and providing hemodialysis for about 26 patients with end-stage renal disease (82).

6.2. Study period

The study was carried out from February to March 2021.

6.3. Study design

An institution-based retrospective cohort study was employed in this study.

6.4. Source population and study population

6.4.1. Source population

All medical records on maintenance hemodialysis in governmental hospitals dialysis centers in Addis Ababa.

6.4.2. Study population

All medical records of end-stage renal disease patients undergoing maintenance hemodialysis attended dialysis centers during the period from January 1st, 2014 to December 31st, 2019 time periods.

6.5. Inclusion and exclusion criteria

6.5.1. Inclusion Criteria

- All medical records of patients who were on maintenance hemodialysis for ESRD during the specified period were included in the study.

6.5.2. Exclusion criteria

- Medical records of patients, who started on hemodialysis for acute renal failure, transfer in from other dialysis centers.
- Incomplete medical records and missed medical records during data collection

6.6. Sample size determination and sampling procedure

6.6.1. Sample size determination

The entire population small and below the calculated sample size to present a full and reliable picture of the population. The sample size was all medical records of maintenance hemodialysis patients who have undergone hemodialysis in enrolled in three governmental dialysis centers (St. Paul's hospital millennium medical college, Zewditu memorial hospital, and Minilik hospital) from January 1^{st,} 2014 to December 31st, 2019. Within the data collection period, 176 patients registered from January 1^{st,} 2014 to December 31^{st,} 2019 from this 12 charts were excluded due to incompleteness, 7 charts missing finally 157 patients' medical records that have fulfilled the criteria were included in the study.

6.6.2. Sampling procedure

First, all medical records of patients on maintenance hemodialysis of end-stage renal disease patients registered from January 1^{st,} 2014 to December 31st, 2019 were selected then study participants who fulfill inclusion criteria were selected starting from January 1st, 2014, to December 31st, 2019 using a census sampling technique.

6.7. Study variables

6.7.1. Dependent variable:

- Time to death

6.7.2. Independent variables

- **Socio-demographic factors** -Age, sex, family history, marital status, residence, insurance status, blood group, and body mass index.
- **Clinical parameters** -albumin, hemoglobin, hematocrit, electrolyte, blood urea nitrogen, creatinine, and comorbidity, and types of comorbidity.
- **Treatment factors** -Types of vascular access, duration of dialysis, frequency of dialysis, erythropoietin supplement, adequacy of treatment and fluid overdose, blood transfusion.

6.8. Operational definitions

Censored: Patients who didn't develop the outcome of interest (death) at the end of the follow-up period.

Event: death of patients due to the end-stage renal disease on maintenance hemodialysis

Follow-up period: The time from the beginning of the study period to an event, the end of the study, or loss of contact or withdrawal from the study.

Time to death: the time between the first dates of hemodialysis to the date of death

Survival status: The outcome of patients' status dichotomized death or censored.

Follow-up- Causes of death were obtained from the patients' death certificates. Patients submitted to kidney transplant were censored at the date of transplantation for survival analysis.

Incomplete card – charts which were unknown the starting of hemodialysis and end date

6.9. Data collection tools and procedures

The data was collected by using a data extraction tool adapted from different studies (33, 35,39-41) which consisted of socio-demographic information (including age, sex, residence area) and clinical parameters and laboratory investigation (including hemoglobin, creatinine, and blood urea nitrogen levels, number of weekly dialysis sessions, the type of intravenous access) these were conducted by reviewing patients' medical records and the cause of death was obtained from the patients' death certificate. Then, the records of all the study participants were selected according to the eligibility criteria. Six BSc nurses (two in every hospital) and two MSc nurses for supervisors who were involved in the data collection in a specific period.

6.10. Data quality Assurances

To ensure the quality of the data the questionnaires were adapted from different published articles with some modification and check by a senior researcher and academician. Pretest on 5% medical record review was done at Saint Paul Hospital Millennium Medical College two weeks before the actual data collection time. Training to data collectors and supervisors was given for one day. The training was focused mainly on the aim of the study and the data extraction tool, the need for data completeness, confidentiality, and how to approach data extraction during the data collection process. After the collected data were checked daily for its completeness, clarity, and consistency by the supervisor and the principal investigator. Overall activity was controlled by the principal investigator.

6.11. Data processing and analysis

Data were cleaned, coded, and then entered into using epi-data version 4.2 and statistical analysis was performed using STATA 14 after export. The mean, median, and standard deviation of the descriptive statistics were used to summarize continuous data and frequency distribution for categorical data. The incidence density and cumulative incidence density were calculated over the study period. The patients’ status was dichotomized into death and censor. The survival table was used to estimate the probability of survival of maintenance hemodialysis at different time intervals. Kaplan

Meier survival curve, and the log-rank test, was used to estimate the survival curve and the existence of differences in survival between explanatory variables. Prior to Cox proportional hazard regression, multicollinearity was checked. The basic assumptions of the Cox regression model were tested by using the goodness-of-fit test by Shenfield residual and variables having P-value >0.05 were considered as fulfilling assumptions.

Bivariate Cox- proportional regression was done at the p-value < 0.25 those variables fitted at a p-value less than 0.25 were input into multivariable Cox proportional regression analysis. Those predictors' variables with a p-value less than 0.05 were considered as statistically significant factors from time to death in hemodialysis patients. The P-value with a hazard ratio was used to determine the statistical significance and strength of association between the predictors' variable and outcome variables.

6.12. Ethical consideration

Ethical clearance was obtained from the institution review board (IRB) of Addis Ababa University, School of Nursing, and Midwifery. The cooperation letter was written to the concerned bodies. Consent was obtained from the medical director and dialysis center focal person of each hospital. The name of the patient was not extracted to ensure the privacy of patients and confidentiality was maintained throughout the study. To keep all confidentiality, after the computer collects data was coded and locked by password, and the data was disclosed to any person other than the principal investigator.

6.13. Dissemination of result

The result of the thesis will be presented and submitted to Addis Ababa University, College of Health Science, School of Nursing and Midwifery, Department of nursing. The result will also be distributed to governmental hospitals, dialysis centers in Addis Ababa. In addition, the final result document will be presented to responsible bodies working in the area. The final effort will be made to publish in a peer-reviewed Journal.

7. Result

7.1. Socio-demographic characteristics of the study participants

Out of 157 study participants, 120 were censored and 37 have died. About night-nine (63.1%) were male. At the beginning of hemodialysis mean age of the patients was 39.43 $\pm$ 12.9 SD years minimum and maximum age 19 and 76 respectively. A large proportion of 122(77.7%) of the patients from Addis Ababa. More than half 87(55.4%) were married. BMI most participants were in the 18.5-24.9 Kg/m^2 range. About more than two-thirds 131 (83.4%) of the participants were paid. Regarding the potential cause of CKD, eighty (51%) were hypertension and 6.4 % diabetes, 8.9% both hypertension and diabetes and 10.2% glomerulonephritis (Table 1).

Table 1. Baseline socio-demographic characteristics of maintenance hemodialysis patients' governmental dialysis centers from January 2014-December 2019 Addis Ababa Ethiopia (n=157).

Variable	**Category**	**Status of last**		**Total No. (%)**
		Death No. (%)	Censored No. (%)	
Gender	Male	21(21.2)	78(78.8)	99(63.1)
	Female	16(27.6)	42(72.4)	58(36.9)
Age	19-34	9(13.2)	59(86.8)	68(43.3)
	35-64	22(27.2)	59(72.8)	81(51.6)
	>65	6(75.0)	2(25)	8(5.1)
Marital status	Single	11(17.2)	53(82.8)	64(40.8)
	Married	25 (28.7)	62(71.3%)	87(55.4)
	Others	1(16.7)	5(83.3)	6(3.8)
Family history	Yes	5(21.7)	18(78.3)	23(14.6)
	No	32(23.9)	102(76.1)	134(85.4)
Residency	Addis Ababa	26(21.3)	96(78.7)	122(77.7)
	Other	11(31.4)	24(68.6)	35(22.3)
Insurance	Free	1(3.8)	25(96.2)	26(16.6)
	Paid	36(27.5)	95(72.5)	131(83.4)
Body mass index	<18.5	14(35.0)	26(65.0)	40(26.3)
	18.5-24.9	19(19.8)	77(80.2)	96(63.2)
	25-29.5	3(18.75)	13(81.25)	16(10.1)
	>30	-	-	-

NB-CKD Chronic Kidney disease, others - renal trauma, renal stone, and unknown causes

7.2. Clinical parameter and treatment-related factors

Slightly higher than two-third of patients 102(65%) had three sessions of dialysis a week. The duration of each session range between 3.5 to 4 hours. On average, patients took maintenance hemodialysis for a mean of 35.7 months. Only one patient survival longer than 6 years. The mean serum creatinine at dialysis initiation was 8.4 ± 4.66.mg/dl. The mean blood urea nitrogen 81.5 ± 27.87.mg/dl. The arteriovenous fistula was common vascular accesses used for hemodialysis at centers. About 82(52.2%) of patients were given erythropoietin for complication of end-stage renal disease of which 56(68.3%) were given regular and 26 (31.7%) given at least once. Forty-seven (29.9%) of them have been given blood transfusions at least once during their time on dialysis. A paired sample t-test shows that the mean serum creatinine at the last session of hemodialysis dropped from 8.4mg/dl to 6.82mg/dl from initiation of dialysis (P <0001). The mean blood urea nitrogen also drops from the initial dialysis level 81.5mg/dl to 70.1mg/dl last session (P <0.0001) but there was no significant change in hematocrit and potassium, during the initiation of dialysis most patients anemia was recorded. Regarding comorbidity, the most common comorbidity condition was identified with hypertension which was recorded 131(83.4%), 39(24.8% was at least one type of pathology cardiovascular disease, and diabetes mellitus 25(15.9%), and one recorded malignancy (**Table.2**)

Table 2: Clinical parameters and treatment-related characteristics maintenance hemodialysis patients governmental dialysis centers from January 2014- December 2019 Addis Ababa, Ethiopia (n=157).

Variable	**Category**	**Status of last**		**Total No (%)**
		Death No (%)	CensoredNo (%)	
Frequency of dialysis session /week	Twice	7(12.7)	48(87.3)	55(35.0)
	Tripled	30(29.4)	72(70.6)	102(65.0)
Duration of dialysis	3.5 hrs.	3(13.0)	20(87.0)	23(14.6)
	4 hrs.	34(25.4)	100(74.6)	134(85.4)
Types of vascular access	Fistula	16(13.2)	105(86.8)	121(77.1)
	Catheter	21(58.3)	15(41.7)	36(22.9)
Erythropoitin treatment	Yes	16(19.5)	66(80.5)	82(52.2)
	No	21(28.0)	54(72.0)	75(47.8)
Blood transfusion at least once	Yes	16(34.0)	31(66.0)	47(29.9)
	No	21(19.1)	89(80.9)	110(70.1)
Fluid overload	Yes	9(56.3)	7(43.8)	16(10.2)
	No	28(19.9)	113(80.1)	141(89.8)
Baseline albumin (mg/dl)	≤ 3.5	25(42.4)	34(57.6)	59(37.6)
	>3.5	12(12.2)	86(87.8)	98(62.4)
Baseline hemoglobin (g/dl)	≤ 10	21(30.9)	46(69.1)	68(43.3)
	>10	16(18.0)	73(82.0)	89(56.7)
Baseline hematocrit (%)	≤ 30%	23 (33.3)	46 (66.7)	69 (43.9)
	>30%	14 (15.9)	76 (84.1)	88(56.1)
Baseline BUN (mg/dl)	≤81.5	14(17.1)	68(82.9)	82(52.2)
	>81.5	23(30.7)	52(69.3)	75(47.8)
Baseline Creatinine (mg/dl)	≤8.4	15(17.2)	72(82.8)	87(55.4)
	>8.4	48(68.6)	22(31.4)	70(44.6)

7.3. Survival status of maintenance hemodialysis patients

The mean survival of patients was 57.323 months (95% CI; 53.56-61.087) at 72 months of follow-up. The overall mortality rate in follow-up during 467.1 person-year observation (PYO) was 7.92 per 100 (95% CI: 5.74–10.93) pers on-year follow-up. The cumulative incidence of death maintenance hemodialysis patients over six years follow-up period was 37 (23.6%) while 120 (76.4%) of the study participates were censored from this 24(15.2%) were transplanted.

7.4. Overall survival of maintenance hemodialysis patients

In this study, a total of 157 patients on maintenance hemodialysis were followed for a total of 72 months. As shown in the Kaplan- Meier survival estimate curve, in the 72-month follow-up the overall survival rate was 47.6% (95% CI: 30.62-62.85%).The estimated cumulative survival rate of maintenance hemodialysis patients were at 12, 24, 36, 48, and 60 months were 94.8%, 91.1%, 81.2%, 77.3%, and 57.2% respectively **Figure 2**. Kaplan-Meier survival curve indicated that an increase in time decreases the survival rate of hemodialysis patients. In this study, the highest mortality rate was found between 20-40 months. The frequency registered cause of death was cardiovascular disease 35.1% followed by septicemia 21.6% and 16.2 % uremic complication. Thirty-three deaths occurred in the hospital while the remaining four were at home.

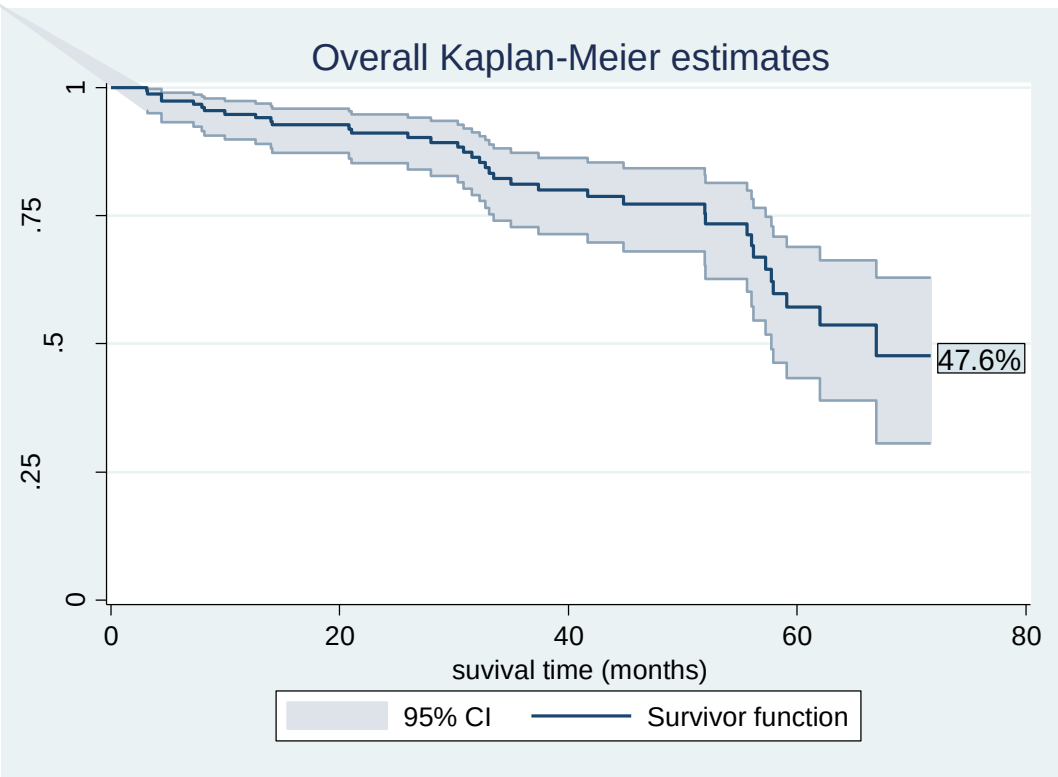

Figure 2. Overall survival status among maintenance hemodialysis patients in governmental dialysis centers, Addis Ababa, Ethiopia from January 2014 to December 2019.

7.5. Survival estimates among predictors variables

The log-rank test was conducted to check for the existence of any significant difference in survival among the various level categorical variable considered in the study. The test statistics in this study showed a significant association in survival function for different variables. According, the Kaplan–Meier analysis indicated that significant evidence of differences, the presents of diabetes mellitus, baseline albumin level and catheter vascular access, erythropoietin treatments. Patients who have diabetes mellitus disease had shorter survival than the non-diabetic disease. The mean survival for those who had diabetes was 38.54month (CL: 29.87-47.21) and non-diabetic 62.33(CI: 58.6-66.1). The baseline albumin less than 3.5mg/dl was short time survival compared to albumin level greater than 3.5mg/dl mean survival (46.86, 95% CI: 41.0-52.3)and 64.38(95%, CI 60.47-68.22). Kaplan-Meier survival analysis showed that vascular access catheter used and erythropoietin treatments were given significantly short and long survival time

respectively. The mean survival time using catheter and fistula was 62.82 (CI: 58.94-66.68) and 44.38(CI: 36.89-51.87) respectively (shown in Table -3)

Table 3. The Mean survival time, cumulative survival probability, and log-rank test for the according to different characteristics of patients six-year follow-up (Kaplan –Meier) hemodialysis patients in governmental dialysis centers hospital Addis Ababa, Ethiopia.2021 (n=157).

Variable	**Category**	**Mean Survival time in months (95% CI)**	**Overall, 6-year Survival (%)**	**Log-rank test (p-value)**
Age	19-34	60.6(54.65-66.5)	77.3	0.065
	35-64	57.6(52.7-62.5)	47.6	
	>65	44.5(28.9-60.2)	0	
Gender	Male	58.9(54.74-62.1)	60.2	0.148
	Female	47.86(47.2-59.2)	18.1	
Residence	Addis Ababa	58.9(54.74-62.1)	54.6	0.049
	Other	47.86(41.97-53.75)	13.9	
Marital status	Single	58.7(52.7-64.8)	66.3	0.42
	Married	56.5(51.7-61.3)	41.1	
	Other	42.0(30.5-53.5)	83.3	
Insurance	Free	65.5(60.5-70.5)	92.3	0.03
	Paid	55.6(51.4-59.7)	42.4	
Family history	Yes	53.57(47.2-61.9)	57.13	0.93
	No	57.4(53.5-61.4)	47.4	
CVD	Yes	48.7(41.89-55.5)	12.3	0.001
	No	62.5(57.34-65.7)	71.74	
HTN	Yes	58.4(54.375-62.4)	48.7	0.206
	No	51.4(42.04-62.712)	42.42	
DM	Yes	38.5(28.87-47.2)	6.33	0.000
	No	62.33(58.62-66.04)	63.9	

Types of vascular	Fistula	62.8(58.9-66.6)	69.8	0.000
	Catheter	44.4(36.9-51.87)	11.1	
Frequency /session	Twice	60.5(53.8-67.21	69.73	0.34
	Tripled	56.3(51.82-60.73)	44.0	
Duration dialysis	3.5hrs	61.99(52.51-71.48	45.7	0.316
	4hrs	56.1(52.1-60.0)	60.7	
EPO Treatment	Yes	61.0(56.55-65.48	54.86	0.039
	No	52.0(46.26-56.75	42.8	
Fluid overdose	Yes	41.93(36.73-53.13)	18.5	0.001
	No	59.41(55.6-63.21)	51.5	
Blood transfusion	Yes	48.46(41.55-55.22)	17.4	0.008
	No	66.38(56.26-64.51)	56.7	
Albumin (mg/dl)	≤ 3.5	46.86(41.0-52.71)	20.4	0.000
	>3.5	64.38(60.47-68.22)	68.4	
Hemoglobin (g/dl)	≤ 10	52.49(46.71-58.29)	24.12	0.023
	>10	60.04(55.52-64.56)	67.9	
Hematocrit (%)	≤ 30	51.1(45.14-56.96)	19.6	0.006
	>30	60.44(56.02-64.86)	67.35	
Blood urea nitrogen(mg/dl)	≤81.5	61.3(56.6-65.9)	51.7	0.065
	>81.5	52.7(47.5-58.0)	50.1	
Creatinine (mg/dl)	≤8.4	61.6(57.3-65.9)	52.7	0.015
	>8.4	51.2(45.5-56.9)	43.6	

NB-CVD-cardiovascular disease, HTN -hypertension, EPO –Erythropoietin, CI- confidence interval

The below graph showed that the mean survival for those patients who had diabetes mellitus was (38.5 months, CI: 28.9-47.2) which was lower than the mean survival time of those who had without diabetes mellitus (62.3 months, CI: 58.6-66.1) with statistical difference of p-value <0.0001 (figure 3 below).

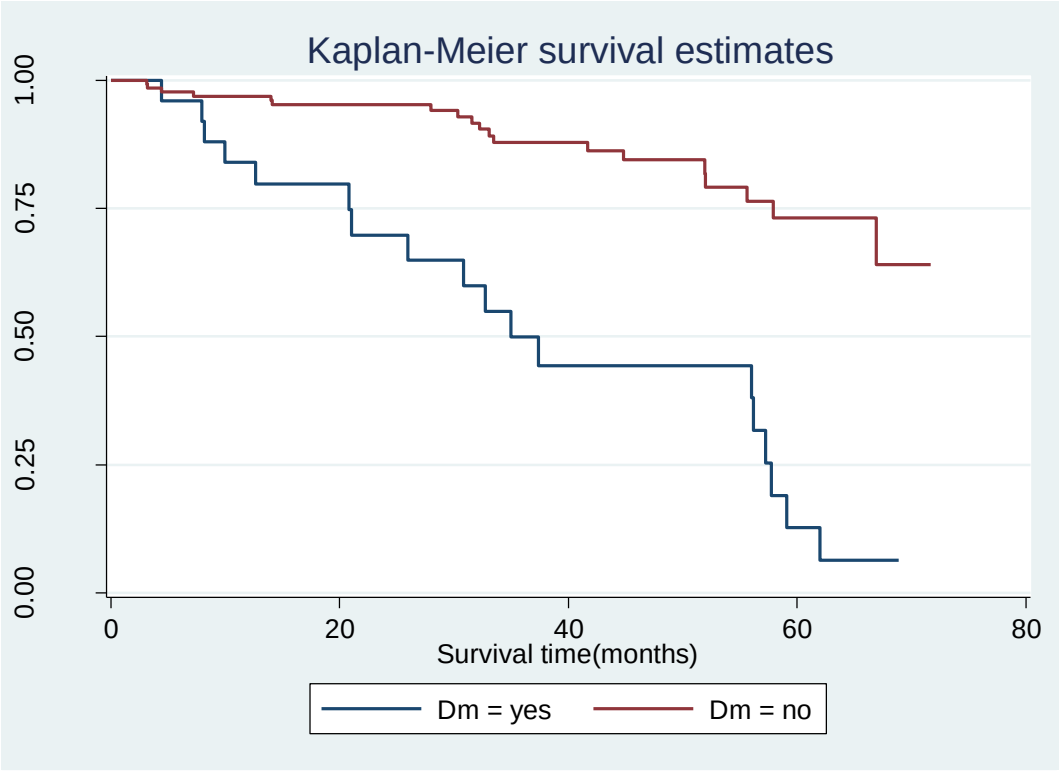

Figure 3. The Kaplan-Meier survival curves compare survival time of patients starting hemodialysis patients present and absence of diabetes mellitus in governmental dialysis centers, Addis Ababa, Ethiopia from January 2014 - December 2019 (n=157).

The Kaplan Meier graph showed that the mean survival for those patients who had catheter was (44.4months, CI: 36.9-51.87) which was lower than mean survival time of those who had a fistula (62.8 months, CI: 58.9-66.6) with statistical difference of p value=0.000(As shown figure 4 below).

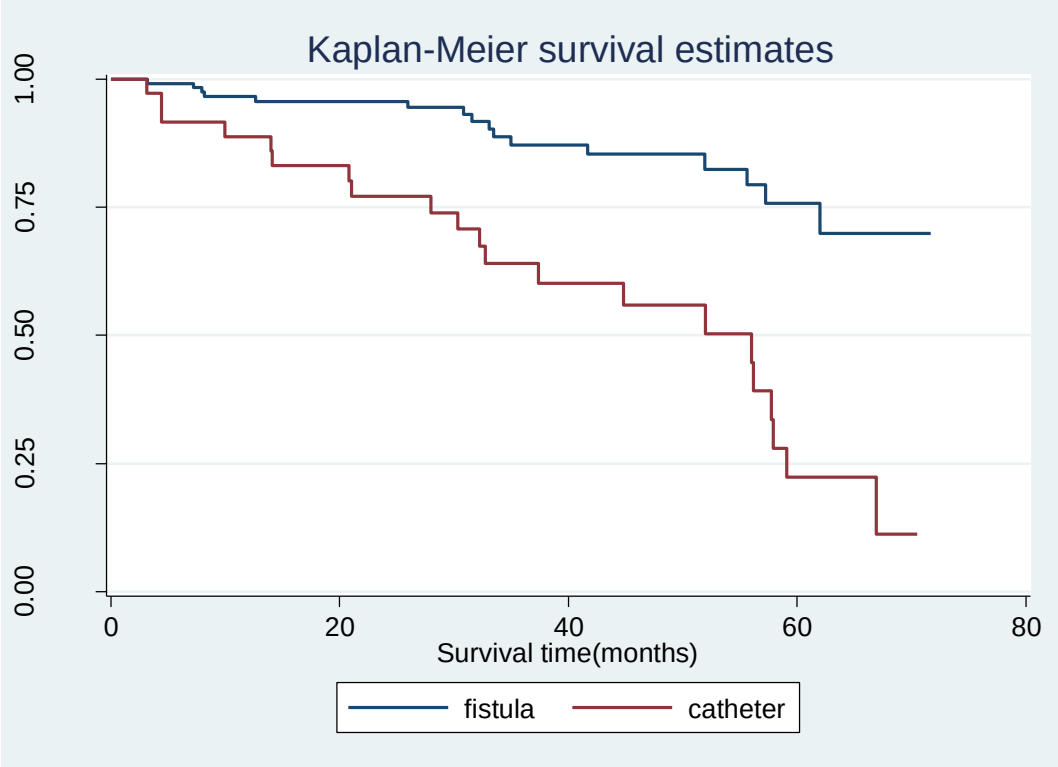

Figure 4. The Kaplan-Meier survival curves compare survival time of patients starting maintenance hemodialysis patients with vascular access types in governmental dialysis centers, Addis Ababa, Ethiopia from January 2014 to December 2019(n=157).

The Kaplan Meier graph indicated that the mean survival for those patients who had albumin level less than 3.5mg/dl (46.46 months, CI: 41.3-52.7) which was lower than mean survival time of those who had albumin level >3.5mg/dl (64.38 months, CI: 60.47-68.2) with statically difference of p value<0.001(As shown figure 6 below).

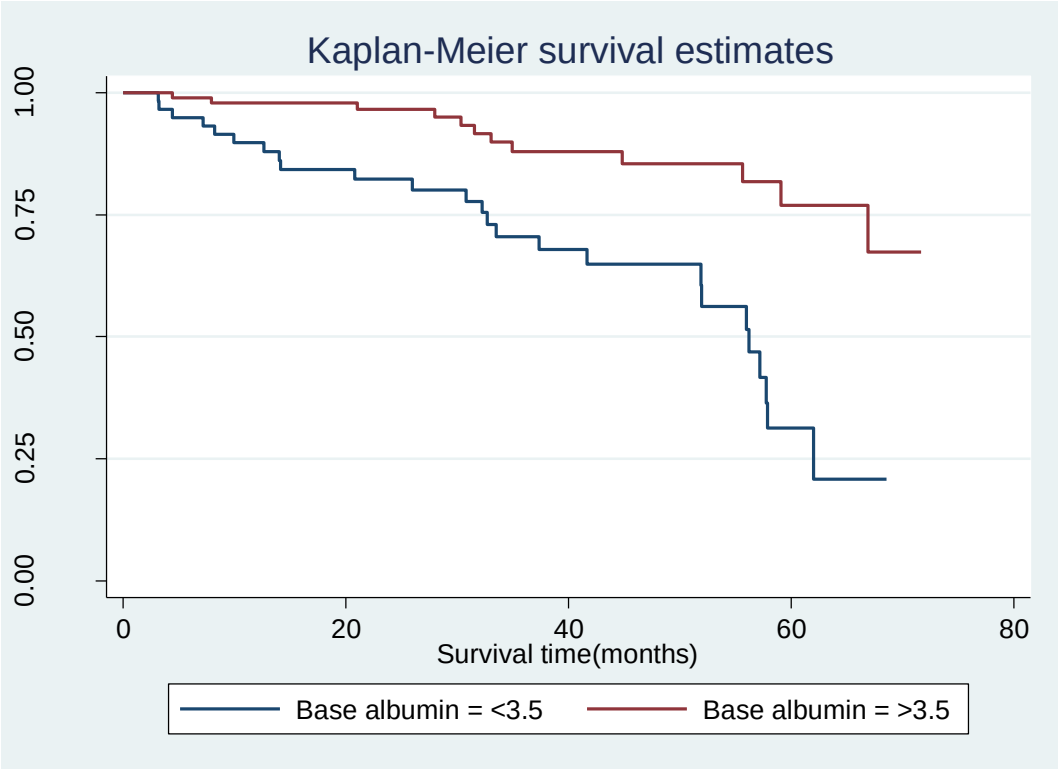

Figure 5. The Kaplan-Meier survival curves compare survival time of patients starting maintenance hemodialysis patients with baseline albumin in governmental dialysis centers, Addis Ababa, Ethiopia from January 2014 - December 2019 (n=157).

The Kaplan Meier graph showed that the survival time of hemodialysis patients who received erythropoietin treatment was longer survival than that of those who had never received it. The mean survival time was (61.0 months, CI: 56.5-65.5) and (52 months CI: 46.26 - 56.7), statistically different p-value = 0.039 (As shown in figure 7 below).

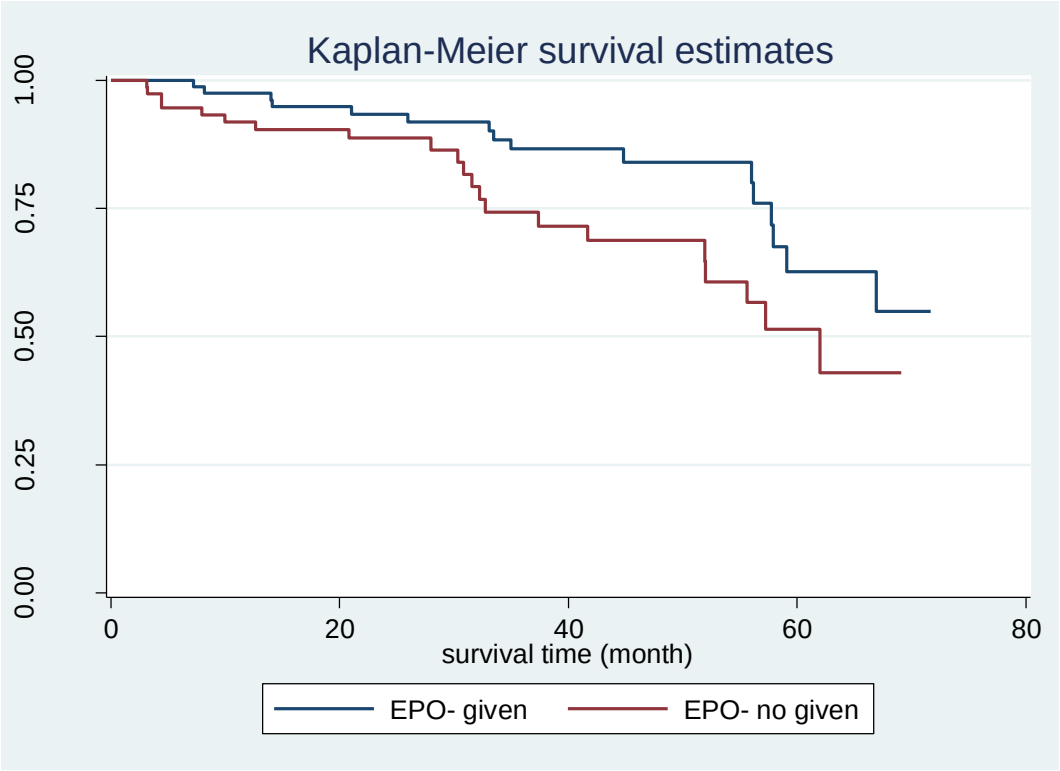

Figure 6. The Kaplan-Meier survival curves compare survival time of patients starting hemodialysis patients with erythropoietin treatment present or absent in governmental dialysis centers, Addis Ababa, Ethiopia from January 2014 to December 2019(n=157).

7.6. Predictors of maintenance hemodialysis mortality patients

In bivariable Cox-proportional hazard regression age group, gender, residency, insurance, CVD, HNT, DM, vascular accesses, erythropoietin treatment, fluid overload, blood transfusion at least once, albumin hemoglobin, blood urea nitrogen, and creatinine were fitted bivariable analysis at ($p < 0.25$). In multivariable those variables with a p-value <, 0.25 in the bivariable analysis and non-collinear independent variables were included. In the multivariable Cox-proportional hazards model; diabetes mallets, vascular accesses, baseline albumin level, and erythropoietin treatment were significant predictors of mortality of patients undergoing maintenance hemodialysis (P-value<0.05).

As the multivariable analysis showed patients who had diabetes mellitus were 3.1- times at high hazard to die than patients without diabetes mellitus (AHR: 3.1, 95%, CI:1.10-8.87**)**. Among hemodialysis patients who had catheter, vascular access was 3.56 times at high hazard to die than those who had a fistula (AHR: 3.56, (95%, CI: 1.60-7.93). Regarding patients with albumin level less than 3.5mg/dl were 3.2 times at high hazard to die than those who were albumin greater than 3.5 mg/dl (AHR: 3.2, CI: 1.245-8.10). Furthermore, patients who have been given erythropoietin treatments during hemodialysis were reduced mortality by 67% compared to those who were never given (AHR: 0.33, 95% CI: 0.143-0.77) (Table 4).

Table 4. Bivariable and multivariable Cox-regression analysis result maintenance hemodialysis patients governmental dialysis centers, Addis Ababa, Ethiopia from January 1st, 2014 to December 31st, 2019(n=157).

Independent Variables	Bivariable cHR (95% CI)	Multivariable aHR (95% CI)	p-value
Age			
19-34	1	1	
35-64	1.32(0.60-2.91)	0.71(0.26-1.96)	0.51
>65	3.2(1.123-9.141) *	0.27(0.05-1.59)	0.15
Gender			
Male	1	1	
Female	1.62(.84-3.13)	1.61(0.63-4.17)	0.31
Residence			
Addis Ababa	1	1	
Other	2.04(0.98-4.21)	1.46(0.56-3.794)	0.43
Insurance			
Free	1	1	
Paid	6.67(.914-48.6)	3.7(0.46-29.64)	0.21
CVD			
No	1	1	
Yes	2.84(1.48-5.42) **	1.22 (0.47-3.15)	0.68
HNT			
No	1	1	
Yes	0.61(0.27-1.32)	0.38(0.14- 1.10)	0.07
DM			
No	1	1	
Yes	5.45(2.85-10.42) ***	3.1(1.10-8.87) *	0.035
Vascular			
Fistula	1	1	
Catheter	4.21(2.196-8.077) ***	3.56(1.60-7.93)*	0.002
Fluid overdose			
No	1	1	
Yes	3.34(1.569-7.119) *	2.39(.829-6.94)	0.10
EPO treatment			
No	1	1	
Yes	0.51(0.262-0.98) *	0.33(0.14-0.77) *	0.011

Blood transfusion			
No	1	1	
Yes	2.38(1.235-4.589)**	2.25(.859-5.92)	0.09
Baseline albumin			
>3.5mg/dl	1	1	
≤ 3.5mg/dl	4.4(2.162-9.024) ***	3.2(1.245-8.10) *	0.016
Baseline Hemoglobin			
>10mg/dl	1	1	
≤ 10mg/dl	2.1(1.091-4.038) *	1.8(.67-5.13)	0.22
Baseline Hematocrit			
> 30%	1	1	
≤ 30%	2.43(1.258-4.706) *	1.6(.59-4.47)	0.34
Baseline BUN			
≤ 81.5mg/dl	1	1	
>81.5mg/dl	1.8(0.95-3.67)	2.25(0.94-5.41)	0.06
Baseline creatinine			
≤ 8.4mg/dl	1	1	
> 8.4mg/dl	2.23(1.153-4.33)*	1.45(0.65-3.22)	0.35

NB: CI; confidence interval, AHR; adjusted Hazard ratio, CHR: crude hazard ratio, CVD -cardiovascular disease, DM-diabetes mallets, HTN-hypertension, EPO –erythropoitin treatment * indicate Significant (P-value < 0.05), ** indicate significant (p-value<0.01), *** indicate significant (p<0.001)

7.7. Test of proportional hazard assumption

A Cox regression model was used to examine the fitted proportional hazard models. A. goodness-of-fit (GOF) was conducted particularly the Schoenfeld residuals proportional hazard (PH) assumption test for the individual covariates and global tests were used. From Table below. Each covariate (P-Value > 0.05) and all of the covariates at the same time (Global test for Cox proportional hazard P-Value=0.7514>0.05) satisfy the PH assumption.

Table 5. Goodness-of-fit test assessing proportional hazards Assumption.

Variable	rho *	Chi-square	df**	Prob>chi2
Age	0.16926	1.68	1	0.1953
Gender	0.24426	3.27	1	0.0704
Residence	0.06375	0.15	1	0.6987
Insurance	-0.09914	0.44	1	0.5048
Cardiovascular disease	-0.06513	0.23	1	0.6333
Hypertension	0.22916	2.98	1	0.0841
Diabetes mellitus	0.13342	1.43	1	0.2313
Vascular access	0.08555	0.35	1	0.5558
EPO treatment	0.17519	1.51	1	0.2198
Fluid over	-0.08608	0.34	1	0.5576
Blood transfusion	-0.02234	0.02	1	0.8798
Albumin	-0.03057	0.06	1	0.8038
Hemoglobin	0.10265	0.71	1	0.3999
Hematocrit	-0.16513	1.75	1	0.1858
Creatinine	-0.04994	0.11	1	0.7444
Blood urea nitrogen	0.04786	0.12	1	0.7277
Global test		11.89	16	0.7514

*The correction coefficient between the residual times **degree of freedom

8. Discussion

Hemodialysis is a common renal replacement therapy option for end-stage renal disease patients in Ethiopia. In this retrospective follow-up study was aimed to assess the survival and predictors of maintenance hemodialysis patients to identify factors that could be associated with mortality follow–up for 72 months. At the end of the follow-up, the study showed that the cumulative incidence was found to be 37(23.6%) and mortality rate 7.9 (95% CI: 5.74– 10.93) person per year. This finding in line with the study in Brazil [24.69%] (40), Indian [19.8%](83). Although the lower than that of a study conducted in Iran [34.4%] (42). Ethiopia [45.1%](35) and higher than south Indian [10.4%](46) the possible explanation could be variation in sample size and follow-up period there was change treatment modality.

The mean survival time was 57.3 months (95%, CI: 53.5-61.1) the highest mortality rate occurred between 24-48 months, and 35% of deaths occurred. In contrast reports from the previous study showed that the mortality rate was higher in the first 12 months(36). In Ethiopia [23.1%] was died in first 3 months (35), India [66 %] died in first 4 months (84). This difference could be justified by in this study high rate of renal transplantation may cause patients to withdraw from hemodialysis and delay the registration of deaths at home. Another possible explanation age of patients who start hemodialysis treatment their sample was used older age.

This retrospective follow-up study revealed that the overall 1, 3-, and 5-years survival rate were 94.8%, 81.2%, and 57.2 % respectively. This finding is consistent with other similar study which have been conducted Taiwan [92.1%, 77.4 % and 66.4%] (44), Iran [91.9%, 66%, and 46%)] (42), Morocco [95%, 87.3% and 80.2%](47).However, this finding was higher than reported from a previous study in Ethiopia, Addis Ababa [45.1% and 16.5 %] (35), in Mekel [55 % and 21.5%] (50) at 1 - 5-years. Even higher than other previous result in Indian [87.3% ,45.5 % and 21.5%] (45), Brazil [84.7%,78.7% and 63.3%] at 1- 3 and 5 years (40).The possible explanation variation in survival could be due to different, sample composition regarding age, comorbidity condition and also higher transplantation rate in our patients leaves from undergoing hemodialysis and the

period of study, the accessibility of hemodialysis services was the increase in currently and also delay the recording of patients' deaths at home.

Diabetes mellitus is another comorbidity risk factor and had a significant negative impact on patient survival. According to this study, patients with diabetes mellitus had a 3.1-times greater hazard to die than those who do not have diabetes mellitus (AHR,3.1, 95%CI: 1.10-8.87). This finding is supported by the study conducted in Taiwan, Iran, and Indian the presents of a diabetic was an increase in mortality 1.77, 1.9, and 1.73-times compared with non-diabetes mellitus respectively (44, 58, 85).
This explained that some factors may be contributed to the poor prognosis of survival diabetic patients including deterioration of atrial stiffness, infection, a problem with vascular access, and weight gain during hemodialysis interval high probability to occurred die in diabetic mellitus patients (59).

This study showed that a baseline albumin level of less than 3.5mg/dl was found a significant predictor of death among end-stage renal disease on maintenance hemodialysis. Accordingly, patients who had an albumin level < 3.5mg/dl 3.2-times more hazard to die as compared to those who had albumin greater than 3.5mg/dl [AHR: 3.2, CI: 1.245-8.10]. This finding is supported by a previous study which has been conducted in West Iran mortality of patients with an albumin level of less than 3.5 g/dL was 2.05 times higher hazard than those with higher amounts of albumin (62).Taiwan low albumin 1.40-time higher hazard of die(44). Brazil low albumin levels were 5.74-times an increased hazard of mortality compared to the highest albumin (40).

The possible explanation related to dialysis patient's low serum albumin level indicated that low level of protein which leads to inflammation, inability to hemostasis of body fluid due to decrease in oncotic pressure and other complication of CKD like anemia, and decrease over time correlated with increase cardiovascular death(61). Another explanation of renal dysfunction and physician prescribed dietary-recommendation, disease association inadequate dietary intake, across dialysis membrane further reduced albumin level increase hazard of the die.

The Studies showed that types of vascular access powerful predictors of patients' survival. The current study showed that 22.9% of patients had catheter as vascular access 58.8% death compared with fistula. The mean survival was 44.4 months [95%, CI 36.8-51.8] for the catheter group and 62.8 months [95% CI: 58.9-66.6] in fistula vascular accesses (p< 0001). Patients having catheters had 3.56 times a hazard to die compared to fistula [AHR, 3.56, CI: 1.59-7.58]. This finding is supported by previous studies conducted French, United State, Iran, and Taiwan in which was 1.74, 2.25, 1.58, and 3.23-times higher hazard compared with fistula respectively (44, 59, 69, 76).

Several explanations have been suggested for patients with catheters dialysis were catheter-related bloodstream infection, catheters deliver a lower blood flow which may lead to a lower dialysis dose, central vein obstruction, and more frequent hospitalization due to dysfunction of catheter, thrombosis, bleeding, and hematoma formation (70, 86).

The result from this study shows that patients who had received erythropoietin treatments were found to be a predictor of longer survival than those who had never received erythropoietin treatments regardless of the dose erythropoietin which patients who give erythropoietin had 67% reduce mortality compared with never given AHR,0.33(95%, CI:0.143-0.77). This is supported by a previous study in Ethiopia patients given erythropoietin treatments longer survival than not given (35). United States study showed that patients treated with erythropoietin were significant improvements (76). This could be justified by patients treated with erythropoietin can prevent anemia by increasing hemoglobin levels, thus increasing maximum oxygen consumption, improving quality of life, and preventing chronic kidney disease complications such as heart disease (87).

9. STRENGTHS AND LIMITATIONS

9.1. Strength

- The study was conducted for a long-term follow-up (six years), which increased the observation time and allowed us to understand the long-term impact of maintenance hemodialysis on patients survival
- Data were collected by nurses who were experienced in data collection, which plays an important role in data quality.

9.2. Limitations

- Data collected from secondary source; some important predictors were not registered and not included in the analysis, but several studies report that these predictors determine the survival rate of hemodialysis patients, such as the nutritional status of the patient, C-reactive protein, parathyroid hormone, serum iron levels, serum ferritin level, and lipid profile.
- The sample size small might not be reflecting the overall maintenance hemodialysis patients' status nationally.
- The data were collected retrospectively information bias to some extent existed

10. CONCLUSION AND RECOMMENDATION

10.1. Conclusion

The overall survival probability of hemodialysis patients was 47.6% at the 72 months of follow-up. Despite the advance in diagnosis, pharmacological treatments, and increase in the accessibility of hemodialysis the survival rate was a decline over years, not show improvements. Vascular catheter, baseline albumin level, and comorbidity of diabetes mellitus were found to be significant predictors of mortality. Whereas, erythropoietin treatment reduced mortality in hemodialysis patients. This finding makes it possible to identify high-risk patients early improve and adjust the care of patients on hemodialysis, thus improving the survival rate and quality of life of these patients.

10.2. Recommendations

Based on study finding, the following important recommendations could be forwarded to:

To the federal minister of health:

- Patients on maintenance hemodialysis required long term care need to be strengthened more to develop a way to reducing mortality by providing important clinical laboratory monitoring service such as albumin test, increase the availability of drugs and materials.

To dialysis centers and health care providers:

- Health care providers could be emphasized to those patients with diabetic mellitus comorbidity
- Special emphasis could be given to patients who had used catheter vascular access early detection of catheter-related infection, timely change dysfunction catheter
- Increase availability and accessibility of erythropoietin drug and timely update serum albumin level.

To Future researchers:

- Further prospective follow-up studies could be conducted, including important predictive factors such as the patient's quality of life, parathyroid hormone, nutritional parameters, and blood lipid status, and institutional and social factors
- Could address the limitation of this study

.

11.REFERENCES

1. Webster AC, Nagler EV, Morton RL, Masson P. Chronic kidney disease. The lancet. 2017;389(10075):1238-52.
2. Lok CE, Huber TS, Lee T, Shenoy S, Yevzlin AS, Abreo K, et al. KDOQI clinical practice guideline for vascular access. American Journal of Kidney Diseases. 2020;75(4):1-164.
3. Fraser SD, Roderick PJ. Kidney disease in the global burden of disease study 2017. Nature Reviews Nephrology. 2019;15(4):193.
4. Cockwell P, Fisher L-A. The global burden of chronic kidney disease. The Lancet. 2020;395(10225):662-4.
5. Stirnadel-Farrant HA, Karaboyas A, Cizman B, Bieber BA, Kler L, Jones D, et al. Cardiovascular Event Rates Among Hemodialysis Patients Across Geographical Regions—A Snapshot From The Dialysis Outcomes and Practice Patterns Study (DOPPS). Kidney international reports. 2019;4(6):864-72.
6. Hahr AJ, Molitch, Mark E. Management of diabetes mellitus in patients with chronic kidney disease. Clinical diabetes and endocrinology. 2015;1(1):2.
7. Nzugilwa PM. Survival analysis of patients undergoing hemodialysis during 2015–2018 at Muhimbili Hospital, Dar es salaam, Tanzania: The University of Dodoma; 2019.
8. Ndahayo D. Factors associated with hemodialysis adequacy among end-stage renal disease patients on maintenance hemodialysis in Rwanda: University of Rwanda; 2019.
9. Murdeshwar HN, Anjum F. Hemodialysis. StatPearls. Treasure Island (FL): StatPearls Publishing; 2020.
10. Dai LL, C.Liu, J.Li, S.Jin, H.Chen, F.Xue, Z. Miao, C. Impact of twice- or three-times-weekly maintenance hemodialysis on patient outcomes: A multicenter randomized trial. Medicine. 2020;99(20):2020-2.
11. MEKKI RY, MUDAWI MH, MUSTAFA MS, MOHMMED AOA, Abd ALLA AB, AHMED AR. Parametric Survival Models of Hemodialysis Patients in Relation with Patient-Related Factors. Modern Medicine. 2020;27(4):296.

12. Kassa DA, Mekonnen S, Kebede A, Haile TG. Cost of Hemodialysis Treatment and Associated Factors Among End-Stage Renal Disease Clinicoeconomics and Outcomes Research: CEOR. 2020;12:399.

13. Prabha DR, Prasad G. Predictors of mortality among patients on maintenance hemodialysis. Journal of Dr NTR University of Health Sciences. 2016;5(4):255.

14. Xia XQ, Yagui Yu, Jing Lin, Tong Lu, et al. Ten-year survival of patients treated with peritoneal dialysis: A prospective observational cohort study. Peritoneal Dialysis International. 2020.

15. Liyanage T, Ninomiya T, Jha V, Neal B, Patrice HM, Okpechi I, et al. Worldwide access to treatment for end-stage kidney disease: Systematic review. The Lancet. 2015;385(9981):1975-82.

16. Sanyaolu A, Okorie C, Annan R, Turkey H, Akhtar N, Gray F, et al. Epidemiology and management of chronic renal failure: A global public health problem. Biostatistics Epidemiol Int J. 2018;1(1):5.

17. Stanifer JW, Muiru A, Jafar TH, Patel UD. Chronic kidney disease in low-and middle-income countries. Nephrology Dialysis Transplantation. 2016;31(6):868-74.

18. Shaheen FA, Al-Attar B, Ahmad MK, Follero PM. Burden of disease: Prevalence and incidence of endstage renal disease in middle eastern countries. Clinical nephrology. 2020;93(1):120-3.

19. Ashuntantang G, Osafo C, Olowu WA, Arogundade F, Niang A, Porter J, et al. Outcomes in adults and children with end-stage kidney disease requiring dialysis in sub-Saharan Africa: a systematic review. The Lancet Global Health. 2017;5(4):e408-e17.

20. Wick JP, Turin TC, Faris PD, MacRae JM, Weaver RG, Tonelli M, et al. A clinical risk prediction tool for 6-month mortality after dialysis initiation among older adults. American Journal of Kidney Diseases. 2017;69(5):568-75.

21. Bikbov B, Purcell CA, Levey AS, Smith M, Abdoli A, Abebe M, et al. Global, regional, and national burden of chronic kidney disease, 1990–2017: A systematic analysis for the Global Burden of Disease Study 2017. The Lancet. 2020;395(10225):709-33.

22. Saran R, Robinson B, Abbott KC, Agodoa LY, Bhave, Nicole, Bragg-Gresham ea. US renal data system 2017 annual data report: Epidemiology of kidney disease in the United States. American journal of kidney diseases. 2018;71(3):1-7.

23. Kramer A, Pippias M, Noordzij M, Stel VS, Afentakis N, Ambühl PM, et al. The European renal association–European dialysis and transplant association (ERA-EDTA) registry annual report 2015. Clinical kidney journal. 2018;11(1):108-22.

24. Martin Neovius SHJ, Jonas K Eriksson,Carl-Gustaf Elinder,Britta Hylander. Mortality in chronic kidney disease and renal replacement therapy:a population-based cohort study. BMJ Open. 2014;4.

25. Tapak L, Sheikh V, Jenabi E, Khazaei S. Predictors of mortality among hemodialysis patients in Hamadan province using random survival forests. Journal of Preventive Medicine and Hygiene. 2020;61(3):482.

26. Wong MM, Thijssen S, Wang Y, Usvyat LA, Xiao Q, Kotanko P, et al. Prediction of Mortality and Hospitalization Risk Using Nutritional Indicators and Their Changes Over Time in a Large Prevalent Hemodialysis Cohort. Journal of Renal Nutrition. 2020;30(1):69-78.

27. Yu SB, Yuan HH, Salerno S, Gou SJ, Chen WW, Yang HL, et al. Risk factors for mortality at beginning of maintenance hemodialysis. Chinese medical journal. 2020;133(7):868-70.

28. Liu J, Yu SB, Zeng XX, Yuan HH, Salerno S, Fu P. Clinical Characteristics of Pneumonia in Chinese Hemodialysis Patients. Chinese medical journal. 2018;131(4):498-501.

29. Agboton B, Agueh V, Vigan J, Sourou B, Ahoui S, Agboton C, et al. Assessing the Nutritional Status of Hemodialysis Patients in a Sub-Saharan Country. J Kidney. 2017;3(145):2472-620.

30. Yajima T, Yajima K, Takahashi H, Yasuda K. The impact of abdominal fat levels on all-cause mortality risk in patients undergoing hemodialysis. Nutrients. 2018;10(4):480.

31. Wang C, Yang Y, Yuan F, Li HQ, He LY, Liu D, et al. Initiation Condition of Hemodialysis Is Independently Associated with All-Cause Mortality in Maintenance Hemodialysis Patients: A Retrospective Study. Blood purification. 2019;48(1):76-85.

32. Salman Khazaei (PhD) MYP, Vida Sheikh (MD), Maryam Nazemipour (PhD), Ebrahim ,Hazrati (MD), and Mohammad Ali Mansournia (MD, MPH, PhD). Survival Percentile and Predictors of Difference in Survival among Hemodialysis Patients and Their Additive Interaction Using Laplace Regression. Journal of Research in Health Sciences. 2020;20.

33. Mequanent W. Mekonen KAB, Dessie M. Chekole, Endeshaw A. Derso. Determinants of Overall Survival of Kidney Failure for Patients Receiving Dialysis in Saint Geberial General Hospital, Addis Ababa, Ethiopia. Journal of Kidney. 2020:6:180.

34. Tolossa T, Fetensa G, Regassa B, Tigistu M, Fekadu G, Besho M, et al. Burden and determinants of chronic kidney disease among diabetic patients in Ethiopia: A systematic Review and Meta-analysis. 2020.

35. Shibiru T, Gudina EK, Habte B, Deribew A, Agonafer T. Survival patterns of patients on maintenance hemodialysis for end-stage renal disease in Ethiopia: summary of 91 cases. BMC nephrology. 2013;14(1):127.

36. Hazara AM, Bhandari S. Early mortality rates after commencement of maintenance hemodialysis: A systematic review and meta-analysis. Therapeutic Apheresis and Dialysis. 2020;24(3):275-84.

37. 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 (London, England). 2018;392(10159):2052-90.

38. Pecoits-Filho R, Okpechi IG, Donner JA, Harris DCH, Aljubori HM, Bello AK, et al. Capturing and monitoring global differences in untreated and treated end-stage kidney disease, kidney replacement therapy modality, and outcomes. Kidney Int Supple. 2020;10(1):3-9.

39. De Souza Ferreira E, Moreira TR, da Silva RG, da Costa GD, da Silva LS. Survival and analysis of predictors of mortality in patients undergoing replacement renal therapy: a 20-year cohort. BMC nephrology. 2020;21(1):1-14.

40. Teixeira FL, M. L. Silva, G. A. Santos, R. F. Survival of hemodialysis patients at a university hospital. Jornal brasileiro de nefrologia : 'orgao oficial de Sociedades Brasileira e Latino-Americana de Nefrologia. 2015;37(1):64-71.

41. Khazaei S, Yaseri M, Nematollahi S, Zobdeh Z, Sheikh V, Mansournia MA. Survival rate and predictors of mortality among hemodialysis patients in West of Iran. International Journal of Preventive Medicine. 2018;9.

42. Ossareh S, Farrokhi F, Zebarjadi M. Survival of Patients on Hemodialysis and Predictors of Mortality: a Single-Centre Analysis of Time-Dependent Factors. Iranian journal of kidney diseases. 2016;10(6):369-80.

43. 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. Medical science monitor : international medical journal of experimental and clinical research. 2018;24:5329-37.

44. Yeh LM, Chiu SY, Lai PC. The Impact of Vascular Access Types on Hemodialysis Patient Long-term Survival. Scientific reports. 2019;9(1):10708.

45. Lakshminarayana GR, Sheetal LG, Mathew A, Rajesh R, Kurian G, Unni VN. Hemodialysis outcomes and practice patterns in end-stage renal disease: Experience from a Tertiary Care Hospital in Kerala. Indian journal of nephrology. 2017;27(1):51-7.

46. Hemachandar R. Practice pattern of hemodialysis among end-stage renal disease patients in Rural South India: A single-center experience. Saudi Journal of Kidney Diseases and Transplantation. 2017;28(5):1150.

47. Msaad RE, R. Mohtadi, K. Meftah, H.Lebrazi, H.Taki, H. Predictors of mortality in hemodialysis patients. Pan Afr Med J. 2019;33:61.

48. Dada S, Inubile A, Thomas A, Dada O, Akinyemi R. Survival Pattern of Patients on Maintenance Haemodialysis for End Stage Renal Disease in a Nigerian Dialysis Centre. Archives of Nephrology and Urology. 2019;2(1):1-12.

49. Jardine T, Wong E, Steenkamp R, Caskey FJ, Davids MR. Survival of South African patients on renal replacement therapy. Clinical kidney journal. 2020;13(5):782-90.

50. Belachew AB, Mohammed AN, Kahsay AB. Determinants of Survival among Hemodialysis Patients at Ayder Comprehensive Specialized Hospital, Tigray, North Ethiopia: A Retrospective Cohort Study. Research & Reviews: Journal of Oncology and Hematology. 2019;7(3):22-9.

51. Sanyang Y, Sambou M. Mortality rate in hemodialysis patient in Edward Francis Small Teaching Hospital The Gambia. International Journal of Africa Nursing Sciences. 2020;13:1002-6.

52. Matos CM, Silva LF, Santana LD, Santos LS, Protásio BM, Rocha MT, et al. Handgrip strength at baseline and mortality risk in a cohort of women and men on hemodialysis. Journal of renal nutrition : the official journal of the Council on Renal Nutrition of the National Kidney Foundation. 2014;24(3):157-62.

53. Song KK, Zhao DL, Wang YD, Wang Y, Sun XF, Miao LN, et al. Analysis of Factors Associated with Death in Maintenance Hemodialysis Patients: A Multicenter Study in China. Chinese medical journal. 2017;130(8):885-91.

54. Tao SZ, Xiaoxi Liu, Jing Fu, Ping. Socioeconomic status and mortality among dialysis patients: Systematic review and meta-analysis. International urology and nephrology. 2019;51(3):509-18.

55. Park J-M, Lee J-H, Jang HM, Park Y, Kim YS, Kang S-W, et al. Survival in patients on hemodialysis: Effect of gender according to body mass index and creatinine. PloS one. 2018;13(5):965.

56. Brilleman SLM-B, M. Polkinghorne, K. R. McDonald, S. P. Crowther et al. Changes in Body Mass Index and Rates of Death and Transplant in Hemodialysis Patients: A Latent Class Joint Modeling Approach. Epidemiology (Cambridge, Mass). 2019;30(1):38-47.

57. Ceretta ML, Noordzij M, Luxardo R, De Meester J, Abad Diez JM, Finne P, et al. Changes in co-morbidity pattern in patients starting renal replacement therapy in Europe—data from the ERA-EDTA Registry. Nephrology Dialysis Transplantation. 2018;33(10):1794-804.

58. Soleymanian TK, Zeinab,Ramaghi, Rozita,Mahjoub, Alireza,Argani, Hassan. Clinical outcomes and quality of life in hemodialysis diabetic patients versus non-diabetics. Journal of nephropathology. 2017;6(2):81.

59. Alencar De Pinho NC, R.Metzger, M. Labeeuw, M.Ayav, C. et al. Vascular access conversion and patient outcome after hemodialysis initiation with a nonfunctional arteriovenous access: a prospective registry-based study. BMC Nephrol. 2017;18(1):74.

60. Georgianos PA, Rajiv. Blood pressure and mortality in long-term hemodialysis time to move forward. American journal of hypertension. 2017;30(3):211-22.

61. Kamyar Kalantar-Zadeh LHF, Jennifer Bazzanella,Claudy Mullon. Slipping Through the Pores: Hypoalbuminemia and Albumin Loss During Hemodialysis. International Journal of Nephrology and Renovascular Disease 2021;14:11–21

62. Khazaei SY, Mehdi Sheikh, Vida Mansournia, Mohammad Ali. Predictors of long-term survival of hemodialysis patients in Hamadan province, west of Iran. Journal of Nephropathology. 2017;6(4):389-94.

63. Pereira GR, Strogoff-de-Matos JP, Ruzany F, dos Santos SF, D'Almeida Filho E, de Vasconcelos MS, et al. Early changes in serum albumin: impact on 2-year mortality in incident

hemodialysis patients. Jornal brasileiro de nefrologia : 'orgao oficial de Sociedades Brasileira e Latino-Americana de Nefrologia. 2015;37(2):198-205.

64. Nagai K, Tsuchida K, Ishihara N, Minagawa N, Ichien G, Yamada S, et al. Implications of Albumin Leakage for Survival in Maintenance Hemodialysis Patients. Therapeutic apheresis and dialysis : official peer-reviewed journal of the International Society for Apheresis, the Japanese Society for Apheresis, the Japanese Society for Dialysis Therapy. 2017;21(4):378-86.

65. Kuo KL HS, Tseng WC, Tsai MT, Liu JS, Lin MH, Hsu CC, Tarng DC. Association of Anemia and Iron parameters with mortality among patients undergoing prevalent hemodialysis in Taiwan. J Am Heart Assoc. 2018; (15):7.

66. Allon M. Vascular access for hemodialysis patients: New data should guide decision making. Clinical Journal of the American Society of Nephrology. 2019;14(6):954-61.

67. Kim DH, Park JI, Lee JP, Kim YL, Kang SW, Yang CW, et al. The effects of vascular access types on the survival and quality of life and depression in the incident hemodialysis patients. Renal failure. 2020;42(1):30-9.

68. Brown RS, Patibandla BK, Goldfarb-Rumyantzev AS. The Survival Benefit of "Fistula First, Catheter Last" in Hemodialysis Is Primarily Due to Patient Factors. Journal of the American Society of Nephrology : JASN. 2017;28(2):645-52.

69. Soleymanian T, Niyazi H, Noorbakhsh Jafari Dehkordi S, Savaj S, Argani H, Najafi I. Predictors of Clinical Outcomes in Hemodialysis Patients: a Multicenter Observational Study. Iranian journal of kidney diseases. 2017;11(3):229-36.

70. Hamadneh SA, Nueirat SA, Shurrab M, Qunibi WY, Hamdan ZJSJoKD, Transplantation. Vascular access mortality and hospitalization among hemodialysis patients in Palestine. 2018;29(1):120.

71. Vanholder RP, Anneleen Schepers, Eva Glorieux, Griet. Biochemical and clinical impact of organic uremic retention solutes: a comprehensive update. Toxins. 2018;10(1):33.

72. Emmett CJ, Macintyre K, Kitsos A, McKercher CM, Jose M, Bettiol S. Independent effect of haemodialysis session frequency and duration on survival in non-indigenous Australians on haemodialysis. Nephrology. 2020;25(4):323-31.

73. Swaminathan S, Mor V, Mehrotra R, Trivedi AN. Initial Session Duration and Mortality Among Incident Hemodialysis Patients. American journal of kidney diseases : the official journal of the National Kidney Foundation. 2017;70(1):69-75.

74. Rivara MB, Adams SV, Kuttykrishnan S, Kalantar-Zadeh K, Arah OA, Cheung AK, et al. Extended-hours hemodialysis is associated with lower mortality risk in patients with end-stage renal disease. Kidney international. 2016;90(6):1312-20.

75. Ye YL, Hongyong,Chen, Yanbing,Zhang, Yunqiang,Li, Shaomin,Hu, Wentao,Yang, et al. Hemoglobin targets for the anemia in patients with dialysis-dependent chronic kidney disease: a meta-analysis of randomized, controlled trials. Renal failure. 2018;40(1):671-9.

76. Arhuidese IJO, B. J.Nejim, B.Malas, M. Utilization, patency, and complications associated with vascular access for hemodialysis in the United States. J Vasc Surg. 2018;68(4):1166-74.

77. Kim HWK, Su-Hyun Kim, Young Ok Jin et al. Comparison of the impact of high-flux dialysis on mortality in hemodialysis patients with and without residual renal function. PLoS One. 2014;9(6):971-84.

78. Dekker MJ, Konings C, Canaud B, van der Sande FM, Stuard S, Raimann JG, et al. Interactions between malnutrition, inflammation, and fluid overload and their associations with survival in prevalent hemodialysis patients. Journal of Renal Nutrition. 2018;28(6):435-44.

79. Komaba H, Kakuta T, Wada T, Hida M, Suga T, Fukagawa M. Nutritional status and survival of maintenance hemodialysis patients receiving lanthanum carbonate. Nephrology Dialysis Transplantation. 2019;34(2):318-25.

80. 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. Medical science monitor: international medical journal of experimental and clinical research. 2018;24:5329.

81. Chirakarnjanakorn S, Navaneethan SD, Francis GS, Tang WW. Cardiovascular impact in patients undergoing maintenance hemodialysis: clinical management considerations. International journal of cardiology. 2017;232:12-23.

82. Abeje S. Assessment of hemodialysis-associated thrombocytopenia and associated factors among patients on renal replacement therapy in Addis Ababa Ethiopia. 2019.

83. Chandrashekar A, Ramakrishnan S, Rangarajan D. Survival analysis of patients on maintenance hemodialysis. Indian journal of nephrology. 2014;24(4):206.

84. Prasad GP, DRatna. Predictors of mortality among patients on maintenance hemodialysis. Journal of Dr NTR University of Health Sciences. 2016;5(4).

85. Vijayan MR, S. Abraham, G. Mathew, M. Sampathkumar, et al. Diabetic kidney disease patients on hemodialysis: A retrospective survival analysis across different socioeconomic groups. Clin Kidney J. 2016;9(6):833-38.
86. Hurst FP, Lee RE, Thompson AM, Pullin BD, Silverstein DMJCJotASoN. FDA regulatory perspectives for studies on hemodialysis vascular access. 2018;13(3):513-8.
87. Cernaro V, Coppolino G, Visconti L, Rivoli L, Lacquaniti A, Santoro D, et al. Erythropoiesis and chronic kidney disease–related anemia: From physiology to new therapeutic advancements. Medicinal research reviews. 2019;39(2):427-60.

12. ANNEXES

Annex 1: Information Sheet English Version

Title of the Research proposal: Survival status and predictors of mortality on maintenance hemodialysis among end-stage renal disease patients from 2015 to 2019 in dialysis centers in Addis Ababa city, Ethiopia, 2021. A retrospective cohort study

Name of Investigator: Yalew Mossie (BSc)

Name of the Organization: Addis Ababa University, College of Health Science, School of Nursing and Midwifery, Department of Adult health nursing

Name of the Sponsor: Addis Ababa University

Purpose of the Research Project: To assess the survival status and predictors of mortality among end-stage renal disease patients undergoing maintenance hemodialysis enrolled from January 1st, 2014 to December 31st, 2019 in Addis Ababa, Ethiopia, 2021.

Procedure: To achieve the above objective, information that will necessary for the study take from medical record forms with the aid of a data extraction tool and patients enrolled from 2014 to 2019.

Risk and /or Discomfort: since the study was conducted by taking appropriate information from the medical chart, it did not cause any harm to the patients. The name or any other identifying information was not be recorded in the questionnaire, and all information obtained was from the chart keep strictly confidential and in a keeping place. The information retrieves would only be used for the study purpose

Benefits: This research has no direct benefit to the patients whose files/records were included in this research. However, the indirect benefits of this research to program participants and other clients are obvious. This is because if the planner is preparing a planned plan, the client will benefit from the plan to provide appropriate care and treatment services to the patient. All in all, research work has direct major benefits to health care planners and managers

Confidentiality: To ensure confidentiality, the data on the charts was collected without the name of the client, and the information collected from this research project will be kept confidential and stored in the filing cabinet. Also, it is not allowed to be used by

anyone except researchers, and it will be stored in the key and lock system along with the computer pass area`

Person to contact: The research project was reviewed and approved by the Institutional Review Board of the School of Nursing and Midwifery, School of Health Sciences. If you have any questions you can contact any of the following individuals (Investigator and Advisors) and you might ask at any time you want.

Mr. Tigestu Gebreyohannis MSc, Assistant Professor: Addis Ababa University, College of Health Sciences, School of Nursing and Midwifery

Mr. Boka Dugassa MSc lecturer: Addis Ababa University, College of Health Sciences, School of Nursing and Midwifery.

Yalew Mossie, BSc: Addis Ababa University, College of Health Sciences, School of Nursing and Midwifery

Cell phone: +251922266104, E-mail:- ymossie21@gmail.com

Annex 2: Data Extraction tool

This checklist was used for the collection of patient-related and Clinic parameters and treatment-related factors of patients on maintenance hemodialysis in end-stage renal disease. All this information was retrieved from the client's registration book and an individual patient card without mentioning the name of the client from (2014-2019).

Code (MRN)	……		
1.	The date starts hemodialysis …….		
Socio-demographic factors patients			
2.	Age	**_____ years**	
3.	Gender	1. Mal 2. Female	
4.	Body mass index	……...Weight ……...High **……..** Kg/m^2	Category Underweight (under 18.5) Normal weight (18.5-24.9) Overweight 25-29.9 Obesity over 30
5.	Place of residence	1. From Addis Ababa 2. Outside Addis Ababa	
6.	Marital status	1. Single 2. Married 2. Divorced 4. Widowed	
7.	Blood group	1. A 2. B 3. AB 4. O	
2.	Insurance	1. Free 2. paid	
3.	Primary causes of end-stage renal disease	1. Hypertension 2. Diabetes mellitus 3. Glomerulonephritis 4. Urologic and obstructive disease 5. Others…….	
4.	Family history of ESRD	1. Yes, 2. No	

Comorbidity condition		
5.	Cardiac vascular disease	1. Yes 2. No
6.	Anemia	1. Yes 2. No
7.	Hypertension	1. Yes 2. No
8.	Diabetes mellitus	1. Yes 2. No
9.	HIV	1. Yes, 2. No
10.	Malignancy (cancer)	1. Yes, 2. No
Baseline laboratory and Clinical parameters.		
11.	Serum albumin	
12.	Hemoglobin((g/dL)	
13.	Hematocrit	
14.	BUN (mg/dl)	`
15.	Creatinine (mg/dl)	
16.	Calcium	
17.	Potassium	
18.	Sodium	
19.	Phosphate	
Treatment-related factors		
20.	Types of vascular access	1. Fistula 2. Catheter 3. Graft
21.	Frequency of dialysis per sessions/week	1. Once 2. Twice

		3. Tripled
22.	Duration of dialysis	1. 3.5h 2. 4h
23.	Adequacy of dialysis	1. >1.2kt/v 2. <1.2kt/v
24.	Erythropoietin treatment	1. Yes 2. No
25.	If yes in q1. 24	1. Regularly 2. At least once
26.	Fluid overload	1. Yes 2. No
27.	Blood transfusion at least one	1. Yes 2. No
Follow-up status		
28.	Status of the patient during the last contact	**1.** Dead **2.** Censored **3.** Transplant **4.** Loss follow-up
29.	If death when (date)	……..
30.	Where is death occur?	1. At home 2. At hospital
31.	Cause of death	1. Sepsis 2. Cardiovascular disease 3. Uremic complications 4. Metabolic acidosis 5. Sudden death 6. Others…….
32.	Date Last contact date	……..