UGANDA MARTYRS UNIVERSITY

MOTHER KEVIN POSTGRADUATE MEDICAL SCHOOL, NSAMBYA

PREDICTORS OF HOSPITAL SURVIVAL AMONG PATIENTS INITIATED ON HEMODIALYSIS AT A TERTIARY HOSPITAL

BY

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DECLARATION

I, Nakabugo Katumba, do hereby declare to the best of knowledge and understanding, that this thesis entitled "PREDICTORS OF HOSPITAL SURVIVAL OF PATIENTS INITIATED ON HEMODIALYSIS AT A TERTIARY HOSPITAL" is my own original work and that it has never been presented to any institution of learning for any award.

I therefore submit it for the award of the master's degree of medicine in Internal Medicine at Uganda Martyrs University, Nkozi, Mother Kevin Postgraduate Medical School Nsambya.

Signed: ……. Date: ……..

NAKABUGO KATUMBA

APPROVAL

We acknowledge that we supervised this research and certify that it has been submitted with our approval and that it complies with the requirements of Uganda Martyrs University Nkozi, Mother Kevin Postgraduate Medical School Nsambya.

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DEDICATION

I dedicate this work to my dear husband, **Simon Peter Nsingo** and beloved children, **Lisa, Christian & Samuel**, who endured the divided time and attention during my study.

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LIST OF ABBREVIATIONS

ABGs	Arterial Blood Gases
AKI	Acute Kidney Injury
APACHE	Acute physiological assessment and chronic health evaluation
AVF	Arteriovenous fistula
AVG	Arteriovenous graft
BMI	Body mass index
CKD	Chronic Kidney Disease
CKDepi	Chronic Kidney Disease Epidemiology Collaboration
CRRT	Continuous renal replacement therapy
CVC	Central Venous Catheter
EGFR	Estimated Glomerular Filtration rate
ESKD	End stage Kidney Disease
GFR	Glomerular Filtration Rate
HD	Hemodialysis
ICU	Intensive Care Unit
IHD	Incident Hemodialysis
IRRT	Intermittent renal replacement therapy
KDIGO	Kidney Disease Improving Global Outcomes
KDOQi	Kidney Disease Outcomes Quality Initiative
LICs	Low Income Countries
NCD	Non Communicable Disease
SFN	St. Francis Hospital Nsambya
USRDS	United States Renal Data System

OPERATION DEFINITIONS

Hospital survival	**:**	Patient alive at discharge from hospital
Initiation of haemodialysis	**:**	First haemodialysis session received at St. Francis hospital Nsambya. Participant shouldn't have had HD prior to this session.

ABSTRACT

Introduction: Hemodialysis (HD) is a life-saving treatment for kidney disease patients, but hospital survival rates are poor in low-income countries due to limited resources. Despite this, there is a lack of knowledge on factors affecting hospital survival among HD patients in these countries. This study aimed to identify the hospital survival rates and predictors of hospital survival among HD patients in low-income countries.

Methods: We retrospectively analyzed medical records of adult patients who started hemodialysis (HD) at St. Francis Hospital, Nsambya between 2015 and 2022. We included patients aged 18+ years and excluded those with renal transplants, missing records, or early referrals. We collected demographic, clinical, and laboratory data. Survival analysis and Cox regression were used to estimate hospital survival and hazard ratios among variables respectively.

Results: We retrieved 172 admission charts of patients initiated on HD, with a 59.3% hospital survival (n=102). Positive predictors of hospital survival included: being male (HR 0.61, p=0.046), prior nephrologist care (HR 0.53, p=0.046), age <60 (HR 0.51, p=0.006), ward admission (HR 0.21, p<0.001), and blood transfusion (HR 0.34, p<0.001). Negative predictors included: reduced consciousness (HR 17.74, p<0.001), mechanical ventilation (HR 2.46, p<0.001), and vasopressor use (HR 2.56, p<0.001)

Conclusion: There is a low in-hospital survival rate among patients initiated on HD. Critically ill patients (on ventilation, vasopressors, or with altered consciousness) and those without prior nephrologist care are less likely to survive. Thus, early identification of high risk patients and early referral of kidney patients to nephrologists can improve hospital survival among hemodialysis patients in low-income countries.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

Kidney disease is an increasing global public health problem (Bolton et al., 2002) with an estimated prevalence of 8 – 16% (Hill et al., 2016). Globally, the prevalence of end stage kidney disease (ESKD) per million people has increased from 2003 to 2016 (Johansen et al., 2023) with the greatest numbers from low income countries (MIC) (Johansen et al., 2023). This corresponds to nearly 500 million affected individuals, of whom 78% (387.5 million) reside in low-income to middle-income countries (LMICs) (Jha et al., 2013).

Hemodialysis (HD) is a lifesaving therapy (Lee et al., 2021) with over seven Million people in need of Hemodialysis worldwide (Lv and Zhang, 2019). Despite advances in technology, survival rates remain low among dialysis patients especially in low income countries (LIC) (Thamer et al., 2015). The global survival rate of patients initiated on HD range from 82.3% to 84 % in the first year after initiation of HD (Thamer et al., 2015) (Dahlerus et al., 2021). The 30days` survival rate of patients initiated on HD in low income countries and low middle income countries ranges from 47.5% in Uganda (Kwizera et al., 2016) to 65.9% in Rwanda (Igiraneza et al., 2018) to 74% in Nigeria (Abdu et al., 2020), far below the global rates.

Overall, documented causes of death among HD patients include, cardiovascular disease (Collins et al., 2010), infections (Chong et al., 2023). Studies done in LIC have documented late referrals, cost of HD and limited resources as negative predictors of survival (Eghan et al., 2009)

In Uganda, access to HD services is abysmal due to poor access and limited cost (Bagasha et al., 2015). In addition, There are only 12 dialysis centers located in only 2 out of 130 districts with only 14 nephrologists for a population of >44.7 million people(Kalyesubula et al., 2022). These challenges in access to HD in Uganda, highlight the need for a detailed understanding of the factors that influence survival among patients on hemodialysis.

1.2 Problem statement

Hemodialysis prolongs life and reduces death, yet with low survival especially in the first months after initiation (Bae et al., 2015). Although HD is a lifesaving therapy preventing death from complications of kidney disease, it is expensive with limited access in LMIC with fewer resources allocated to healthcare (Lee et al., 2021). Despite lower survival rates in LIC (Eghan et al., 2009), little information is available about the factors that influence survival in these LIC (Bradbury et al 2017), unlike HIC where predictors of survival of patients initiated on HD has been extensively studied (Chong et al., 2023). Globally, several studies have identified the predictors of survival of patients initiated on HD, yet very few have documented the factors during the first few days of dialysis therapy especially in during hospitalization(Bae et al., 2015) .

The applicability of these findings done elsewhere to the Ugandan context remains uncertain due to differences in healthcare infrastructure, patient demographics, and disease burden especially in the first days of dialysis therapy.

Thus in this study, we documented the predictors of hospital survival among patients initiated on hemodialysis at a tertiary hospital in Uganda.

1.3 Justification and Significance of the study

Determination of hospital survival of patients initiated on hemodialysis will aid in mitigation planning and establishment of corrective measures to ultimately improve survival.

Data from this study will aid clinicians prognosticate their patients during pre-dialysis counselling.

The hospital administration can use these findings to plan expand, improve supplies as well as human resources allocation towards the care of patients receiving dialysis therapy.

The findings of this study will contribute to literature for survival of dialysis patients from a LIC.

1.4 Research questions.

1. What are the indications of HD for patients initiated on hemodialysis?
2. What is the hospital survival of adult patients initiated on HD?
3. What are demographic, biochemical and clinical characteristics that predict in-hospital survival of patients initiated on HD?

1.5 Study objectives

1.5.1 General objective

To describe the indications, hospital survival and predictors of hospital survival of patients initiated on incidence hemodialysis.

1.5.2 Specific objective

1. To describe the indications of hemodialysis of patients initiated on hemodialysis.
2. To determine the hospital survival of patients initiated on HD.
3. To determine the predictors of hospital survival of patients initiated on HD.

1.6 Conceptual frame work

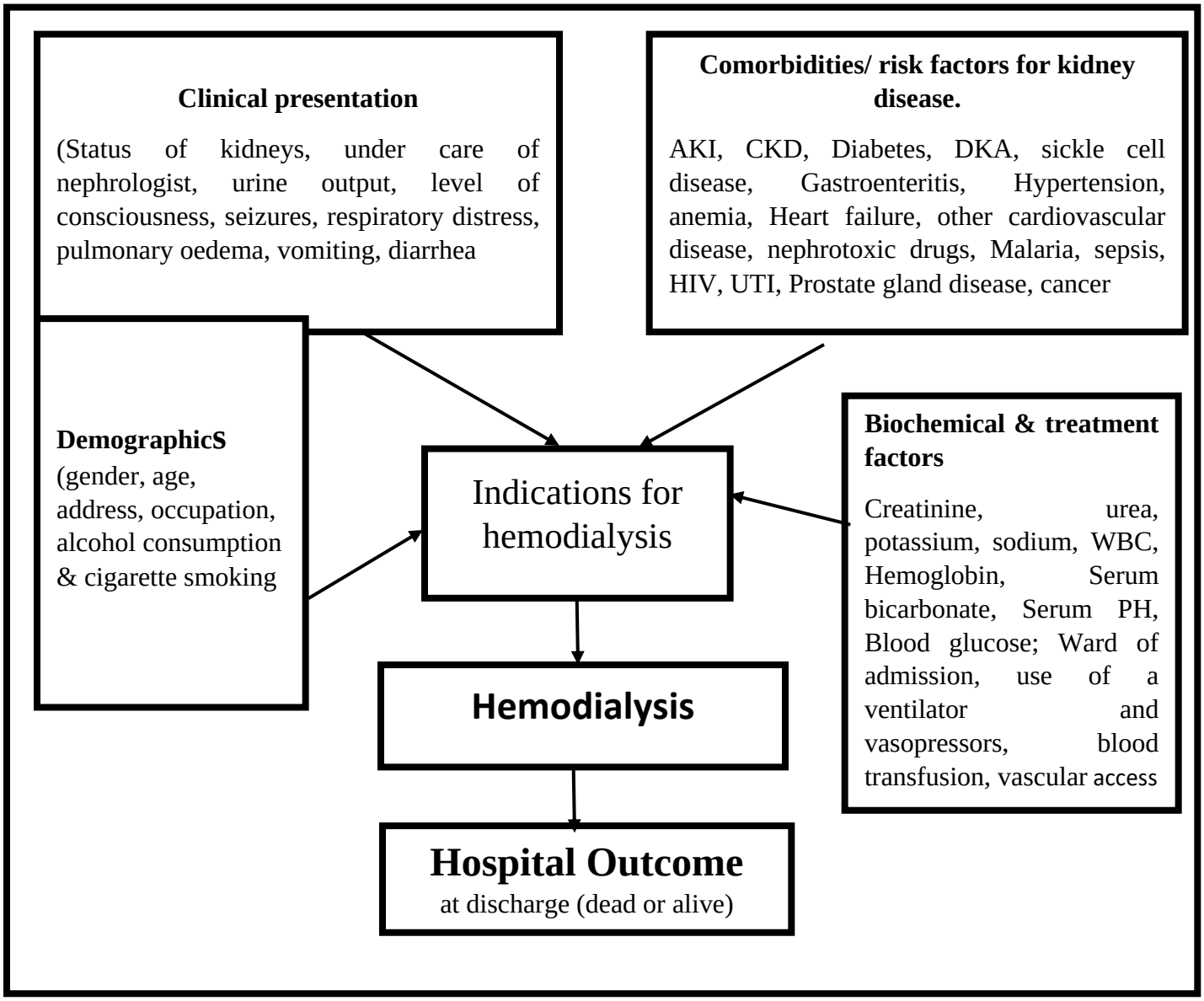

Figure 1: Conceptual framework showing relationship between the dependent and independent variables of the study

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Dialysis is defined as the diffusion of molecules in solution across a semipermeable membrane along an electrochemical concentration gradient. The 2 types in dialysis including peritoneal and hemodialysis (HD). HD is the most common type of dialysis and its goal is to restore the intracellular and extracellular fluid environment that is characteristic of normal kidney function. HD can either be intermittent (IRRT- performed for less than 4 hours in each 24 hour period, two to seven times per week) or continuous (CRRT- performed continuously without any interruption throughout each day) (Group, 2013)

In-center hemodialysis is the most common dialysis modality available in the country where dialysis centers are only available in 2 districts (Kampala and Mbarara) out of 130 districts in the country.(Kalyesubula et al., 2022). Dialysis in Uganda is mostly paid as an out-of-pocket cost because of absence of a national insurance. (Kalyesubula et al., 2022).

This literature review provides an insight into the different indications pf HD, hospital survival rate of patients initiated on HD and predictors of hospital survival of patients initiated on HD from various studies.

2.2 Indications for Hemodialysis

KDIGO recommends that for patients with AKI, dialysis should emergently be initiated when life-threatening changes in fluid, electrolyte, and acid-base balance exist. However, a broader clinical context, the presence of conditions that can be modified with RRT, and trends of laboratory tests—rather than single BUN and creatinine thresholds alone—when making the decision to start HD for survival (Kellum et al., 2012)

For patients with CKD, KDIGO suggests that dialysis be initiated when one or more of the following are present: symptoms or signs attributable to kidney failure (acid-base or electrolyte abnormalities, intractable pruritus, anorexia, uremic encephalopathy); inability to control volume status or blood pressure; a progressive deterioration in nutritional status refractory to dietary intervention; or cognitive impairment (Stevens et al., 2024). KDIGO further recommends that for

any patient with CKD and develops AKI, the same guidelines as in patients with AKI should be followed (Stevens et al., 2024)

For patients with CKD, up to 47%, initiated dialysis therapy primarily due to the development of uremic symptoms; 21%, due to volume overload or hypertension; 18%, due to laboratory evidence of kidney function decline; and 6%, due to hyperkalemia. Less than 2% of the cohort initiated dialysis therapy primarily due to metabolic acidosis and only 1% because of electrolyte abnormalities other than hyperkalemia.(Rivara et al., 2017).

Another study in the USA done in 11 nephrology centers, reported that reasons for initiation of HD among CKD patients were found to be 62.7% clinical and 37% biochemical. (Heaf et al., 2022) Uremic symptoms were present in over 8 out of every 10 patients, the most common being fatigue (44%), nausea (24%) and anorexia (22%). Other symptoms at DI included pulmonary edema (10%), dyspnea (4%) and edema (8%). The most common biochemical indication for IHD was low GFR" (13%).

The above findings are not any different from studies done in Africa which also showed that 85% of the all patients initiated on HD in a new center Nigeria had fluid overload presenting as body swelling, others presented with uremic symptoms such as nausea and vomiting (85.5%) Pruritus 88 (39%) Lethargy 132 (58.4%) Hypertensive encephalopathy 58 (25.6%) and Uremic encephalopathy 60 (26.5%) (Abdu et al., 2020).

In Rwanda, a study done among patients with AKI initiated on HD, Most of the patients had fluid overload presenting as pulmonary edema (54.8%) and 50% had uremic encephalopathy. 45.1% of them had refractory hyperkalemia and 18.29% had refractory metabolic acidosis. This proportion is higher than that observed in CKD which implies that patients with AKI are more likely to have biochemical indications for HD (Igiraneza et al., 2018). This is similar to findings in Tanzania where most of the patients with ESRD presented with fluid overload, uremia and electrolyte imbalance as compared to those with AKI where only 12% presented with fluid overload and majority presented with anuria (56%), intoxications (44%), electrolyte imbalance (28%), uremia (22%), and infections (19%). Other causes included Eclampsia (21.8%) and Postpartum hemorrhage (15.6%) patients for HD.(Meremo et al., 2017).

2.3 Hospital Survival of Patients on Hemodialysis.

Survival among patients on HD is much lower as compared to the general population (URSDS, 2019). Upon initiation on HD, patients need to be closely monitored within the first year which is a transitional period for new HD patients. According to the United States Renal Data System (USRDS) report (URSDS, 2019), all-cause mortality peaked about two months after dialysis initiation in HD patients. Another study conducted in 11 developed countries showed that the highest mortality of HD patients was observed in the first month after dialysis initiation.(Robinson et al., 2014) This is supported by a study done by Heaf et al. (2022) in Sweden which noted a gradual increased in survival rate from 76.1% to 81.1% to 82% to 84.6% over the different quarters of the year. this is also supported by a study done in Uganda by Kwizera et al. (2016) who found out that of the ICU patients with AKI initiated on hemodialysis less than half of them (47.5%) survived beyond 30-days. This implies that the early hemodialysis period is a high-risk time and efforts to improve outcomes should focus on the transition period (Robinson et al., 2014)

Other studies done over much longer periods have shown a decrease in survival with increasing duration in years on HD. A study in Egypt over a period of 1.5years found the survival frequency to be 86% among patients on incident dialysis. (Megahed et al., 2020). A retrospective study carried out in Dodoma, Tanzania over a period of 2.5years with 84 patients of ESRD, found the survival rate to be 82.1%.(Meremo et al., 2017) A study in Iran over 9 years among 395 patients on incident hemodialysis showed a decreasing survival rate of 90.8%, 61.6%, 42.1%, and 28.0% over 1year,3 years,5 years and 9 years. (Ossareh et al., 2016). Another study in Iran among 428 patients on HD over 4 years showed overall survival of 48% and survival rates of 74% 42% 25% and 17% over 1 year 2years 3 years and 4 years. (Ebrahimi et al., 2019) Messa et al. (2015) also reported the same trend with the cumulative probability of surviving at least 12 months at 88.6% (95% CI: 85.6-91.0), and 24 months at 74.5%.

In Taiwan patients initiated on dialysis had an overall survival of 33.6% over a longitudinal five-year follow-up. (Lin et al., 2022). Abdu et al. (2020) In Nigeria found an overall survival of 74.3% over a 7 year period. Another study in Brazil among 3082 patients on incident hemodialysis

showed a 58.2% global 5year survival rate. (Matos et al., 2011) From these studies one can say the longer the duration of dialysis the lower the survival rate among patients on HD.

Studies done in more developed countries like the U.S.A have reported much higher survival (87%) over 5 years on HD. (Molnar et al., 2016) . this may be due to HICs having better HD equipment and better trained staff versus LICs. Overall survival is also noted to be much lower among some patient populations such as patients with CKD whose survival over 2.4 years after DI was found to be 60%. (Rivara et al., 2017)

Overall survival among patients initiated on dialysis ranges from as high as 90.8% to as low as 17% and is affected by duration on HD, age, comorbidity and socioeconomic status to mention but a few.

2.4 Predictors of Hospital Survival of Patients Initiated on Hemodialysis

2.4.1 Demographics:

Age

The effect of age on hospital survival of patients initiated on hemodialysis can vary depending on the study and population being analyzed. However, generally older patients may have a higher risk of complications and death during the hospitalization period for hemodialysis initiation (Anand et al., 2010) This may be due to underlying comorbidities and decreased physiological reserve in older individuals. (de Arriba et al., 2021)

A cohort study among patients with CKD initiated on HD over 80 years reported that only 3 for every 10 patients survived the first year, (30.8% , 29.5% patients survived the 2^{nd} year , 30.8% patients survived the 3^{rd} to 5^{th} years, and hardly 1 for every 10 patients (9%) survived 5years on HD treatment. This is markedly lower than observed in studies done among adult populations on HD, which have shown a first year survival rate of over 90% in some studies (Sladoje-Martinovic et al., 2014) Lower survival rates have also been reported by other studies among the elderly. These reported a survival of (52.5%) over a follow up period of 4years. (Lin et al., 2013, Tuğcu et al., 2018).

The much lower survival rates can be explained by the fact that the elderly usually have more chronic comorbidities that greatly reduce life expectancy. Therefore, elderly HD patients should be given special attention.

Gender

Statistics have shown that women have a survival advantage over men however a study done among patients with ESKD on HD reported markedly lower survival among women as compared to men (Vongsanim and Davenport, 2019). This was explained by the fact that female patients due to their lower BMI are prescribed for lower effective dialysis doses that require a shorter dialysis duration as well as lead time bias, whereby men are initiated sooner on HD due to higher creatinine levels accumulated sooner by their higher muscle bulk as compared to women. (Vongsanim and Davenport, 2019) (Arhuidese et al., 2015).

Socioeconomic Status

Poverty is a risk factor for morbidity and mortality, studies have also showed that patients who earn a higher income have higher chances of survival regardless of race and patients living in areas in the highest Gini Index quartile i.e. areas with a high disparity in distribution of wealth had lower chances of survival compared to those living in areas with a lower GINI index. (Kimmel et al., 2013).

2.4.2 Pre Dialysis care.

According to a study done in Spain in 2004, patients referred early to a nephrologist with CKD 3months prior to DI had higher survival rates (93.2%) in the first year of follow up compared to those who came much later (76.7%). it was noted that at 12 months, the number of deaths was 3 times higher in the unplanned versus the planned group (Lorenzo et al., 2004). These findings are similar to a study done among geriatrics 80yrs and over which reported that patients referred to a nephrologist at least 6 months before initiation of HD had statistically significant better survival. (Sladoje-Martinovic et al., 2014) This can be explained by the fact that a higher proportion; (73%) of patients referred earlier to a nephrologist have an AVF placed which has a marked survival benefit versus only 30% for those who are referred late. (Lorenzo et al., 2004) .

2.4.3 Hemodialysis Treatment Factors

Vascular access

Vascular access (VA) is a cornerstone for conducting HD, it can be by central venous catheter or arteriovenous access which is either AVF or AVG. Numerous studies have been carried out to show that survival is higher in patients with arteriovenous access as compared to those with central venous catheter access (Azevedo et al., 2017, Torreggiani et al., 2021) (Yap et al., 2018, Li et al., 2021).

A cross sectional study in Spain reported that the risk of death among patients with a CVC is 1.43 times higher as compared to those who used arteriovenous fistula (AVF) to perform dialysis treatment at DI.(Roca-Tey et al., 2016) A prospective cohort study carried out in Korea by Kim et al. (2020) showed that patients with arteriovenous access had a higher Kidney disease quality of life which is associated with higher survival. These findings are backed up by numerous studies that have found a higher survival rate for patients with arteriovenous access as compared to patients with Central Venous Catheters. (Azevedo et al., 2017, Kim et al., 2020, Perl et al., 2011, Yeh et al., 2019). A retrospective analysis in the USA reported a higher 1 year survival and five year in patients with arteriovenous access AVF (84%-89%) and (48% -55%) as compared to patients with central venous catheters (78%). (45%) (Malas et al., 2015).

This is similar to a study by (Brown et al., 2017) which registered lower mortality rates mortality rates at 6, 12, and 24 months after DI of 9%, 17%, and 31%, among patients with AVA versus patients with CVC at 32%,46%, and 62%, respectively, Even studies done among the elderly have reported a 2.5 higher risk for death among patients with CVC as compared to those with arteriovenous access. (Sladoje-Martinovic et al., 2014). AVGs and AVFs have a longer patency period and are associated with fewer infection as compared to CVCs that predispose patients to of blood borne infections hence the observed lower survival. (Yap et al., 2018, Torreggiani et al., 2019).

2.4.4 Clinical Factors

Clinical signs and symptoms

In a study carried out to assess the mortality of older patients initiated on HD in Peru, presence of uremic encephalopathy was associated with lower survival and a lower estimated glomerular filtration rate with lower mortality (Herrera-Añazco et al., 2020). In hemodialysis patient's extracellular fluid overload is a predictor of mortality. Patients initiating dialysis therapy due to volume overload have increased risk for mortality compared with patients initiating dialysis due to laboratory evidence of kidney function decline. Patients who present with signs and symptoms of fluid overload such as pulmonary stasis, dyspnea, hypertension, pericarditis, edema and cardiac symptoms have much lower chances of survival. (Rivara et al., 2017, Dekker et al., 2017). These findings are also similar to a study by (Onofriescu et al., 2015) who found that overly hydrated patients had a 2.12 fold increased risk for all-cause mortality. Banerjee et al. (2007) also reported much lower 5 year survival rates among patients with congestive heart failure(12.5%), fluid overload(, 20.2%), and pulmonary edema(21.3%%) (Banerjee et al., 2007)

Comorbidity

The Charlson Comorbidity index is a method of categorizing comorbidities of patients. The higher the score, the more the comorbidities and the less the chances of survival. Different studies among patients on HD have showed that survival steadily decreased with increased CCI scores. Median years of survival steadily decreased with increased CCI scores. (Ng et al., 2013, Lin et al., 2013). This is seconded by two cohort studies that reported decreased survival with increase in the comorbidity score. (Ng et al., 2013, Lin et al., 2013)**.** Other studies have also reported a decreased chance of survival among patients with cardiovascular disease. Such as hypertension ventricular hypertrophy and cardiovascular disease. (Messa et al., 2015, Zhu et al., 2021). This can be explained by the fact that patients with comorbidities have an increased incidence of cardiovascular events which is the main cause of mortality among patients on HD. To note is the fact that intradialytic hypotension is a risk factor for death in HD patients and so patients should be closely monitored during HD.(Li et al., 2021).

2.4.5 Biochemical Factors.

Different biochemical parameters have been documented as predictors of survival. These include Hemoglobin levels, High density lipoproteins, serum albumin, creatinine levels and CRP. Literature shows that low hemoglobin levels are associated with poor survival of patients on incident hemodialysis. Anemia is a common complication of chronic kidney disease due to declining erythropoietin production. A study carried out in Japan by Akizawa et al. (2014) showed that the three-year survival rate of patients with <9 g/dL Hemoglobin after 6 months was 74.1%, which was significantly lower than 89.3% for patients with hemoglobin levels 10 to 11 g/dL. This is similar to findings that revealed an increase in survival among patients for each increase in a unit of hematocrit (Messa et al., 2015, Lorenzo et al., 2004). Lin et al. (2013) noted reduced survival in patients with low Albumin and those with high CRP value. Lorenzo et al. (2004) also reported an increased probability of survival for each gram per deciliter of albumin increased. A cohort study carried out in California by Chang et al. (2018) showed that increasing serum HDL cholesterol over time was associated reduced survival among patients on DI. High levels of serum creatinine were associated with greater survival (Park et al., 2018). Most of the parameters associated with lower survival rates are markers of morbidity which explains the high rates of mortality among patients with these parameters.

CHAPTER THREE: METHODOLOGY

3.1 Study design.

This was a retrospective cohort study which used analytical study methods.

3.2 Study site

The study was conducted at St Francis hospital Nsambya which is a tertiary referral hospital with a bed capacity of 361 beds. It is a private not for profit catholic-church founded regional referral hospital, located in Uganda`s capital city, Kampala which is found in the central part of the country. However, it also receives patients from other regions of the country and neighboring countries such as Democratic republic of Congo and South Sudan. It is also a teaching hospital training doctors, nurses and allied health professionals.

The hospital has a fully furnished renal dialysis unit which offers hemodialysis to both inpatients and outpatients. The unit has 6 dialysis machines with 2 in-house nephrologists, medical officers, senior house officers (residents), intern doctors, dialysis nurses and auxiliary nurses. It is open daily to serve patients on dialysis with averagely 4 patients initiated on dialysis per week. It should be noted that all patients initiated on HD are admitted for observation or initiation is made on already admitted patients. All study participants were recruited from this dialysis unit.

3.3 Study population.

3.3.1 Target population

Patients receiving their first dialysis session at SFN

3.3.2 Accessible population

Patients initiated on hemodialysis at SFN from July 2015 to December 2022

3.3.3 Actual population and study participants

Patients initiated on hemodialysis at Nsambya hospital, Uganda from July 2015 to December 2022 who meet the eligibility criteria

3.3.4 Study Duration.

The study was conducted over a period of 23 months from January 2023 to February 2024 after receipt of ethical approval.

3.4 Eligibility

3.4.1 Inclusion criteria

- Patients aged 18 years and above admitted at SFN. (It should be noted that all patients are admitted for the initiation of hemodialysis)
- Patients having their first HD session initiated at SFN

3.4.2 Exclusion criteria

- Received renal transplant.
- Patients who had their first HD session from another facility other than SFN.
- Patients with missing records
- Patients referred out to other facilities before discharge

3.6 Sample size estimation

Sample size was calculated using the sample size formula for cohort studies by Fleiss (Fleiss 1981). The outcome was hospital survival and the exposure was hyperkalemia.

Calculating the sample size for predictors of the outcome (hospital survival) of patients initiated on hemodialysis at St Francis hospital Nsambya.

$$\boldsymbol{N_{Fleiss}}=\frac{\left[z_{\alpha/2}\sqrt{(r+1)p(1-p)}+z_{\beta}\sqrt{rp_0(1-p_0)+p_1(1-p_1)}\right]^2}{r(p_0-p_1)^2}$$

$$\boldsymbol{N_{Fleiss-cc}}=\frac{N_{Fleiss}}{4}\left[1+\sqrt{1+\frac{2(r+1)}{N_{Fleiss}r|p_1-p_0|}}\right]$$

$$\boldsymbol{P}=\frac{p_0+rp_1}{r+1}$$

Where;

α = 0.05, the probability of type I error (significance level) is the probability of rejecting the true null hypothesis

β = 0.2, the probability of type II error (1 - power of the test) is the probability of failing to reject the false null hypothesis.

*P_0 = 75.6 %. with without Hyperkalemia(*Igiraneza et al., 2018*)*

*P_1 =54.1 % with hyperkalemia (*Igiraneza et al., 2018*)*

r = 1, the ratio of No hyperkalemia to Hyperkalemia

***$N_{1Fleiss-cc}$** =86. Required sample size for the population 1 group using Fleiss formula with continuity correction.*

N_2 = r x $N_{1Fleiss-cc}$ = 86

***Required** Sample size = N_1 + N_2=172.*

3.7 Sampling procedure

Consecutive sampling was used where by, every participant who met the study's inclusion criteria was selected until minimum required sample size was reached.

3.9 Study variables

3.91 Dependent variable

Dependent variable was hospital survival. This was defined as the vital status of the patient at discharge. It was a binary variable coded as 1 for alive and 0 for dead.

3.9.2 Independent variable

Independent variables were categorized as sociodemographic characteristics, Clinical and biochemical characteristics of the patients and treatment characteristics including HD characteristics.

Socio-demographic characteristics included: Age, gender, place of residence and distance from the dialysis facility, occupation and education level.

Clinical characteristics of the patients included: Patients` comorbidities, presenting symptoms and signs, diagnosis during admission, plus the ward onto which patient has been admitted to.

Biochemical characteristics included baseline investigations of Urea and Creatinine done just before dialysis. The other laboratory investigations included ABGs, electrolytes, hemoglobin

Treatment characteristics included: HD characteristics – Indications for HD, type of HD, vascular access. Other treatment characteristics will include; blood transfusion, use of vasopressors and use of mechanical ventilators.

3.10 Data collection

3.10.1 Data collection tools

A data abstraction form was used to collect data from the dialysis records book and patient medical charts. Baseline data and patients outcome at discharge were collected.

3.10.2 Data collection procedure

Information on all patients initiated on HD from July 2015 to December 2022 was retrieved from the dialysis records book to generate a list of all patients initiated on HD during the study period. Using the generated list of all patients initiated on HD, Patient files were retrieved from the records office and were screened for eligibility. The data collection tool was then used to extract data on the baseline characteristics and the vital status of the patients at discharge.

3.11 Data management

The PI performed data quality checks on the abstracted data for accuracy and completeness. Data was entered into the computer using Kobo Collect with in-built quality control checks. The final data was then exported to Stata version 14/MP (STATA CORP, TEXAS USA) for data cleaning and analysis. The collected data and other study records were retained by the PI in a secure location.

3.12 Data analysis

Descriptive statistics was used to describe the study sample. At univariate analysis, continuous variables were summarized using descriptive statistics such as means, standard deviations for normally distributed data and median and interquartile range (IQR) for skewed data while categorical variables were summarized using frequencies and percentages and displayed in tables or graphs.

The indication of hemodialysis, demographic, baseline clinical characteristics, pre dialysis care, and dialysis related characteristics was expressed as proportions of the overall study participants. The biochemical characteristics were compared between the alive and dead using Student T-Tests.

The outcome was hospital survival defined as the patient's vital status whether alive or dead at discharge from hospital. The Kaplan-Meier method and the log-rank test were used to evaluate and compare survival curves.

Cox Regression analysis was done to estimate the unadjusted and adjusted hazard ratio and its 95% confidence intervals amongst the variables studied. In order to adjust for confounders, all

factors with a p-value of less than or equal to 0.2 in unadjusted analysis were considered for adjusted analysis using forward selection technique.

3.13 Quality control

Digital data collection tools were be used to ensure completeness and consistency of data through real time inspection of data and quality control checks embedded into the digital tool. Before the commencement of the actual data collection, the data collection tools were pretested to identify gaps and ability of the tool to collect the desired information. The PI reviewed data uploaded on the server daily for completeness and consistency.

3.14 Ethical considerations

Ethical clearance and approval was obtained from Nsambya hospital research and ethics committee. Administrative permission and clearance was obtained from SFN administration before study initiation. Data collected during the study was kept strictly confidential and access limited to only authorize study personnel. All electronic records were password protected and stored securely on password protected devices. Should any part of this data be published, no identifying features will be utilized.

3.15 Dissemination of results.

Results of the study were compiled into a dissertation and availed to the:

- Department of Internal medicine, dialysis unit SFN.
- Mother Kevin Postgraduate medical school, Uganda Martyrs' University – Nkozi
- A manuscript will be written for publication in peer reviewed journals.

CHAPTER FOUR: RESULTS

4.1 Description of the study profile

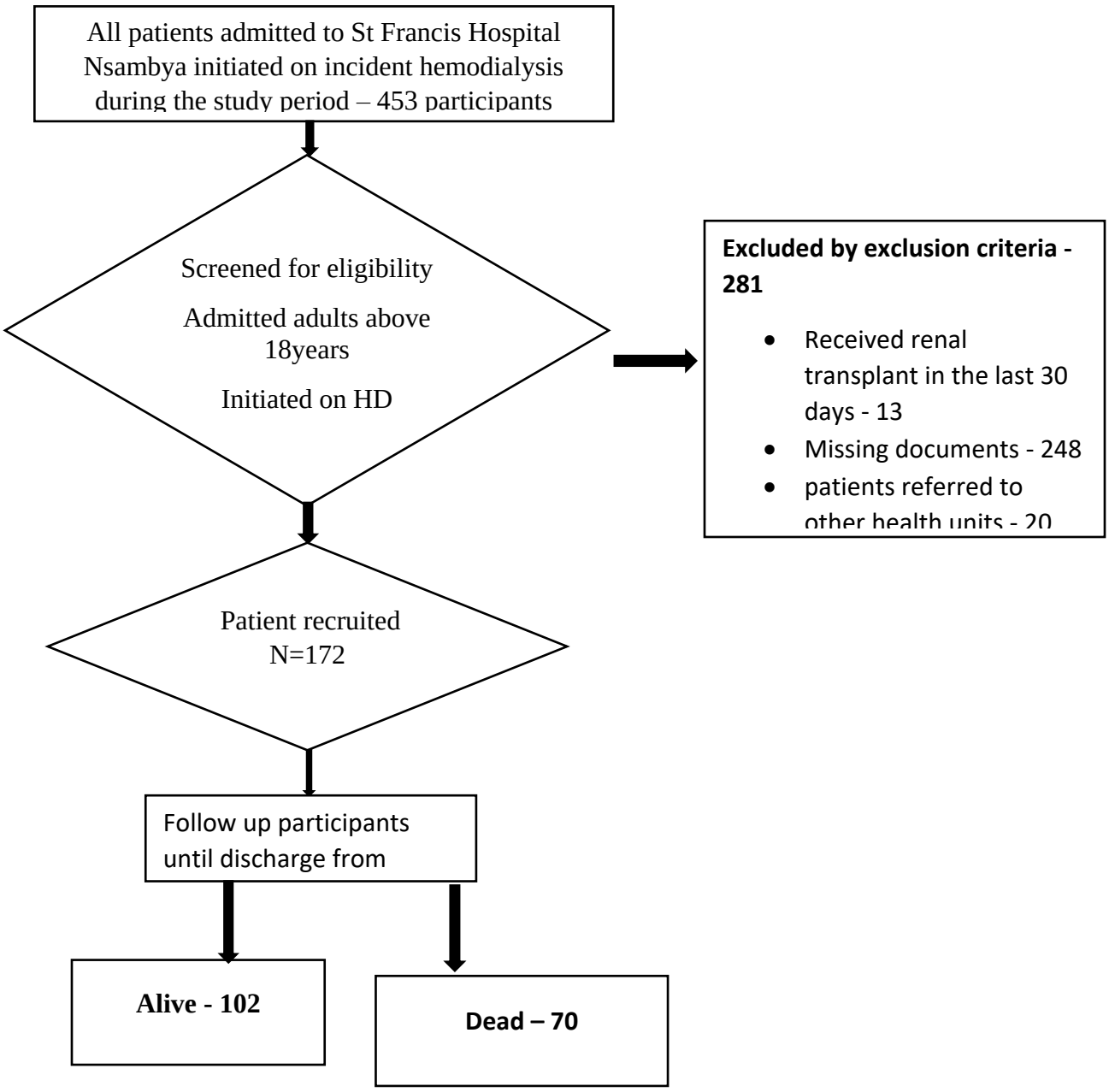

Figure 2: Study procedure and profile.

4.1.1 Description of demographic and clinical characteristics of respondents

A total of 172 participants enrolled into the study. The demographics and clinical characteristics of participants are summarised in table 1. The mean age in years of participants was 52 +/- 12 (IQR: 36-62). Majority of patients (65.7%) were less than 60years. Majority of them were male n = 106 (61.0%). The average length of in-hospital stay was 10 days (IQR: 6-17). The commonest presentations of participants were respiratory distress (89.5%), anaemia (78.5), reduced levels of consciousness (76.7%) and oliguria (72.4%). The indications for initiation of the 4 participants with normal kidneys were; severe metabolic acidosis due to diabetic keto-acidosis n=2 and pulmonary oedema due to congestive heart failure n=1 and organophosphate poisoning n=1, intractable to medical therapy.

The overall in hospital survival rate was 59.3%. In bivariate analysis, factors that were significantly associated with increased in hospital survival included age <60years (HR-0.51, P value – 0.006), being male (HR-0.61, P value – 0.046), and prior nephrologists` care (HR -0.53, P value -0.046). Reduced levels of consciousness (HR – 18.2, P value – 0.004) was significantly associated with reduced hospital survival.

Table 1: Demographic characteristics of adults initiated on hemodialysis

	Total n (%)	Alive n (%)	Dead n (%)	HR (95% CI)	p value
Total participants.	**172 (100)**	**102 (59.3)**	**70 (40.7)**		
Gender					
Female	67 (39.0)	33 (49.3)	34 (50.7)	1	
Male	105 (61.0)	69 (65.7)	36 (34.3)	0.61 (0.38-0.99)	0.046
Age					
<60	113 (65.7)	77 (68.1)	36 (31.9)	0.51 (0.32-0.83)	0.006
>=60	59 (34.3)	25 (42.4)	34 (57.6)	1	
Place of residence					
Rural	54 (31.6)	29 (53.7)	25 (46.3)	1	
Urban	117 (68.4)	73 (62.4)	44 (37.6)	0.81 (0.49-1.32)	0.391
Distance of place of residence to this dialysis center					
50km - 100km	37 (21.5)	22 (59.5)	15 (40.5)	0.95 (0.40-2.25)	0.909
<50KM	114 (66.4)	67 (58.8)	47 (41.2)	0.91 (0.43-1.94)	0.812
> 100KM	21 (12.2)	13 (61.9)	8 (38.1)	1	
Alcohol Consumption					
No	49 (28.5)	32 (65.3)	17 (34.7)	0.71 (0.37-1.33)	0.284
Unknown	69 (40.1)	40 (58)	29 (42)	1.24 (0.72-2.13)	0.448
Yes	54 (31.4)	30 (55.6)	24 (44.4)	1	
Cigarette smoking					
No	101 9 (58.7)	63 (62.4)	38 (37.6)	0.55 (0.21-1.41)	0.211
Unknown	63 (36.6)	36 (57.1)	27 (42.9)	0.83 (0.32-2.16)	0.703
Yes	8 (4.7)	3 (37.5)	5 (62.5)	1	
Under care of a nephrologist in the last 6 months	56 (32.6)	44 (78.6)	12 (21.4)	0.53 (0.28-0.99)	0.046
Status of Kidneys before admission					
AKI	74 (42)	40 (54.1)	34 (45.9)	1	
AKI on CKD	44 (25.6)	22 (50)	22 (50)	1.07 (0.62-1.83)	0.816
CKD	50 (29.1)	37 (74)	13 (26)	0.74 (0.39-1.40)	0.354
Normal	4 (2.3)	3 (75)	1 (25)	0.91 (0.12-6.69)	0.924
Urine output					
Anuria	37 (21.8)	16 (43.2)	21 (56.8)	1	
Normal	10 (5.9)	7 (70)	3 (30)	0.62 (0.18-2.09)	0.44
Oliguria	123 (72.4)	79 (64.2)	44 (35.8)	0.63 (0.37-1.06)	0.083
Anemia	135 (78.5)	84 (62.2)	51 (37.8)	0.6 (0.35-1.02)	0.059
Reduced level of consciousness (GCS - <15)	132 (76.7)	63 (47.7)	69 (52.3)	18.02 (2.50-129.84)	0.004
Seizures	14 (8.1)	6 (42.9)	8 (57.1)	1.77 (0.84-3.71)	0.131
Respiratory distress	154 (89.5)	85 (55.2)	69 (44.8)	6.23 (0.86-44.94)	0.07
Pulmonary edema	74 (43)	48 (64.9)	26 (35.1)	0.62 (0.38-1.02)	0.06

4.2 Comorbidities and treatment modalities of admitted patients initiated on hemodialysis

Table 2 shows the comorbidities and treatment modalities of adults initiated on hemodialysis. Majority of the participants (58.2%) were admitted on wards while only 15.3% were admitted to ICU. The commonest comorbidity of adults initiated on HD were Hypertension (59.9%), sepsis (57.3), diabetes mellitus (34.7%), urinary tract infections (27.9%), HIV (22.1%) and prior surgery (18%). All participants had central venous access as the vascular access for HD. 37.2% received vasopressors, 36.6% were ventilated and 52.9% were transfused with blood.

In the bivariate analysis, receiving blood transfusion (HR 0.4, P value - <0.001) and being admitted to wards alone (HR – 0.12, P value - <0.001) were significantly associated with improved survival. Factors that were associated with reduced hospital survival included; use of mechanical ventilator (HR – 2.46, P value - <0.001) & use of vasopressors (HR – 2.56, P value - <0.001).

Table 2: Comorbidities and treatment modalities of admitted patients initiated on hemodialysis

Variable	Total	Alive n (%)	Dead n (%)	HR (95% CI)	p value
Ward admission					
Both ward and ICU admission	45 (26.5)	23 (51.1)	22 (48.9)	0.16 (0.09-0.30)	<0.001
ICU admission	26 (15.3)	2 (7.7)	24 (92.3)	1	
Ward admission	99 (58.2)	76 (76.8)	23 (23.2)	0.12 (0.07-0.21)	<0.001
Surgery / Trauma	31 (18)	18 (58.1)	13 (41.9)	1 (0.55-1.83)	0.997
COVID-19	1 (0.6)	0 (0)	1 (100)	0 (0.00-.)	1
Diabetes Mellitus	59 (34.7)	32 (54.2)	27 (45.8)	1.17 (0.71-1.91)	0.54
Diabetic Keto-acidosis	14 (8.1)	7 (50)	7 (50)	1.99 (0.90-4.42)	0.09
Sickle cell disease	2 (1.2)	1 (50)	1 (50)	0.9 (0.12-6.52)	0.917
Gastroenteritis	20 (11.6)	13 (65)	7 (35)	1.04 (0.47-2.28)	0.923
Hypertension	103 (59.9)	61 (59.2)	42 (40.8)	0.98 (0.61-1.59)	0.935
Heart failure	25 (14.5)	16 (64)	9 (36)	0.56 (0.27-1.17)	0.122
Other cardiovascular diseases	19 (14.6)	14 (73.7)	5 (26.3)	0.44 (0.18-1.11)	0.082
Nephrotoxic drugs	22 (12.9)	13 (59.1)	9 (40.9)	0.73 (0.35-1.55)	0.415
Malaria	12 (7)	8 (66.7)	4 (33.3)	0.83 (0.30-2.27)	0.712
Sepsis	98 (57.3)	52 (53.1)	46 (46.9)	1.25 (0.75-2.06)	0.393
HIV infection	38 (22.1)	21 (55.3)	17 (44.7)	1.01 (0.58-1.75)	0.966
Urinary tract infection	48 (27.9)	22 (45.8)	26 (54.2)	1.41 (0.86-2.31)	0.168
Prostate gland disease	9 (5.2)	5 (55.6)	4 (44.4)	1.79 (0.62-5.16)	0.279
Cancer	12 (7)	4 (33.3)	8 (66.7)	1.73 (0.82-3.64)	0.149
Use of a ventilator	63 (36.6)	21 (33.3)	42 (66.7)	2.46 (1.52-3.98)	<0.001
Use of vasopressors	64 (37.2)	20 (31.3)	44 (68.8)	2.56 (1.57-4.18)	<0.001
Blood transfusion	91(52.9)	58 (63.7)	33 (36.3)	0.4 (0.25-0.65)	<0.001

4.3 Indications of HD among patients initiated on HD at SFN.

The commonest indications for HD were uremia (88.4%), acidosis (63.4%) and hyperkalemia (45.3%). In bivariate analysis, fluid overload (HR – 0.57, P value – 0.31) and end stage renal disease (ESRD) HR – 0.51, P value – 0.034) were significantly associated with increased chances of survival. Acidosis (HR – 2.06, P – value 0.012) were significantly associated with reduced hospital survival.

Table 3: Indications of HD among admitted patients initiated on hemodialysis

	Total n (%)	Alive n (%)	Dead n (%)	HR (95% CI)	p value
Uremia	152 (88.4%)	93 (61.2)	59 (38.8)	0.6 (0.31-1.14)	0.119
Acidosis	109 (63.4%)	56 (51.4)	53 (48.6)	2.06 (1.18-3.61)	0.012
Hyperkalemia	78 (45.3%)	46 (59)	32 (41)	1.08 (0.67-1.74)	0.75
Fluid overload	70 (40.7%)	46 (65.7)	24 (34.3)	0.57 (0.34-0.95)	0.031
ESRD	51 (29.7%)	39 (76.5)	12 (23.5)	0.51 (0.27-0.95)	0.034
Intoxications	2 (1.2%)	2 (100)	0 (0)	0 (0.00-.)	1

4.4 Biochemical Characteristics before Dialysis

Table 4 evaluates the relationship between pre-dialysis biochemical parameters and hospital survival of patients. The most significant predictor was creatinine, where surviving patients had a notably higher mean level (12.7 ± 7.1) t-statistic – 5.6, P value - < 0.001 compared to those who did not survive (7.5 ± 3.8), p value <0.001. Other parameters like urea, potassium, sodium, white blood count, haemoglobin, serum bi-carbonate, serum PH, and blood glucose showed differences in mean values between the alive and dead groups; however, none of these differences reached statistical significance.

Table 4: Biochemical Characteristics before dialysis

	Total mean	Alive	Dead		
	Mean +/-	**mean +- sd**	**mean +- sd**	**t -statistic**	**p value**
Creatinine	10.6 +/- 6.6	12.7 +- 7.1	7.5 +- 3.8	5.6	<0.001
Urea	208.3 +/-109.2	219.1 +- 108.5	192.6 +- 109	1.6	0.118
Potassium	5.5 +/- 1.4	5.5 +- 1.4	5.4 +- 1.4	0.7	0.502
Sodium	132.1 +/- 15.8	131 +- 11.3	133.6 +- 20.7	-1.1	0.288
White blood count	13.8 +/- 12.6	12.3 +- 9.3	16 +- 16	-1.9	0.056
Hemoglobin	9.4 +/- 3.2	9.2 +- 3.3	9.5 +- 3	-0.6	0.558
Serum Bi- carbonate	12.2 +/- 11.2	11 +- 6	13.7 +- 15.3	-1.2	0.238
Serum PH	7.2 **+/- 0.3**	7.2 +- 0.2	7.2 +- 0.4	0.7	0.475
Blood glucose	9.3 **+/- 5.8**	9.2 +- 6	9.3 +- 5.5	-0.1	0.917

4.5 Hospital survival of patients initiated on Haemodialysis

Out of the 172 participants initiated on HD, 102 (59.3%) were alive by the time of discharge. Majority of the participants who died before discharge (n=53 out of 70, 75.7%), died in the first 14 days of admission. The median time to death was 21 days (95% CI: 16-41) meaning that by day 21, the probability of survival was 50% (Figure 3).

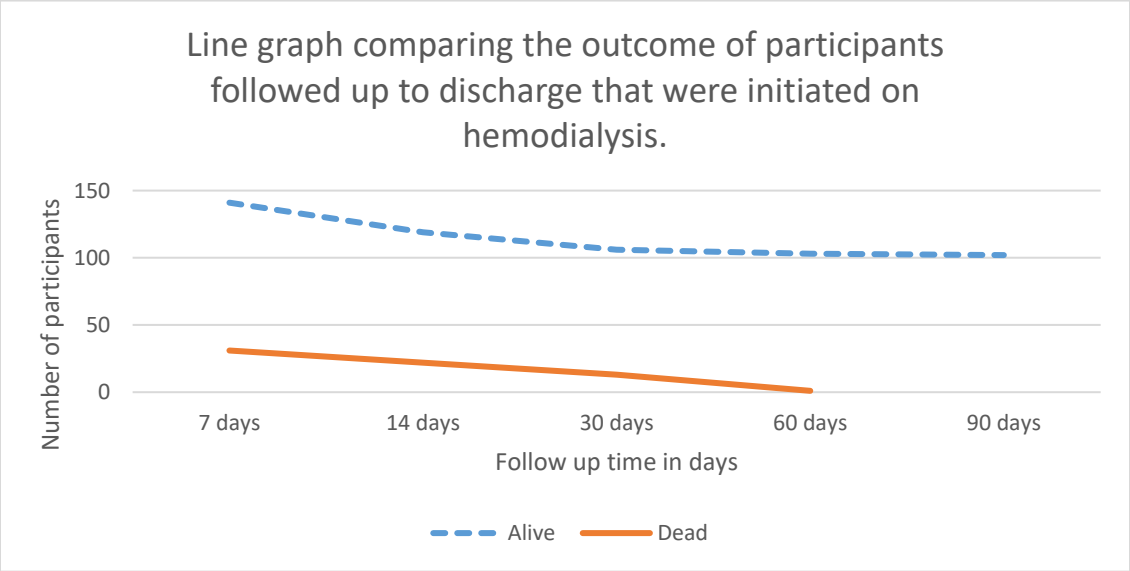

Figure 3: Hospital survival of patients initiated on Hemodialysis

4.6 Multivariate analysis of predictors of hospital survival of patients initiated on hemodialysis.

After cox regression, the independent positive predictors of hospital survival in adults initiated on HD were age less than 60years, admission to ward alone or both on ward and ICU and receiving a blood transfusion. Reduced levels of consciousness was the only negative independent predictor of survival that was significant at multivariate analysis.

Table 5: Multivariable analysis of the predictors of hospital survival of patients initiated on hemodialysis

	Crude HR (95% CI)	**P value**	**Adj. HR (95% CI)**	**P value**
Age				
<60	0.24 (0.10-0.63)	0.003	0.34 (0.12-0.94)	**0.037**
>60	1		1	
Place of admission				
Both ward and ICU admission	0.16 (0.09-0.30)	<0.001	0.14 (0.07-0.29)	**<0.001**
ICU admission	1		1	
Ward admission	0.12 (0.07-0.21)	<0.001	0.21 (0.11-0.41)	**<0.001**
Blood transfusion	0.4 (0.25-0.65)	<0.001	0.34 (0.19-0.61)	**<0.001**
Reduced level of consciousness	18.02 (2.50-129.84)	0.004	17.74 (2.37-132.92)	**0.005**

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This study described the indications, hospital survival and hospital survival predictors for patients starting hemodialysis (HD) at SFN. It identified acidosis and uremia as the most common reasons for initiating HD. The overall hospital survival of patients initiated on HD was 59.3% with a median survival time indicating a 50% chance of survival by day 21. Independent predictors of survival included age, admission location, blood transfusion and level of consciousness.

5.2 Hospital survival of patients on initiated on hemodialysis.

The overall hospital survival was 59.3%. The median time to death was 21 days (95% CI: 16-41), indicating a 50% probability of survival by day 21. Results align with findings from study in Uganda, where 47.5% of ICU patients with Acute Kidney Injury (AKI) on HD survived beyond 30 days (Kwizera et al., 2016). It's important to note that only 41.8% of our study's participants had a history of ICU admission, signifying an equally low survival even among non-critically ill patients on dialysis.

However, these rates are still far below the hospital survival rates from high income countries. A study done in South Korea found a hospital survival of 83.2% among all new patients that were initiated on hemodialysis (Bae et al., 2015). Research conducted United States has documented significantly higher five-year survival rates for individuals undergoing hemodialysis (HD), with figures reaching up to 87% (Molnar et al., 2016) .

The major difference identified is that most patients in low income countries usually have emergency unplanned dialysis compared to planned hemodialysis for CKD patients in high income countries. However, the universally critical nature of the initial 90 days post-initiation emerges as a common denominator, highlighting a period of significantly reduced survival rates irrespective of geographic or economic context (Robinson et al., 2014).

In our study, the risk of death was higher in the first 2 weeks where majority n = 53 out of 70 (70.75%) within the first 2 weeks of hospitalisation. These findings are similar to a study done in America where the initial 2-week risk of death for a typical dialysis patient was 2.72-fold higher (Chan et al., 2011). Thus these initial weeks after starting dialysis require an increased attention because dialysis patients appear most vulnerable during this period.

5.3 Predictors of hospital survival of patients initiated on hemodialysis.

At bivariate analysis, factors that were significantly associated with increased chances of survival include; age <60years, blood transfusion, admission to wards alone instead of ICU alone, end stage kidney disease, prior nephrologist`s care and being male. Factors significantly associated with reduced chances of survival included; use of mechanical ventilation, vasopressors use, Acidosis and reduced levels of consciousness.

At multivariate analysis only age <60years, blood transfusion, ward admission and reduced levels of consciousness were the only significant predictors of survival. The mean serum creatinine levels of patients that were initiated on hemodialysis and survived was significantly higher than the mean serum creatinine value of the non-survivor patients.

5.3.1 Age

Multivariable analysis revealed age less than 60 years (Adjusted HR – was significantly associated with improved hospital survival. Specifically, individuals aged 30-39 exhibited a 66% lower risk of mortality (Adjusted HR - 0.34, P value – 0.37) compared to those aged over 60. This finding is consistent with previous studies which suggested that older patients generally face a heightened risk of complications and death during hospitalization for hemodialysis initiation (Anand et al., 2010). This increased risk of death among those aged above 60years can be contributed to underlying multiple comorbidities and diminished physiological resilience (de Arriba et al., 2021).

The average age of patients initiated on haemodialysis in our study was less than 60years that is 52 years, lower than in a similar in-hospital survival study done in South Korea where the average age of participants was 64.7 years (Bae et al., 2015). However, the average age was much higher in our study compared to studies done in Rwanda (938) and Uganda (38.5 +/-12) among acute kidney injury patients initiated on haemodialysis(Igiraneza et al., 2018) (Kwizera et al., 2016).

5.3.2 Being Male.

Majority of the patients initiated on hemodialysis were male n = 105 (61.0%). Similar findings in the general population of Ugandans receiving dialysis countrywide 59% (Kalyesubula et al., 2022). This finding can be explained by the fact that women are more inclined to choose conservative management instead of being initiated on hemodialysis. Women have protective effects of estrogen while men have damaging effects of testosterone, together with unhealthier lifestyles, might cause kidney function to decline faster in men than in women.

Being male was also significantly associated with increased hospital survival (HR -0.61, P value – 0.046) in our study. This can be explained by the physiological differences between men and women which may influence their response to hemodialysis. Men generally have higher muscle mass, which affects serum creatinine levels and may influence the perceived severity and progression of kidney disease. These biological factors can impact the overall health status and resilience of patients undergoing hemodialysis.

5.3.3 Prior Nephrologists care

Only 32% (n = 56 participants) had a history of prior nephrologists` care. This can be explained by the few number of nephrologist specialists in the country, only 14 for a population of >44.7 million people. (Kalyesubula et al., 2022). This can also be explained by the low awareness of kidney disease among the population and health workers in the country, evidenced by the late presentation of kidney patients, with 56% presenting for the first time with advanced symptoms of end-stage kidney disease -ESKD (Babua et al., 2015). This can also be explained by the heterogeneity of the study including all patients with different underlying kidney disease (AKI, CKD, normal kidney function) where 42% of all patients had AKI and thus may have not needed a prior nephrologist review.

Majority of the charts of the patients that had prior nephrologist care n= 44 out of 56 (78.6%) had a statistically significant increased chanced of survival compared without prior nephrologist care (HR- 0.5, P value – 0.046). This values are similar in both LIC and HIC. Can be attributed to the fact that patients with prior nephrologists care are better prepared for a transition to dialysis care for better outcomes.

5.3.4 Level of consciousness

Majority of the participants n = 132 (76%) had reduced levels of consciousness. Important to note that at multivariate analysis, reduced levels of consciousness were significantly associated with reduced hospital survival (Adjusted HR – 17.74, P value – 0.005)

This finding resonates with the findings of (Liman et al., 2014), who noted that patients who passed away during dialysis were those who were more likely to have impaired levels of consciousness (Chan et al., 2011). Reduced consciousness among individuals with uremia may arise from various factors including metabolic encephalopathies, hypertensive crises, infections, and drug-related toxicity(Lee et al., 2021).

5.3.5 Biochemical characteristics

The mean creatinine for all participants initiated on haemodialysis was 10.6 +/- 6.6. Those that survived had a mean creatinine level of 12.7 +/- 7.1 significantly higher than the mean of those that died of 7.5 +/- 3.8, with a t-statistic of 5.6 and P value <0.001. This These findings are similar to studies done in the united states where survivors had a mean creatinine of 8.2 +/-6.5 significantly higher than the non survivors whose mean creatinine was 4.5 +/-2.8 just before dialysis with a P value of <0.001(Bae et al., 2015). The paradoxical findings could be explained by the fact that clinicians may choose high intense dialysis sessions and close follow ups for patients with high creatinine values, and thus increasing their chances of survival (Lowrie, 1990).

5.3.6 Indications for haemodialysis of patients initiated on HD at SFN

The indications for haemodialysis were in order of most frequent; Uraemia 88.4%, Acidosis 63.4%, Hyperkalaemia 45.3%, Fluid overload 40.7%, end stage renal disease 29.7 % and intoxications 1.2%. These findings contrast a study done in Nigeria and Rwanda where majority of patients initiated on haemodialysis had fluid overload (Abdu et al., 2020) (Igiraneza et al., 2018)

Participants with end stage renal disease (ESRD) were more likely to survive (HR 0.51, P value – 0.034). A possible explanation for this is that patients with ESRD were more likely to have prior nephrologist`s care on a regular basis. Thus better prepared for a transitional period of dialysis therapy resulting into increased chances of survival.

Acidosis was also significantly associated with reduced hospital survival. This situation may be attributed to the frequent stock-outs of reagents needed to diagnose acidosis, leading clinicians to rely on clinical features of acidosis, which typically present only in cases of severe, non-refractory acidosis.

One interesting finding was that hyperkalaemia (HR- 1.0, P value 0.75) was statistically not significantly associated with survival of patients initiated on haemodialysis. This contrasts findings from other studies done in Rwanda where hyperkalaemia (HR – 3.23, P value 0.043) was significantly associated with reduced survival (Igiraneza et al., 2018). The probable explanation for this contrasting finding could be the study population where these 2 studies where done. Our study was conducted among all patients initiated on haemodialysis where as the one in Rwanda was conducted among patients admitted with acute kidney injury and started on haemodialysis. The other probable explanation is that clinicians in our study were well equipped in early detection of hyperkalaemia and thus providing interventions early in our study.

5.3.7 Place of admission

Patients admitted to either the ward alone or to both the ward and ICU experienced significantly higher survival rates compared to those admitted solely to the ICU, with adjusted hazard ratios (Adj. HRs) of 0.14 (0.07-0.29) and 0.21 (0.11-0.41), respectively. This difference may be attributed to the fact that ICU admissions typically involve life-threatening complications, such as severe comorbidities and organ system failures including multiple drugs prescriptions (Johansen et al., 2023).

5.3.8 Blood transfusion

At multivariate analysis, receiving a blood transfusion was significantly associated with an increased chances of survival with an adjusted hazard ratio (Adj. HR) of 0.34 & P value - <0.001.

This paradoxical may be attributed to the fact that participants that needed blood transfusion and received it survived compared to those that may have needed it and did not receive it due to challenges of blood stock outs. Blood transfusions improve tissue oxygenations which improves organs function and quicken patient recovery.

However, it's important to acknowledge that blood transfusions come with inherent risks, both short-term and long-term, including transfusion-associated infections, systemic iron overload, and the development of antibodies to human leukocyte antigens (Malas et al., 2015) which could complicate future management of renal disease.

The other statistically significant predictors of non-survival at bivariate analysis included use mechanical ventilation (HR -2.46, P value - <0.001) and use of vasopressors (HR -2.56, P value - <0.001). These results are consistent with a study done in Uganda where mechanical ventilation for acute respiratory distress syndrome and use of vasopressors were statistically significant negative predictors of survival (Kwizera et al., 2016). These findings indicate that critically sick patients requiring vasopressors and mechanical ventilation have less chances of survival after initiation on haemodialysis.

5.4 Strength and Limitations

This study represents a pioneering effort in Uganda and Sub-Saharan Africa to detail the in-hospital survival rates for hemodialysis patients and identify its predictors, marking a significant contribution to the regional healthcare literature.

The limitations of the study included

The reliance on secondary data further limits the study, as it precludes control over data quality and completeness with missing data in a few charts. These limitations were acknowledged and taken into account during the analysis and interpretation of the results.

Study included both CKD, AKI and normal kidney patients, giving it a heterogeneous population in terms of underlying diseases and risk factors for kidney disease.

We could not demonstrate a causes of death of the participants initiated on hemodialysis, since this was a retrospective study.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

There is a low survival rate among patients initiated on HD. Critically ill patients (on ventilation, vasopressors, or with altered consciousness) and those without prior nephrologist care are less likely to survive. Thus, early identification of high risk patients and early referral of kidney patients to nephrologists can improve hospital survival among hemodialysis patients in low-income countries.

6.2 Recommendations

1. Clinicians need to be aware of the predictors of in hospital survival, to better plan and equip themselves with skills to attend to those patients that have chances of survival to improve their in hospital survival.

2. Clinicians should have patients with CKD referred to the nephrologist to improve their survival as noted in this study that those with prior nephrologist`s care had better survival.

3. Hospitals should better plan and prepare for management of critically sick patients initiated on hemodialysis to improve these patients` survival after initiation of hemodialysis. This can be done by expanding their high dependency units (HDU) and intensive care units (ICU) through proper recruitment and continuous training of HDU & ICU personnel, purchase of required equipment, drugs and supplies.

4. We recommend that more studies should be carried out on the survival of both incident and prevalent dialysis in specific dialysis populations' e.g. CKD, AKI, and DKA among others.

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APPENDICES

APPENDIX 1: DATA ABSTRACTION TOOL

PREDICTORS OF HOSPITAL SURVIVAL OF PATIENTS INITIATED ON INCIDENT HEMODIALYSIS AT NSAMBYA HOSPITAL, UGANDA.

Patient Information

Demographics and clinical characteristics of participants.

Age	1.☐ 18 - 39 2.☐ 30 - 39 3.☐ 40 - 49 4.☐ 50 - 59 5.☐ >60
BMI	1.☐ < 18.5 2.☐ 18.5 - <25 1.☐ 25 - >30 2.☐ >30
Gender	1.☐ Male 2.☐ Female
Place of residence	1.☐ Rural 2.☐ Urban
Distance of place of residence to this dialysis centre.	1.☐ <50KM 2.☐ 50km – 100km 3.☐ > 100KM
Ward admission	1.☐ Ward admission 2.☐ ICU admission 3.☐ Both ward and ICU admission
Date of admission	
Date of discharge / Death	
Length of hospital stay	
Status of Kidneys before at admission	1.☐ Normal 2.☐ AKI 3.☐ CKD 4.☐ AKI on CKD 5.☐ Unknown
Occupation	1.☐ Employed 2.☐ Self employed 3.☐ Un employed 4.☐ Retired
Alcohol Consumption	1.☐ Yes 2.☐ No

	3.☐ Unknown
Cigarette smoking	1.☐ Yes 2.☐ No 3.☐ Unknown
Urine output	1.☐ Normal 2.☐ Oliguria 3.☐ Anuria
Reduced level of consciousness	1.☐ Yes 2.☐ No
Seizures	1.☐ Yes 2.☐ No
Respiratory distress	1.☐ Yes 2.☐ No
Pulmonary edema	1.☐ Yes 2.☐ No
Vomiting	1.☐ Yes 2.☐ No
Diarrhea	1.☐ Yes 2.☐ No
Under care of a nephrologist in the last 6 months	1.☐ Yes 2.☐ No
Anemia	1.☐ Yes 2.☐ No
Surgery	1.☐ Yes 2.☐ No
COVID-19	1.☐ Yes 2.☐ No
Diabetes Mellitus	1.☐ Yes 2.☐ No
Diabetic Keto-acidosis (DKA)	1.☐ Yes 2.☐ No
Sickle cell disease	1.☐ Yes 2.☐ No
Gastroenteritis	1.☐ Yes 2.☐ No
Hypertension	1.☐ Yes 2.☐ No
Heart failure	1.☐ Yes 2.☐ No
Other cardiovascular disease	1.☐ Yes 2.☐ No
Nephrotoxic drugs	1.☐ Yes 2.☐ No

	If yes specify
Malaria	1.☐ Yes 2.☐ No
Sepsis	1.☐ Yes 2.☐ No
HIV infection	1.☐ Yes 2.☐ No
Urinary tract infection	1.☐ Yes 2.☐ No
Prostate gland disease	1.☐ Yes 2.☐ No
Cancer	1.☐ Yes 2.☐ No If yes, specify ……

Biochemical characteristics

Creatinine	
Urea	
Potassium	
Sodium	
White blood count	
Haemoglobin	
Serum Bi- carbonate	
Serum PH	
Blood glucose	

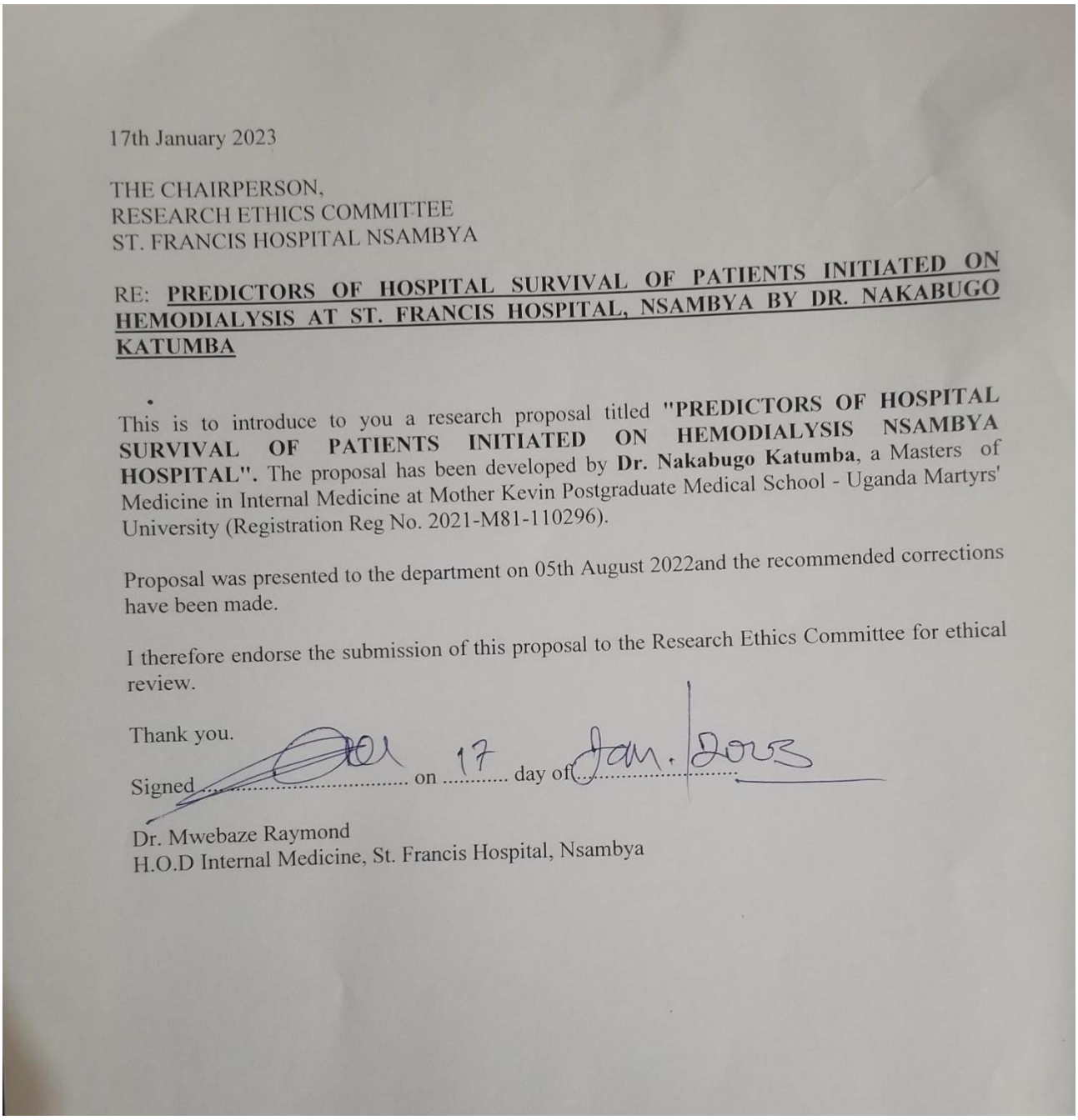
Indications for hemodialysis

Acidosis	1. ☐ Yes 2. ☐ No
Hyperkalaemia	1.☐ Yes 2.☐ No
Intoxications	1.☐ Yes 2.☐ No
Fluid overload	1.☐ Yes 2.☐ No
Uraemia	1.☐ Yes 2.☐ No
Others	Specify……

Treatment and discharge characteristics

Use of a ventilator	1.☐ Yes 2.☐ No
Use of vasopressors	1.☐ Yes 2.☐ No
Vascular access	1.☐ Central venous catheter 2.☐ Arterial venous fistula 3. ☐ Arterial venous graft 2.☐ No
Blood transfusion	1.☐ Yes 2.☐ No
Status at discharge	1.☐ Alive 2.☐ Dead
Dialysis to be continued even after discharge	1.☐ Yes 2.☐ No

APPENDIX II: ENDORSEMENT LETTER



17th January 2023

THE CHAIRPERSON,
RESEARCH ETHICS COMMITTEE
ST. FRANCIS HOSPITAL NSAMBYA

RE: **PREDICTORS OF HOSPITAL SURVIVAL OF PATIENTS INITIATED ON HEMODIALYSIS AT ST. FRANCIS HOSPITAL, NSAMBYA BY DR. NAKABUGO KATUMBA**

This is to introduce to you a research proposal titled **"PREDICTORS OF HOSPITAL SURVIVAL OF PATIENTS INITIATED ON HEMODIALYSIS NSAMBYA HOSPITAL".** The proposal has been developed by **Dr. Nakabugo Katumba**, a Masters of Medicine in Internal Medicine at Mother Kevin Postgraduate Medical School - Uganda Martyrs' University (Registration Reg No. 2021-M81-110296).

Proposal was presented to the department on 05th August 2022and the recommended corrections have been made.

I therefore endorse the submission of this proposal to the Research Ethics Committee for ethical review.

Thank you.

Signed ..... on 17 day of Jan. 2023

Dr. Mwebaze Raymond
H.O.D Internal Medicine, St. Francis Hospital, Nsambya