FACTORS ASSOCIATED WITH HEMODIALYSIS ADEQUACY AMONG END STAGE RENAL DISEASEPATIENTS ON MAINTENANCE HEMODIALYSIS IN RWANDA

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RESEARCH PROJECT

FACTORS ASSOCIATED WITH HEMODIALYSIS ADEQUACY AMONG END STAGE RENAL DISEASEPATIENTS ON MAINTENANCE HEMODIALYSIS IN RWANDA

BY

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Kigali, June, 2019

DECLARATION

I, NDAHAYO Didace, do hereby declare that this research dissertation entitled *"**Factors Associated with hemodialysis adequacy among end stage renal disease (ESRD) patients on maintenance hemodialysis in Rwanda".*** Submitted for the partial fulfillment of the requirements for the degree of Master in Nursing Science (Nephrology) at the University of Rwanda/College of Medicine and Health Sciences, is my original work and has not previously been submitted elsewhere. I declare that a full list of references is provided indicating all the sources of information quoted or cited.

NDAHAYO Didace Date: 12/06/2019

Signature

DEDICATIONS

I dedicate this work to my family and friends, University of Rwanda, Masters Program in Nursing Sciences, Supervisor Dr.Geldine Chironda, and Rwanda Military Hospital.

All your supports are proved to be valuable to me forevermore.

May the Almighty God bless you abundantly!

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NDAHAYO Didace

ABSTRACT

Introduction: Hemodialysis substitutes the natural work of the kidney and helps ESRD patients to increase quantity and quality of life. Inadequate dialysis treatment has been observed among ESRD patients in Rwanda and this leads to poor patient survival, increase cost and mortality rate.

Aim of the study: The aim of this study was to assess the factors associated with dialysis adequacy in ESRD patients on maintenance in Rwanda.

Methodology: A descriptive cross-sectional design was conducted. Asample size of 66 Hemodialysis patients was selected using purposive sampling strategy.An interview scheduled guide was used to collect data. Dialysis adequacy was calculated using kt/v Daugirdas &Schneditz formula. Data was coded and entered into SPSS version 21 in preparation for analysis. Descriptive statistical methods and inferential statistics of chi square and multiple regressions were used to analyse the data. .

Results: The mean of hemodialysis adequacy was 1.26± 0.34. Most participants (62%) had optimal hemodialysis adequacy of equal or greater than to 1.2, 19(29%) had near optimal hemodialysis adequacy (0.8 - 1.2 kt/v) where 6(9%) had less than optimal hemodialysis adequacy (kt/v <0.8).Factors associated with hemodialysis adequacy were name of hospital (p = .010), age (p = .007), BMI (p =.004) and blood pressure level ((p = .018). where, mode of transport and type of drinking water was also significantly associated with hemodialysis adequacy (p = 0.032 and 0.030 respectively).

Conclusions: Generally, the level of hemodialysis adequacy was average among ESRD patients and the associated factors were predominantly demographic characteristics. Therefore, there is need for nephrology staff to assess the interventions that promote adequacy during hemodialysis depending on the personal attributes of the patient. Moreover, further research inquiry is needed on other factors which include technical to establish their association with hemodialysis adequacy.

Keywords: End stage renal disease, hemodialysis adequacy, Rwanda**.**

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BFR	Blood Flow Rate
CKD	Chronic Kidney Disease
DM	Diabetes Mellitus
eGFR	estimated Glomerular Filtration Rate
ESRD	End Stage Renal Disease
HD	Hemodialysis
HDA	Hemodialysis Adequacy
HIV	Human Immunodeficiency Virus
HTN	Hypertension
PD	Peritoneal Dialysis
QoL	Quality of Life
RAAS	Renin Agiontensin aldosterone System
RRT	Renal Replacement Therapy
SPSS	Statistical Package for the Social Sciences
SSA	Sub Saharan Africa
US	United State
USA	United State of American
VA	Vascular Access

CHAPTER ONE

1.1 Introduction

End stage renal disease (ESRD) is the last stage of chronic kidney disease (CKD) which requires constant treatment known as kidney transplantation and dialysis therapy (Kristin, 2018). Yet transplantation is still limited by the number of available kidneys, suitable donors and the medical condition of the potential recipients (Skelton, 2015) thus make dialysis especially hemodialysis (HD) renal replacement modality for the majority worldwide (Naicker, 2015, p.169). Even the continuous improvement of HD technology and pharmacological treatment, morbidity and mortality rates for HD patients still high (Chandrashekar & Rangarajan2014, p.12). Patients undergoing HD face many Side effects result in frequent hospitalization and increased mortality rate. HD adequacy is an important and effective factor in reducing these side effects; numerous studies have shown that hemodialysis adequacy improves patients' health status, increases life expectancy and reduces the mortality rate (Nahid et al., 2016, p.3).

1.2 Background

End stage renal disease is stage 5 of CKD with an estimated glomerular filtration rate (eGFR) of less than 15 ml/min/1.73m^2 which requires some form of dialysis regardless of the underlying cause (Jeffrey, 2015, p.13). This CKD stage represents patients with the lowest level of kidney function (The renal association, 2017).The progression of CKD to ESRD is inevitable (Usama et al., 2016, p.258) some studies suggest Proteinuria as the best-known and most studied risk factor for Progression of CKD while Claudia with her team revealed the correlation with decreases in eGFR and high serum phosphate and Parathyroid hormone (PTH) levels. ESRD presents with gastro intestinal disturbance, neurological problems, accumulation of wastes products and excess fluids in the body, mineral bones diseases, persistent hypertension and etc (Chauhan& Mendonca, 2015, p.3). A patient with ESRD needs three HD sessions in a week for survival (Fujisaki et al., 2018, p.308). HD is a treatment process that cleans the body of unwanted toxins, waste products and excess fluids according National kidney foundation, (2015) and mentions that HD can take the place of some kidney's function and along with medication and proper care help people to live longer.

End stage renal disease is global burden leading cause of morbidity and mortality; the prevalence of the disease and needs of renal care rose from 4.7millions in 2010 to 9.7million in 2015 (Thaminda et al., 2015, p.8).Two years later in 2017one in ten have been reported to have CKD which progressively leads to ESRD in its last stage (Marcia, 2017). Again the estimated prevalence ranges of 7% in south Asia and 12% in Europe. In Africa like the rest of the world the needs of renal care is increasing but the lack of renal registries means that there is no reliable statistics about the prevalence of ESRD in the majority of African countries (Thaminda et al., 2015, p.9). The recent review of ESRD in Sub Saharan Africa (SSA) reported 13.9% prevalence of ESRD (Adremi et al., 2017, p.365). Still there are no recent published population-based studies of ESRD prevalence in Rwanda except in 2015 when Partners In Health's study estimated 10% of ESRD prevalence.

The major risk factors leading to ESRD worldwide are Hypertension, type two Diabetes mellitus and population aging (Sarah et al.,2015,p.2621) and glomerular diseases is mentioned in the developing countries especially Sub Saharan Africa (SSA) regions (Naicker et al.,2014) contrary to the North Africa where the principal causes of ESRD are interstitial nephritis (14 to 32%) often attributed to environmental pollution and inadvertent use of medications; North Africa accounts glomerulonephritis at (11 to 24%) mostly from mesangioproliferative and focal segmental sclerosis, diabetes at (5 to 20%) and nephrosclerosis at (5 to 21%)(Rachad, 2017, P.111).

In 2015, Rwanda Demographic Health Survey data showed a projected total population of 11,274,221 people with approximately 84 percent of them living in rural area this is evident that there is little or nothing known about the proportion of people living with ESRD or requiring RRT in Rwanda. Despite limited studies on ESRD in Rwanda the available data suggest infections and hypertension as the major causes of ESRD (Partners In Health, 2015 p.1) and noted malaria, tuberculosis and HIV as contributors in areas with high prevalence rate.

The current standard of care for ESRD is kidney transplantation and dialysis (Frank, et al., 2015, p.1).Dialysis substitutes the natural work of the kidney (Stephens, 2017). Dialysis has the three main approaches but hemodialysis (HD) and peritoneal dialysis (PD) are the only modalities offered for ERSD patients in Rwanda. Renal transplantation is the treatment of choice for a minority of patients with ESRD (Bradley,2018) despite the known benefits of kidney transplant; renal transplantation is limited by the number of available kidneys, suitable donors and the medical condition of the potential recipients (Skelton , 2015). HD remains the renal replacement modality for the majority worldwide (Naicker, 2015, p.163.) ,he adds that PD is offered in limited numbers due to peritoneal dialysis fluids which are often imported and not locally made.

1.3 Problem Statement

Inadequate dialysis treatment has been observed by the researcher among ESRD patients in Rwanda. However there is lack of literature or no study done to affirm this in Rwanda. Despite the current clinical guidelines to improve dialysis adequacy, HD seems inadequate in the majority of patients (Suman, 2017).research conducted by, Sheikh& Ghazaly in Egypt (2016) revealed inadequate HD dose among 60% of population involved on their study. A study in Sudan showed that 58% were labeled as having adequate solute clearance with URR of not less than 65% where Female patients had significantly more adequate dialysis compared with male (Hisham&Mazin, 2015).

Moreover, inadequate HD is common and is associated not only in poor patient survival, but also leads to anemia, malnutrition, functional impairment and frequent hospitalization that culminate in an increased health care cost and increased mortality rate (Chijiokee et al., 2016 p.116). Again, a negative impact on the quality of life (QOL) of ESRD patients on maintenance HD is also apparent as a result of dialysis inadequacy (Marta et al., 2018, p. 578). Furthermore, the factors associated with hemodialysis adequacy are not well documented in literature. Hence the need for this study is to assess the factors associated with HD adequacy in ESRD patients on maintenance hemodialysis in Rwanda.

1.4 The aim of the study

The aim of this study is to assess the factors associated with hemodialysis adequacy in ESRD patients on maintenance hemodialysis in Rwanda.

1.5 Research objectives

To establish the level of hemodialysis adequacy (HDA) in ESRD on maintenance Hemodialysis in Rwanda

To identify factors associated with Hemodialysis adequacy in ESRD on maintenances hemodialysis in Rwanda

1.6 Research questions

What is the level of hemodialysis adequacy in ESRD patients on maintenance HD in Rwanda?

What are the factors associated with hemodialysis adequacy in ESRD on maintenance HD in Rwanda?

1.7 **Significance of the study**

To nursing practice: Inadequate hemodialysis adequacy is closely related to mortality and morbidity in patients on maintenance hemodialysis. Knowledge of patient related risk factors for inadequate delivery of hemodialysis would be helpful for health care professionals in improving their practice.

Research: This study proposes to objectively establish the factors associated with hemodialysis adequacy for our patients; it is noteworthy that there is insufficient local data regarding hemodialysis adequacy among ESRD patients in Rwanda, although most data available currently emanates from developed world and this may not accurately reflect our situation due to major socio-cultural, economic and environmental differences.

Education: The findings from this study serve as pillar in incorporation of renal replacement therapies course in curriculum designed for the general health care professionals because most renal heath care services are provided by the general health care professionals.

Management: The data generated from this study will be used by the hospitals managers in negotiation and advocacy to the health insurances regarding the improvement of quality of life among ESRD undergoing HD in Rwanda.

1.8 Definitions of concepts

Hemodialysis adequacy: Defined as a determination made by clinical assessment of patient well-being. How inadequate dialysis may be overlooked by strictly adhering to clinical criteria; although the inverse is equally true (National kidney foundation, 2016 p.6).In this study hemodialysis adequacy refers to having fractional clearance of urea KT/V~1.8 for patients on twice weekly hemodialysis and Kt/v of ~1.2 to 1.4 for three weekly dialysis associated with urea reduction rate (URR) targeted at 65% for thrice weekly dialysis and~ 80% for twice weekly dialysis.

Factors associated; A factor is something that contributes to a result. It can be in a controlled lab experiment or naturally occurring (Monica, 2016) Associated means a connection between things or concepts. In this study factors associated refers components that should contribute to the hemodialysis adequacy such as demographic characteristics, vascular access, frequency to the dialysis therapy, blood flow rate, compliance to the treatment regimen.

End stage renal disease (ESRD): This is stage 5 chronic kidney disease with a glomerular filtration rate (GFR) of 15 ml/min or less (Pradeep, 2018).In this study refers all patients confirmed Glomerular filtration rate less than 15% and who are on maintenance hemodialysis for survival.

1.9 Structure/organization of the study

This project divided in three following chapters; chapter one introduction which consist of definition of key terms, background, problem statement, objectives (main and specific objectives), and research questions, significance of the study and subdivision of the structure of

the study, chapter two is the review of literature both theoretical and empirical and the third chapter is the research methodology.

1.10 Conclusion of chapter one

ESRD is a known increasing public health concern globally which is often due to the co-morbidities conditions such as hypertension and type two diabetes mellitus. In Rwanda, the prevalence of ESRD is increasing due to increase in aforementioned co-morbidities and this necessitates Renal replacement therapy. Although kidney transplantation is an effective measure for eradication of ESRD, resources constraints and the shortage of kidneys donation remains a challenge. Hence the preferred mode of treatment for ESRD patients in Rwanda is hemodialysis. Hemodialysis adequacy is paramount in ESRD treatment as this reduces the mortality and at the same time promoting the quality of life among the population.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

A literature review is an overview, critical and analytical of existing research on a specific topic in order to identify what has been written on a subject, determines the extent to which a specific research area reveals any interpretable trends, aggregate empirical findings related to a narrow research question. It support evidence-based practice; generate new frameworks and theories; and to identifying topics or questions requiring more investigation (Paré and Spyros, 2017).

These literatures will be covered into two main parts which include theoretical and empirical literature. However all data will be obtained from English language in studies published since 2014. The publications will be identified through literature searches using Google, Google scholar, Pub Med, HINARI, CINAHL, Cochrane Library and reference lists of published articles. Database search terms included keywords such as: end stage renal disease, prevalence of ESRD, etiologies of ESRD, hemodialysis adequacy and factors associated with hemodialysis adequacy.

2.2 Theoretical Literature

Theories are formulated to explain, predict, and understand phenomena and, in many cases, to challenge and extend existing knowledge within the limits of critical bounding assumptions. The theoretical literature review help establish what theories already exist, the relationships between them, to what degree the existing theories have been investigated, and to develop new hypotheses to be tested.(Michael.2019).This part will theroically discuss definition, progression, risk factors and the management of ESRD.

2.2.1 Definition and progression to ESRD

ESRD is the last stage of chronic kidney disease (CKD) characterized by irreversible and permanent loss of kidney functions. Eventually a person said to have ESRD when kidney function is less than 15 mL/min/1.73 m^2 (Kallenbach, 2015).

CKD leads to higher risk of dialysis, hospitalization, cardiovascular morbidity and mortality (Wan et al., 2016) its progression to ESRD is inevitable (Usama et al., 2016 p.258). However highly expected risk factors for CKD progression include age, sex, arterial hypertension and

proteinuria (Fernando et al., 2017). In addition risk ratio for male patients and substantial proteinuria showed significantly higher hazard for the progression from late CKD stage to ESRD whereas diabetes mellitus demonstrates a borderline significance. Moreover Proteinuria has been well established as a marker of kidney damage and widely reported to be an independent perpetuating factor for CKD progression. Still various macrovascular and microvascular diseases such as cardiovascular diseases, cerebrovascular diseases, nephropathy and retinopathy from DM unable diabetic patients to develop CKD but not survive long enough to develop ESRD (Wan eta l., 2016, p.6).

Some studies suggest that protein restriction may retard the progression of CKD toward ESRD (Quan et al., 2017, p.304) especially animal-sourced protein had noted to accelerate decline in eGFR. on the another hand glomerular capillary hypertension, renal fibrosis, podocyte loss, proteinuria and activation of systems such as the Renin Angiontensin Aldosterone System (RAAS) are distinguished as the common pathophysiologic mechanisms underlie the progression of most kidney diseases (Drawz et al., 2015, p. 598). Further it is proved that controlling blood pressure with enhancing therapy directed at inhibiting the RAAS slow the progression of the disease.

2.2.2Risk factors for ESRD

Major risk factors for ESRD are diabetic nephropathy (43.2%), hypertension(HTN) (23%), glomerulonephritis (12.3%), and polycystic kidney disease (2.9%) in developed countries like USA, (Somnath,2016), similarly in Germany HTN and diabetes mellitus (DM) come in front (Girndt& Markau,2016,p.86) and noted former smokers to have slightly increased prevalence ratios for renal dysfunction. Whereas in north Africa where major risk factors are interstitial nephritis (14 to 32%), often attributed to environmental pollution and inadvertent use of medications; glomerulonephritis (11 to 24%), mostly mesangioproliferative and focal segmental sclerosis; diabetes (5 to 20%) and nephrosclerosis (5 to 21%). Again obstructive/reflux nephropathy attributed to urinary schistosomiasis is common in Egypt (7%), Libya and Southern Algeria. In addition to this the Primary urolithiasis is a frequent cause of obstructive nephropathy in the western (hyperoxaluria) and middle (cystinuria) regions (Rashad, 2016, p. 113).

Often in most African countries the etiology of a huge proportion of ESRD remains unknown because of late referral of patients, inadequacy of medical care facilities or lack of health-care manpower but hypertensive nephrosclerosis and chronic glomerulonephritis are similar in the four sub-regions of Sub Saharan Africa (Omar, 2013 p. 595). Anyway the absence of published population-based studies of ESRD in Rwanda (Partners In Health, 2015, p.149) suggested infection such as streptococcus, malaria, tuberculosis and hypertension to be the major risk factors and revealed HIV nephropathy is a major cause of ERSD disease in areas with high HIV prevalence. Yet there no literature talking about diabetic nephropathy in Rwanda but it is estimated in between 6–16% in SSA (Saraladevi, 2013, P.161).

2.2.3 Prevalence and Demographic distribution of ESRD

Overall report showed that 10% of the world's adults had some form of kidney disease (Frellick, 2017)"Many don't know they have it." ESRD affects mainly young people in developing countries compared to developed countries (Rotimi et al., 2014, p.348). The increasing prevalence of non communicable diseases (NCDs) as a major cause of morbidity and mortality coupled with an ageing society undergoing a rapid epidemiological transition has brought CKD which straight to ESRD into the spotlight (Saraladevi & Ashuntantang,2017, p.13).

According to the latest U.S. Renal Data System Annual Data Report more than 660,000 Americans are being treated for ESRD (National Kidney Foundation, 2017) still the incidence of ESRD continues to vary substantially in some European countries (James, 2017, p.149) while there is an average incidence of 182 and prevalence of 522 patients with ESRD patients per million populations in North Africa (NA) (Rashad, 2016, p.14).

Data regarding the epidemiology of ESRD in sub-Saharan Africa are scarce and knowledge about the spectrum renal disease is very limited (Marie et al., 2015, p, 2). Demographically Africa estimated patients with ESRD males to females ratio at 67.2 % to 32.8% (Rotimi et al.,2014, p.348), in contrary to the USA where affected males to female are slightly lower at ratio of 57.3% and 42.6% respectively (National kidney foundation, 2017) similarly in Europe where more incidences in men than in women (Raul et al., 2018,P.1) but in some countries of Asia like in Iraq Males and females distribution is almost similar (Dana et al., 2017,p.211).

2.2.4 Review of ESRD management

ESRD requires constant treatment known as renal replacement therapy (RRT) which consists of kidney transplantation and dialysis therapy (Kristin, 2008). Dialysis substitutes the natural work of the kidneys (Stephens, 2017) and has the three main approaches that are intermittent hemodialysis (HD), peritoneal dialysis (PD) and Continuous renal replacement therapies (CRRT). Renal transplantation is the treatment of choice for a minority of patients with ESRD (Bradley, 2018). Despite the known benefits of kidney transplant; transplantation is limited by the number of available kidneys, suitable donors and the medical condition of the potential recipients (Skelton, 2015).

Peritoneal dialysis which was first used for the management of ESRD since1959 (Pamela, 2016) but currently treatment modalities for ESRD are interesting; about 30% of patients with ESRD in the USA are transplanted although more than 60% in some Asian and Eastern European countries but worldwide kidney transplant ranges at 5 to 10 % (Jeffrey, 2016). This author revealed that PD is performed in about 10% of patients with ESRD in the USA; Hong Kong leads the world at about 45%. HD is the dialysis modality used for about 90% of patients in the United States and in most countries around the world even if home HD remains quite rare except for New Zealand and Australia. HD is the mainstay therapy which is offered for ESRD patients who cannot undergo renal transplantation.

The main purpose of HD is the provision of sufficient and safe patient treatment which contributes to better physical condition of the patient and it prevents further problems and complications that are due to uremia,(Chauhan& Mendonca,2015,P.329). Again HD remains predominant modality in RRT for the most African countries whilst PD is offered in limited numbers (Naicker, 2015, p.162). In Africa the management of ESRD is largely influenced by late referral, co-morbidities and lack of dialysis facilities. Since renal transplantation is largely from live (often unrelated) donors as well it is offered to less than 5% of patients with ESRD (Rachad, 2016, p.113). The current HD treatment rate ranges from <20 per million population for most of Sub-Saharan Africa. In Rwanda like elsewhere in SSA, HD is the most RRT used for almost all of ESRD patient while PD still deserved for the children.

2.3 Empirical Literature

Empirical literature review deals with original research (such as scientific experiments, surveys and research studies). They are researches based on experience and observation, rather than on systematic logic. Itdetails previous empirical studies that have been done on the topic by other researchers and the findings that emerge (Nakano, 2018). The particular topic will discuss on the level of HDA from the previous studies, factors associated with HDA that include demographic characteristics, vascular access types, hemoglobin levels, erythropoietin (EPO),stimulating agents ,Dialyzer types and blood flow rate as well.

2.3.1 Hemodialysis adequacy (HDA)

HDA is considered to be the best therapeutic indicator for patient's clinical results (Sheikh & Ghazaly, 2016, p.399). Although the best index for the assessment of HDA is the urea clearance (Jane, 2008) but HDA is associated with the general clinical state of the patient as manifested by a good nutritional status (maintained muscle mass) and the absence of anemia, edema, hypertension, electrolyte and acid-based disturbances, neurologic symptoms, pruritus, and insomnia (Bengt, 2010).

The determination of HDA is based on measures of intradialytic urea reduction through the fractional clearance of urea (kt/v) and Urea reduction ratio (URR) (Daljit,2017);The Online calculators and normograms are available to calculate Kt/V using formula of $Kt/V = -\ln (R - 0.03) + [(4 - 3.5R) \times (UF \div W)]$.

Where…R= post HD BUN/pre HD BUN,

UF= UF volume in L

W= post dialysis weights in kg (Sternby&Daugirdas, 2015 p.469) while the quick and dirty method use as follow:

If the dialyzer's clearance (K) is known (based on the packet insert provide by the manufacturer at a blood flow rate (BFR) of 400ml/min) and is 250 ml/min and the HD session time is 240 minutes (4 hours) then Kt (dialysis dose) = 250 x 240 = 60,000ml or 60 liters.If the patient

weighs, his TBW is 60% of 70 kgs then V = 70 kg multiplied by .60 = 42 liters. So the ratio – K multiplied by t to V, or Kt/V – compares the amount of water that passes through the dialyzer and is cleared of urea to the amount of water in the patient's body.KT/V for this patient will be= 60/42 = 1.42

Caution: If this same patient has 3 kg of edema fluid (EDW of 70kg) then V = 60% (70kg) + 100% (3kg) = 45L and not 42L.

This is because edema fluid adds to the TBW in its entirety as urea distributes evenly across body water.The minimum optimal dose targeted for HDA is Kt/V of ~1.8 for patient on twice-weekly HD session and KT/V of ~1.2 to 1.4 for thrice weekly dialysis patient whilst the minimum optimal dose targeted for URR is 65% for thrice weekly dialysis patients and 80% for twice weekly HD URR = (predialysis BUN – post dialysis BUN)/predialysis BUN (Sheikh & Ghazaly, 2016, p.400).

The adequacy of hemodialysis is very important since improves patient survival, quality of life; biochemical outcomes (Ozra et al., 2016, p.578), minimizes disease complications and hospitalizations (Amini et al., 2015). The HDA is an essential measure of quality of care in dialysis and has been shown to correlate with better clinical outcomes, prevention not only for hospitalizations and frequent hospital admissions (sajeda et al., 2015 p.7) but also in the mortality rate. On the other hand repeated HD sessions increase workload of nurses and high economic costs is imposed on the health system (Ozra, 2016, p .579).

A study on improvements of dialysis therapy in ESRD patients in Korea (dong, 2015, p.20) revealed that slightly increase of Kt/V of patients undergoing HD enhance the patient survival. In Egypt (Sheikh &Ghazaly , 2016,p.402) revealed inadequate HD adequacy among 60% of population involved on their study nevertheless they also proved that increasing time and frequency of dialysis, good blood flow rates, low recirculation percentages, reduction of intradialytic complaints, and well-functioning vascular access are associated with better HDA.

A study in Sudan showed that 58% were labeled as having adequate solute clearance with URR of not less than 65% where Female patients had significantly more adequate dialysis compared

with male (Hisham&Mazin, 2015, P. 145). There are no researchers regarding the HDA in Rwanda, the available data in the regions was developed in decades ago.

2.3.2 Factors associated with hemodialysis adequacy

2.3.2.1. Demographic characteristics

The environment to which an individual is exposed comprises important factors affecting the health (Mikkonen& Raphael, 2010). Socio-demographic characteristics such as age, gender, race, level of education, occupation, religion and marital status have been found to affect the health of an individual and most of these factors interact with each other (Victoria et al., 2015) in addition the evidence-based knowledge derived from exploring the relationship between socio-demographic factors and non-compliance may help to understand how such factors may be taken into account towards effective early interventions to increase compliance among ESRD patients (Ahrari et al., 2014,p.13).

Age

Study conducted in Iran (Hamid &Fatemeh, 2013, p. 4) found that age had a significant relationship with HDA among dialysis patients and noted Patient's age by itself affects the HD procedure; aged patients require a careful consideration because of their specific problems during HD (Klaric et al., 2016). It may be complicated by the resultant problems one of which is dialysis efficiency (Hamid and Fatemeh, 2013), Ozra with the team (2016) proved that HDA had an inverse relationship with age; and older patients had less HDA. Vashistha and the team in 2014 proved the progressive lower of all-cause, cardiovascular and infection-related mortality in patients younger than 65 years; this decrease had a negative impact on the quality of life of these patients (Hengameh et al., 2016).

Gender

Gender has a direct relationship with the health of an individual (Lane &Cibula, 2000).Despite higher proportions of women in the general population across all age groups (Manfred et al., 2014) found fewer women than men undergoing HD treatment yet the survival advantage that women have over men in the general population was markedly diminished in dialysis patients.

Even fewer women in hemodialysis treatment there is significant relationship between gender and HDA; women had more satisfactory HDA than men (Nahid et al., 2016, p.265).

Race

ESRD is one of the starkest examples of racial/ethnic disparities in health (Keith et al., 2017). ESRD constitutes a major health disparity among racial and ethnic minority groups in the United States particularly among blacks (Robert and Agodoa, 2017). African Americans, Hispanics, and American indians are at high risk for developing kidney failure; this risk is due in part to high rates of diabetes and high blood pressure in these communities. Moreover African Americans are almost four times as likely as Whites to develop kidney diseases (National Institute of Diabetes and Digestive and Kidney Diseases, 2016). Racial/ethnic minorities are 1.5 to nearly 4 times more likely than their non- Hispanic White counterparts to require renal replacement therapy (RRT) with African Americans suffering from the highest rates of ESRD (Keith et al., 2017).

2.3.2.2 Socioeconomic factors

ESRD and its current standard of care RRT, which includes dialysis and/or kidney transplantation) result in substantial economic and societal costs (Frank et al., 2015, P.3). The rising of life expectancy rapidly throughout the world associated with an increasing of health-care expenditures (Fredrick et al., 2018) and this increase of life expectancy in the general population are associated with a higher burden of RRT. ESRD affecting up to 0.03% of the total population in developed countries; further ESRD consumes up to 3% of annual healthcare budgets in many countries (Frank et al., 2015, p.1). currently in USA one year of HD can cost up to $72,000 while a year of peritoneal dialysis costs about $53,000, according to information from the U.S. Renal Data System , same as in Australia where the dialysis estimated to cost up to $79,072 per person per year for hospital HD and $53,112 for peritoneal dialysis (kidney health austalia,2017) slightly cheaper in some European counties like Germany where the dialysis-related cost is about €54 777(63,940USD) per patient year(Icks et al.,2015).

In 2010 ~3Millions people worldwide received RRT despite ~5Millions patients needing RRT, (Thaminda et al., 2015, p.10) but also found largest treatment gaps in low-income countries

particularly Asia and Africa in receiving RRT. Even if the cost of HD is slightly low in developing countries still there is huge burden on the families, like in Palestine where the estimated cost of HD per patient averaged US$16 085 per year (Mustafa et al., 2015), similarly in India where the average cost of therapy per month in India (Mumbai city) was 6142.33 Indian rupees ($ 90) along with an estimated 29.8% of Indians live below the country's national poverty line. This means that most of the patients will not be able to afford ESRD care (Manjunath et al., 2015).

Currently few papers indicate that dialysis is an expensive form of treatment for the population of Asia and Africans countries and these poorer countries have an over-proportional burden to finance dialysis services (Mushi et al., 2015). The systematic review on the cost of dialysis in low and middle-income countries revealed that the annual cost per patient for HD ranged from Int$ 3,424 to Int$ 42,785. Direct medical cost especially drugs and consumables for HD and dialysis solutions are inclusive (Ronnie, 2017), He also proved that those who did begin dialysis most quit usually within two weeks because they could not afford to continue and 88 percent died and he established that only about 10 percent of adults and 35 percent of children with ESRD remained on dialysis for three months.

The burden of the cost for the care of patients on dialysis is noted in all African countries because of up to 80% the population live on less than 2.5 dollars per day while one session of HD costs as much as USD 100 – 200 (Taslim,2014).However most patients with ESRD have to rely on financial support from their extended families, religious organizations and philanthropists to be able to pay for dialysis; many patients with ESRD are denied access to maintenance HD because of rationing policies that limit provision of dialysis to patient with few co-morbidities.

In central Africa countries like in Cameroon the annual median cost of HD per patient is ($ 13 581). Out-of-pocket payments amounted to ($ 4 114)which accounting for 30% of the total cost(Patrice et al., 2017,p.231) same as in Nigeria, more than 90% of the population lives below the poverty line and patients with ESRD pay out-of-pocket for maintenance HD (Babawale et al.,2013) which result to non-adherence of patients to prescribed dialysis in Nigeria, Bello (2014)revealed that3.3% were able to afford thrice weekly dialysis while 13% of patients achieved 70% of scheduled twice weekly dialysis sessions.

It is estimated that by the year 2030 more than 70 % of the patients with ESRD will be residents of developing countries whose collective economies will account for less than 15 % of the total world economy. Despite this huge burden the prevalence of ESRD in Sub Saharan Africa is reported to be less than 150 per million populations unfortunately there very few studies done on the cost of HD in low- and middle-income countries (Mushi et al., 2015).The available data estimate that the cost of HD in Africa is up to $100 per session (Naicker, 2015) the author revealed no difference between annual cost of HD and the annual costs of continuous ambulatory peritoneal dialysis.

2.3.2.3 Adherence to hemodialysis associated factors

The successful treatment for patients with ESRD requires adherence to complex whole of lifestyle changes. Lack of compliance with diet and fluid restrictions may lead to accumulation of metabolic by products and excess fluid in the circulatory system leading to increased morbidity and mortality for ESRD patients (Shahnaz et al., 2014, P.1).

Patients are considered non adherent if they skipped one or more sessions per month, shortened one or more sessions by more than 10 minutes per month, had a serum potassium level greater than 6.0 mEq/L, a serum phosphate level >7.5 mg/dL (>2.4 mmol/L), or interdialytic weight gain (IDWG)>5% of body weight(Saran et al. , 2015). Non compliance to HD treatment is less observed in developed countries compared to developing countries 23% of the US and none of the Japanese (Kana et al., 2018).

Further researches found disparities in adherence among ESRD; in Egypt at least 50% of HD patients are believed to be non-adherent to some part of their treatment (Salwa et al., 2015)but in Palestine (55.5%) patients had good adherence, (40.5%) had moderate adherence and (4.1%) had poor adherence (Karam et al., 2017). Once more, about 41.1% of Iranian patients on maintenance HD reported non-adherence to diet and 45.2% were non-adherence to fluid. Salwa and colleagues proved less HDA and significant impaired of quality of life among the non-compliant patients.

Adherence among ESRD to HD in Rwanda reported at 49% (Claire et al., 2018).Moreover Health promotion behaviors such as regular exercise, adequate sleep, avoiding alcohol and tobacco use, proper nutrition, avoidance of obesity, medical care and avoidance of stress are advised (Jahantigh et al., 2016).

2.3.2.4 Hemodialysis therapy associated factors

Vascular access (V.A)

Blood flow for dialysis, long life, few side effects (infection, stenosis, thrombosis) (SaranietA well-functioning vascular access (VA) is a foundation to perform an efficient HD procedure. There are three main types of access: native arteriovenous fistula (AVF), arteriovenous graft (AVG), and central venous catheter (CVC). The ideal vascular access should have three characteristics: adequate al., 2015). AVF meets all these conditions. The CVC unlike AVF has a high prevalence of infection, high costs and associated with increased morbidity and mortality therefore AVF remains the first choice for chronic HD. It is the best access for longevity and has the lowest association with morbidity and mortality reason why AVF use is strongly recommended by guidelines from different countries (Domenicoet al., 2014, p. 281).

However CVC are still being used for emergent HD in these patients. CVC is also used in people with diabetes, old people or females with vascular diseases. It has also been used for patients with heart failure, patients who are waiting for kidney transplant and those who referred to the nephrologists late (Tammy et al., 2015).One of the major problems and causes of failure in HD was represented by the lack of good VA (Hui et al., 2014)**.**

VA remains the Achilles' heel of HD and is essential since a good VA translates into an efficient HD procedure (Domenico et al., 2014, p.284). Almost 90% of ESRD patients on regular HD using AVF as Vascular access in Egypt (Tarek et al., 2016, p.59). Regardless of the quality of AVF in HD, Vascular access is a real problem in sub Saharan Africa such as in Senegal only less than 10% of all patients undergoing HD use AVF as VA (Kane et al., 2015) whereas less than 25% in Kenya (Ndinya, 2016).

Dose and frequency of hemodialysis

Survival in patients with ESRD is made possible by 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 (Wajeh et al., 2018). Patients receiving 3 times weekly HD treatments

lasting 2.5-5 h of HD experienced a higher delivered HD dose with Kt/V range of 1.8-<2.0 which is associated with lower risk of mortality, the greatest survival gain (Lertdumrongluk et., al.,2014,P.391),and noted a consistent relationship between higher HD dose and greater survival. Yan with team (2018) revealed that patients who underwent twice-weekly HD had 4.26 times less chance of survival as compared to patients with thrice-weekly HD. A higher dialysis dose of >1.2 Kt/V offered better survival as compared to a lower dose of <1.2 Kt/V.

Residual kidney function has consistently been a predictor of greater survival in maintenance HD patients (Zhang et al., 2014, p.140), also noted the residual kidney function to loss significantly lower in the twice-weekly compared with the thrice-weekly. Twice-weekly HD during the first year of dialysis therapy appears to be associated with better Residual kidney function preservation. Moreover twice weekly therapy at least at the start of HD can meet urea clearance "targets" if patients have significant residual function or if they follow a protein- restricted diet (Dipal et al., 2016) They mentioned to have potentiality in reducing health care costs and increase access to renal replacement therapy in low- resource setting of Low and Middle Income Countries.

Hemoglobin Levels

The anemia of ESRD develops in the early stages of CKD yet the management of anemia is suboptimal for a large proportion of patients. Early management of anemia can lead to a reduction in the severity of comorbid conditions and may slow the progression of renal disease.
Anemia is extremely common among HD patients and underlies some of the symptoms associated with reduced kidney function including fatigue, depression, reduced exercise tolerance, and dyspnea. Anemia is also associated with increased morbidity and mortality related to cardiovascular disease and an increased risk of hospitalization and hospital length of stay (Jeffrey et al., 2016). Target Hemoglobin for maintenance is 10–11.5 g/dl in all ESRD patients on maintenance HD (Imari et al., 2015, p.207).

Several studies in ESRD patients have demonstrated that correcting anemia has significant benefits such as improvement in quality-of-life indicators (Hiroki et al., 2018), yet some studies found that there is no significant relationship between hemoglobin and HDA (Ozra et al., 2016).

In contrary to the study of Mahmoud with his team in 2014 where they found that HDA had been shown to be associated with higher hemoglobin levels in patients on maintenance HD.

Erythropoietin supplementation

Anemia is prevalent among patients with ESRD and left untreated has a negative impact on quality of life. There are important differences among the treatment options for anemia. Iron or erythropoietin-stimulating agents (ESA) may be administered to increase hemoglobin levels. Severe cases of anemia in patients with ESRD undergoing HD may be treated with both ESA and red blood cells transfusions to manage hemoglobin levels (Brett et al., 2017, p.1).

ESA decreases the need for blood transfusions, improves patients' health-related quality of life but carry risks of cardiovascular events that includes stroke and increase of mortality. Again blood transfusions are used in acute situations and in patients who do not respond to ESA but are associated with uncommon risks such as acute lung injury, circulatory overload and allosensitization to human leukocyte antigen (HLA)these antigens may interfere with following Kidney transplant(Brett et al., 2017,p.2).

Blood loss in HD therapy among HD patients may cause the increase in ESA requirements in HD patients (Myoung et al., 2015, p.9). Hence both anemia and high doses of erythropoietin have been associated with increased mortality among dialysis patients (Mohsen et al., 2017) Recombinant human erythropoietin treatment increases blood hemoglobin levels in almost all patients with anemia of ESRD and has been a mainstay of managing these patients for decades Both intravenous and subcutaneous erythropoietin effectively ameliorate anemia of kidney ESRD (Daniel et al.,2015,p.1).Shahdadi with his team ,(2016) found that Subcutaneous ESA injection has positive impact on HDA similarly to Daniel et al, (2017) in their study proved that treatment of patients on HD with subcutaneous ESA is associated with more favorable clinical outcomes than those associated with intravenous ESA treatment.

Dialyzers type and blood flow rate

Inadequacy of HDA is one of the main causes of death in HD patients.

Some studies have suggested that high- flux membrane improves the removal of moderate-sized molecules while other studies indicate no significant effect on them (Khodayar et al.,2014,p.1).

Yet the use of high−flux membranes is associated with removing of the middle size and large size molecule that improve the adequacy of dialysis. Maryam et al. (2016) found that High-Flux filters were one of the most effective, efficient and safest methods to enhance the HDA and they mentioned that High-Flux could be associated with some complication such as nausea, vomiting, muscle cramps and headaches. However HD therapy using high-flux membranes did not reduce all-cause mortality but reduced cardiovascular mortality compared to HD using low-flux membranes (Yelena et al, 2015, p.832).

Blood flow rate (BFR) during HD is one of the important determinants of increasing dialysis dose (Kyung et al., 2015, p.1131) and concluded that patients with BFR < 250 ml/min had higher risk for all-cause mortality. BFR of less than 300 ml/min provides insufficient clearance and mentioned that Results of both BFR 320 ml/min and BFR 380 ml/min have Kt/V and URR averages above the minimally adequate dose (keira et al., 2017).Further studies proved that increased BFR is associated with increased rate of clearance (Sheikh & Ghazaly,2016) found that BFRs was statistically significant with the KT/V, the Kt/V values ≥1.2 was associated of BFR 200-250 ml/min while BFR between 251-300 ml/min and above showed the greater clearance rates and they mentioned that low recirculation percentage significantly result in better HDA.

2.4 Critical review and research gap identification

End stage renal disease is a leading cause of morbidity and mortality in both developed and developing countries, Many African countries are currently undergoing rapid epidemiological transitions and are confronted with the double burden of communicable and non-communicable diseases. ESRD, a condition requiring maintenance dialysis or a kidney transplant for survival, carries a high risk of death. ESRD and its current standard of care RRT result in substantial economic and societal costs. Analyses of registry data support that survival of those with ESRD has increased over the past 20–30 years. Howeverthe HDA is the cornerstone for the well being of ESRD patient on maintenance HD. Achievement of HDA is the paramount importance to improve quality of life, decrease healthcare costs and also decrease morbidity and mortality rates in HD patients. Further establishment of HDA and factors associated result the level of outcome and quality of life among end stage renal disease patients.

2.5 Conceptual framework of Health Promotion Model adapted from Pender, 1996

The health promotion model notes that each person has unique personal characteristics and experiences that affect following actions (pender, 1996). Pender's model focuses on three areas: individual characteristics and experiences, behavior-specific cognitions and affect, and behavioral outcomes. The Health Promotion Model makes four assumptions first individuals seek to actively regulate their own behavior, the second; individuals in all their Biopsychosocial complexity interact with the environment, progressively transforming the environment as well as being transformed over time, the third one Health professionals such as nurses, constitute a part of the interpersonal environment which exerts influence on people through their life span and lastly Self-initiated reconfiguration of the person-environment interactive patterns is essential to changing behavior. This health promotion model was used by (Masoud, 2017) through analyzing its effect in Improving the Nutritional Behavior of Overweight and Obese Women.

Pender's health promotion model (HPM) is one of the widely used models to plan for and change unhealthy behaviors and promote health. Different studies have highlighted the efficiency of this model to control unhealthy behavior (Khodaveisi, 2017). Thus patient with ESRD patients on maintenance need behavioral changed in order to meet compliance and hemodialysis adequacy.

Definitions of Components of Model

Individual characteristics and experiences involve personal biological factors, psychological factors, and socio-cultural factors which are the general characteristics of the individual that influence health behavior such as age, personality structure, race, ethnicity, and socioeconomic status (Yeow &Angela, 2016, p.423). In this study this concept refers the all demographic characteristics ESRD that could contribute to hemodialysis adequacy which results to the health promotion.

Behavior-Specific Cognitions and Affect: This concept involves patient perception about the anticipated personal benefits of pursuing positive health outcomes that might result from a given health behavior which means it perceives benefits of action, barriers to action, and activity-related affect subjective feeling occurring prior to, during and following a specific health behavior (Yeow &Angela, 2016, p.424). In this study this concepts refers modifiable factors that

are associated to the adherence to hemodialysis treatment and lastly contribute to the hemodialysis adequacy.

Behavioral outcomes: This concept involves identification and intention of a planned strategy to implement a health behavior. It also can involve alternative behaviors that patients are not able to control because of environmental contingencies which means the desired behavioral end point or of health decision-making and preparation for action (Yeow & Angela, 2016, p.425). In this study this concept presumes the behavioral changes that are acquired after achieving the hemodialysis adequacy

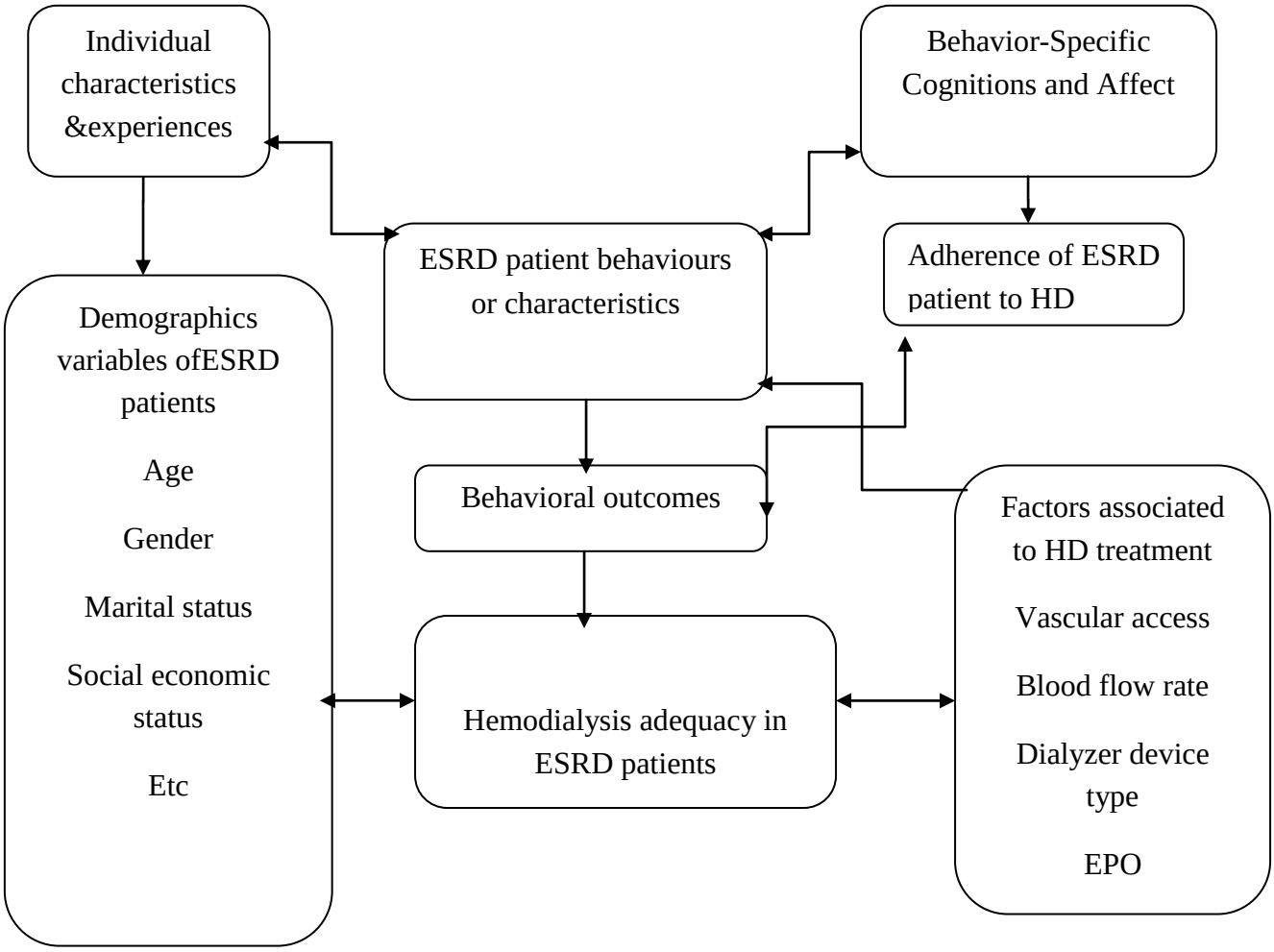

FIGURE 1: ADAPTED CONCEPTUAL FRAMEWORK FROM HEALTH PROMOTION MODEL FROM PENDER, 1996

2.6 Conclusion of chapter two

End stage renal disease is a chronic condition characterized by irreversible and permanent loss of kidney functions. An end stage renal patient needs a kidney transplant or three hemodialysis sessions per week to survive. However because of financial constraints to kidney transplantation, patients are maintained to hemodialysis treatment. Hemodialysis adequacy remains the independent factor that determines the quality of life and lifespan among end stage renal disease patients; although a health promotion model considering each person as unique, basing on personal behavior and social demographic characteristics determine factors that enhance the level of hemodialysis adequacy.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

Research methodology is the systematic theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with branch of knowledge (Creswell, 2017 p.145). This chapter discussed study design, study area, target population, sampling size and methods, data collection tools/methods, management as well as data analysis and ethical considerations. It was also aimed at obtaining data regarding factors associated with hemodialysis adequacy in ESRD patients on maintenance Hemodialysis in Rwanda.

3.2 Research design

A research design is the set of methods and procedures used in collecting and analyzing measures of the variables specified in the research problem (Andrew, 2018).This study was descriptive cross section design in nature. This research design is appropriate for this study as it studies the phenomena under investigation and help to establish the factors associated with hemodialysis adequacy in ESRD on maintenance hemodialysis in Rwanda.

3.3. Research approach

Quantitative research methods are research methods dealing with numbers and anything that is measurable in a systematic way of investigation of phenomena and their relationships (Trochim, 2007).Quantitative methods emphasize objective measurements and the statistical, mathematical, or numerical analysis of data collected through polls, questionnaires, and surveys, or by manipulating pre-existing statistical data using computational techniques. The proponent of quantitative methods was chosen for this study to argue the variables in human phenomena that can only be studied objectively (Parahoo, 2006). It is to this effect that quantitative approach was selected as the most apposite research method for this particular study.

3.4 Research Setting

Research settings Describes the place where the research was undertaken and it also described briefly what type of management and care is normally given to the population under the study (Asya, 2008 p.68).this study entitled the factors associated of hemodialysis adequacy among patients with ESRD on maintenance HD. was conducted in the four referral hospitals in Rwanda.
Rwanda is sovereign state in central and east Africa and one of the smallest countries on the African continent. The country has a health care system that is decentralized on multi-tiered system. It is composed of the following tiers and associated packages of health services 430+ health centers (prevention, primary health care, inpatient, maternity), 39 district hospitals (inpatient and outpatient) and 4 national referral hospitals (specialized inpatient and outpatient).
The 4 referral hospitals are the Rwanda Military Hospital, University Teaching Hospital of Kigali (CHUK), King Faisal Hospital (KFH) which are located in Kigali city apart from University Teaching Hospital of Butare (CHUB) which is in south province. This particular topic will be carried out in the above Referral hospitals.

3.5 Research population

A population according to Parahoo, (2006) study population is the total number of units from which data can potentially be collected. Study population is a group of individuals chosen from the general population who share a common characteristic, such as age, sex, or health condition to which the researchers can apply their conclusions (Suprakash &Amitav, 2010, P .61). The population for this study will be the ESRD patients on maintenance Hemodialysis in Rwanda. Delimitation of the population to a homogenous level group was achieved through inclusion and exclusion criteria.

The target population is the group of elements to which the researcher wants to make inference. At least theoretically, the population is finite and can be counted, the fundamental units of the population are elements, often elements are persons; could be also households, housing units, parts of an organization (Suprakash&Amitav, 2010, P .63). In this study, the target population was made up of all patients with confirmed ESRD on maintenance hemodialysis at Rwanda Military Hospital, University Teaching Hospital of Kigali(CHUK), King Faysar Hospital (KFH) and University Teaching Hospital of Butare(CHUB) satisfying the inclusion criteria.

Inclusion criteria

Inclusion criteria are a set of predefined characteristics used to identify subjects who included in a research study. Inclusion criteria make up the selection or eligibility criteria used to rule in the target population for a research study (Neil, 2010). Hence inclusion criteria were optimized the external and internal validity of the study, improve its feasibility, lower its costs, and minimize ethical concerns, In this study Patients were recruited based on the inclusion criteria with an appropriate signed informed written consent, a confirmed diagnosis of ESRD, age above 18 years old, and being on maintenance hemodialysis for a minimum period of 3 months.

Exclusion criteria

Exclusion criteria are a set of predefined definitions that is used to identify subjects who were not included or who had to withdraw from a research study after being included (Neil, 2010). Exclusion criteria are guided by the scientific objective of the study and have important implications for the scientific rigor of a study as well as for assurance of ethical principles, This study ruled out patients were uncooperative, those who refused to sign the consent form, all younger than 18years old as well as those were not dialyzed less than 3 months.

3.6 Sampling

3.6.1 Sample size

In statistics, a sample is a subset of a population that is used to represent the entire group as a whole. When doing research, it is often impractical to survey every member of a particular population because the sheer number of people is simply too large (Kendra, 2018). In this study the entire population was very small, therefore it was reasonable to base on the census population as it allowed gathering information about the general population, in order to present a full and reliable picture of the population. Therefore, the initial expected sample size was 80 ESRD on maintenance HD in Rwanda. However, at the time of data collection, the researcher used a sample size of 66 because some of the participants were not visit renal unit regularly that means they did not have chance meet with the researcher while others were not stable to participate in the study .

3.6.2 Sampling strategy

Purposive sampling (also known as judgment, selective or subjective sampling) is a sampling technique in which researcher relies on his or her own judgment when choosing members of population to participate in the study (Black, 2010).The sample size of this study obtained through purposive sampling method. The type of purposive sampling used was total population. Total population sampling is a type of purposive sampling where the whole population of interest is studied. This technique involved examining the entire population that had a particular set of characteristics. In this study, all end stage renal disease patients shared the same specific attributes/traits which include the same diagnosis, modality of treatment , exposure to same procedure, challenges and almost the same lifestyle modification as advised byStephanie (2018).

Total population sampling was considered in this study not only the size of the population that had the particular set of characteristics in which the researcher was interested in was typically very small but also the units of interest that had characteristics of providing hemodialysis to ESRD patients.

3.7 Validity and Reliability of Research Instrument

3.7.1 Validity Instruments

Polit and Beck, (2012) define validity of a questionnaire as the degree to which the instrument measures what it is intended to measure**.**

Face validity refers to the extent to which a test appears to measure what it is intended to measure (Ellen, 2013) and it was the weakest validity since it was merely subjective, superficial assessment of whether the measurement procedure used in a study appeared to be a valid measure for given variable but it was considered throughout by structuring the content of instrument into three main readable and clear parts which consists demographic characteristics which include social economic factors, level of hemodialysis and factors associated with hemodialysis adequacy which consists of adherence associated to hemodialysis factors and the factors associated with hemodialysis therapy.

The content validity is the extent to which the elements within a measurement procedure are relevant and representative of the construct that they will be used to measure (Haynes et al., 1995). Content validity was ensured in this study by giving this research instrument to the clinical experts (nephrologists), academic experts like supervisors in order to assess whether all contents to be measured have been included. Content validity ration of the instrument was considered in this study after being rated by the experts afterwards it was calculated by using Lawshe formula as follows; Content validity ratio (CVR) = [(E – (N / 2)) / (N / 2)] where (N) stand for the total number of experts and (E) Stand for the number of experts who rated the instrument as essential. It should measure between -1.0 and 1.0. The closer to 1.0 the CVR is, the instrument considers being more essential conversely the closer to -1.0 the instrument is more non-essential. The CVR from the instrument of this study was 0.8

To ensure adequately the content validity of the instrument used in this study; the content validity index was considered as per (Polit& Beck, 2004,p 423).However this instrument was given to three types of experts thus clinical experts, academic experts and educational specialists for rating the instruments afterwards content validity index was computed calculated .Lynn recommended that Item –Content Validity Index should no lower than 0.78 whereas item content index equal or greater to 0.80 was considered as highly relevant (pilot & beck,2006).

Construct validity refers whether the instruments measure the distinct dimension (construct) they are intended to measure(Neil,2010) thus it does not have a criterion for comparison rather it utilizes a hypothetical construct for comparison. It is the most valuable and most difficult measure of validity. It is a measure of how meaningful the scale or instrument is when it is in practical use (Bolarinwa 2015,p.197) therefore construct validity was achieved by checking items in the data collection tools against study objectives and concepts in the framework to determine whether all construct under study have been measured.

TABLE 1: JUSTIFICATION FOR CONSTRUCT VALIDITY THIS STUDY

Study objectives	**Components of the conceptual framework**	**Study tool**
Objective one :level of hemodialysis adequacy	Behavior-Specific Cognitions and Affect	Section two
Objective two: factors of associated with hemodialysis adequacy	Individual characteristics &experiences	Section one, two and three

3.7.2 Reliability of Instrument

Reliability refers the degree to which an assessment tool produces stable and consistent results (Phelan and Julie, 2005). Then after Test-retest reliability which is a measure of the reproducibility of the scale, that is, the ability to provide consistent scores over time in a stable population(Carlos et al .,2014P.2).It was measured by giving the same interview to the same seven participants on two separate occasions then the scores on the two occasions was correlated. Translating the research tool from English to local language ensured collection of reliable data, free from misinterpretation. Use of the structured interview schedule and following the items using the same wording and sequencing during the interview also enhanced the reliability of the data obtained through the instruments.

A reliability analysis called Cronbach‘s alpha was performed to measure the internal consistency of the study’s instrument. However the item by item cronbach’s alpha was computed calculated and gave value of 0.67 which was acceptable for the internal consistency of the instrument used in this particular study because the values for reliability coefficients range from 0 to 1.0. A coefficient of 0 means no reliability and 1.0 mean perfect reliability. Generally, if the reliability of a standardized test is above .80, it is said to have very good reliability; if it is below .50, it would not be considered a very reliable test.

3.8 Data Collection

3.8.1 Data Collection Instruments

The structured interview scheduled guide with closed ended questions was used for data collections. This tool was developed through in depth literature review of this study and consisted of 3 sessions; first section demographic characteristics composed by age group, gender, marital status, level of education, occupation, religion and race, seconds section level of hemodialysis adequacy and third section hemodialysis adequacy associated factors which consists erythropoietin supplementation, vascular access types, dialyzers type and blood flow rate, hemoglobin level, prescription of hemodialysis treatment and adherence to hemodialysis treatments.

3.8.2 Data Collection Procedure

After obtaining ethical clearance and permission from the CMHS research committee and the hospitals research committee, the researcher approached the Nurse Unit Managers of Renal units and was self- introducing and give information about the research and explained the purpose of the study. For collecting data, the researcher used a structured interview scheduled guide as well. The participants who agreed to participate in the study signed the consent forms, and they were informed about the use of code numbers instead of participants' names.

3.9 Data Analysis

Polit and Beck (2012) define quantitative analysis as manipulation of numeric data through statistical procedures for the purposes of describing phenomena or assessing the magnitude and reliability of relationships among them. In this study, Data were numerically coded and captured in Excel, using an SPSS Software Version number 20 programs. Descriptive statistics used to describe the demographic variables, to establish level of HAD among ESRD patients on maintenance HD, to present the factors that contribute to hemodialysis adequacy. Inferential statistics of chi squared and multiple regressions used to test if there was any association between

demographic variables, and other factors to hemodialysis adequacy in End stage Renal Disease Patients in Rwanda.

3.10 Ethical Consideration

Ethical boards: The permission requested from University of Rwanda ethical review board and research committee to carry out the study afterwards ethical clearance permission to collect data was requested and delivered by hospital research committees from the concerned hospitals which are University Teaching Hospital of Kigali, University Teaching Hospital of Butare, King Faisal Hospital and Rwanda Military Hospital therefore ethical approval were obtained from these hospitals.

Patients' right

Right to self-determination refers the ability to make decision, to ensure participants have the autonomous right to self-determination, researchers must ensure that potential participants understand that they have the right to decide whether or not to participate in research studies voluntarily. Also, self-determined participants must have the ability to ask the researcher questions and the ability to avoid answering questions asked by the researcher (jenifer& William, 2017).it was achieved in this study since decision to participate in this study was based on truly informed consent. This means that researcher had an ongoing obligation to ensure that subjects understood the risks and benefits of participation, which should continue only if the subjects (or their surrogates) freely agreed to remain in the study.

Right to privacy is a concept in research ethics which states that a person in human subject research has a right to privacy when participating in research. Privacy refers someone's right to keep their personal matters and relationships secrets (Paivaet al.2014).

The privacy of the participant in this study was protectedby giving them control over the information that they share with the researcher. Again the researchersecluded a safe room for interviewing participants and ensured that sensitive information was not overheard.

Right to anonymity: participation is anonymous when it is impossible to know whether or not an individual participated (penny,2014) hence it is impossible to maintain participant anonymous in this study since the researcher used face to face structured interview scheduled guide however confidentiality which refers keep a participant's personal information private(Jessica& Denise ,2013) In these cases, participants provided personal information (e.g. name, address, phone number and etc)but because it was confidential, only the researcher and those analyzing the data can identified the responses of individuals, and they did not share this connection with anyone outside of the project .The researcher took steps to protect participants' identities and their information from being discovered by others.

Right to fair treatment or justice: means that the researcher has explained the research study fully and has described the subject's right to refuse to participate and discussed the risks and benefits of participation. This principle requires that researchers are always fair to the participants in their research and that the needs of research participants should always come before the objectives of the study (Leslie, 2015)justice was respected since the researcher was fairly select the participants and all benefits from the results of this study were equally distributed and right to protection from discomfort and harm was not forgotten because participants were protected from the risk of physical, psychological, social, economic, and legal harms.

Informed consent and participant authorization

Participants were explained about the purpose, benefits, risks, and other important options as well as their role if they consent to participate thus Participants given as much time to ask questions before signing the consent and this action was voluntary , . The researcher explained to the participants their rights to ask questions clarification if not clear. The participants were informed that it was allowed to refuse to answer any particular question as well as to discontinue participation in the study at any time without any penalty lastly participant authorization was required.

3.11 Data Management

All data from the four referral hospitals collected by the researcher using interview scheduled guide and data were entered in a statistical package for the social sciences software (SPSS), version 21 for data analysis. Before analysis; data cleaning was be done in SPSS. The soft copies of data kept in a password controlled personal computer while the coded hard copies kept in locked cupboard and will be destroyed or burned after 5 years.

3.12 Data Dissemination

The thesis will be presented to the library, and copies will be given to the study sites, that are University Teaching Hospital of Kigali (CHUK), University Teaching Hospital of Butare (CHUB), King FaisalHospital (KFH) and Rwanda Military Hospital (RMH).

3.13 Limitations of the study

The limitations of the study were those characteristics of design or methodology that impacted or influenced the interpretation of the findings from your research (Aguinis et al., 2014). One of the limitations in his study might be the sample size at the time of data collection, the required sample size was not the expected one due to drop outs of these patients to dialysis and some were dead.

Bias is any trend or deviation from the truth in data collection, data analysis, interpretation and publication which can cause false conclusions (Ana-Maria, 2013).Biased information was pretended in this study because the researcher might selecting or encouraging one outcome or answer over others. This interrelated to face to face interview that the researcher used during data collection.

Hawthorne effect which is a type of reactivity in which individuals modify an aspect of their behavior in response to their awareness of being observed (Kendra, 2017) were pretended in this study because face to face structured interview scheduled guide used.

Recall bias or Reporting bias due to people who could not remember completely or accurately of what happened in the past (Stephanie, 2016) .This was expected limitation for this study since participants of this study were more or less likely to recall and relate information on exposure depending on their outcome status, or to recall information regarding their outcome dependent on their exposure.

Otherwise no selective bias which is an error in selecting participant (Bryn, 2016) was pretended in this study since census population was considered where everyone eligible for inclusion criteria in the population of this study selected for the data collection.

3.14 Conclusion

This is a cross-sectional design was study conducted. A sample size of on 66 Hemodialysis patients was selected using purposive sampling strategy in 4 referral hospitals with renal unit, Rwanda. An interview scheduled guide was used to collect data. We have looked at the level of hemodialysis adequacy and the factors associated. Dialysis adequacy was calculated using kt/v Daugirdas & Schneditz formula. Data was coded and entered into SPSS version 21 in preparation for data analysis. Descriptive statistical methods and inferential statistics of chi square, and multiple regressions were used to analyse the data. Ethical issues were respected during data collection.

CHAPTER FOUR RESULTS

4.1 Introduction

The results of this study are based primarily on the data obtained from the four referral hospitals of Rwanda. The purpose of this study was to assess the factors associated with HDA and to establish that level in ESRD patients on maintenance in Rwanda. A total of the 66 patients with ESRD on maintenance HD were recruited purposively in an interview scheduled guide. Three-part information from interview schedule guide included demographic data, level of HD adequacy and factors related to HDA were utilised.HDA was calculated using kt/v formula of Daugirdas & Schneditz (Sternby&Daugirdas, 2015 p.469).Afterwards the statistical package for the social sciences software (SPSS), version 21.0 were utilized to enter data in preparation for analysis. The study aimed to answer the following questions;

- What is the level of hemodialysis adequacy in ESRD patients on maintenance HD in Rwanda?
- What are the factors associated with hemodialysis adequacy in ESRD on maintenance HD in Rwanda?

Descriptive statistics including frequencies and percentages were first performed to describe the demographic variables of the sample, hemodialysis adequacy and factors influencing the hemodialysis adequacy. Inferential statistics of chi square tests were conducted to identify the demographic characteristics, clinical profile and other factors associated with hemodialysis adequacy in male and female ESRD patients who participated in this study.

TABLE 2: DEMOGRAPHIC DATA OF STUDY PARTICIPANTS (N=66) (A)

Demographic variables	Frequency (%)
Hospital origin of the participants	
Hospital i	8(12)
Hospital ii	7(11)
Hospital iii	31(47)
Hospital iv	20(30)
Gender distribution in participants	
Males	47(71)
Females	19(29)
Age group of the participants	
18 to 30 years	11(17)
31 to 40 years	13(20)

41 to 50 years	15(23)
50 to 60 years	14(21)
Greater than 60 years	13(20)
BMI of the participants	
Under weight	8(12)
Normal weight	46(70)
Overweight	12(18)
Obese	0(%)
Marital status of the participants	
Married	41(62)
Single	17(26)
Divorced	1(2)
Separated	5(8)
Widowed	2(3)
Education level of the participants	
Uneducated	1(2)
Primary	31(47)
Secondary	24(36)
College /university	10(15)
Religion distribution of participants	
Christian	62(94)
Muslim	3(4)
Traditional	1(2)

Table 4.1: Demographic data of study participants (N=66) (B)

Demographic variables	**Frequency (%)**
Occupation of the participants	14(21)
Self employed	7(11)
Skilled worker	44(67)
Unemployed	1(1)
Student	
Monthly income of the participants	
0 to 5000Rwf	20(30)
51 to 10000Rwf	19(29)
101000 to 200000Rwf	15(23)
More than 200000Rwf	12(18)
Medical support system of the participants	
Community based health insurances	6(9)
Government /private medical insurance	45(68)
Family/Friends/NGOs	13(20)
Self-sponsored	2(3)

Residence area of the participants	
Low density	15(23)
Medium density	29(44)
High density	13(20)
Commune or rural	9(13)
Means of transport for the participants	
Public mean of transport	44(67)
Private means of transport	22(33)
Previous area of residence for the participants	
0 to 10 Km	10(15)
11 to 20Km	8(12)
21 to 40Km	25(38)
Far of 40Km	23(35)
Current area of residence for the participants	
0 to 10 Km	27(41)
11 to 20Km	9(14)
21 to 40Km	22(33)
Far of 40Km	8(12)
Sources of drinking water for the participants	
Tape water	45(68)
Packed water	21(32)
Causes of ESRD for the participants	
Hypertension	26(39)
Diabetes mellitus	21(31)
Gromerulonephritis	5(8)
Others (malaria, unknowns, PKD and HIVAN)	14(22)
Time on hemodialysis of the participants	
Between 4 months to one year	21(32)
Between one year to two years	29(44)
Between two years to five years	8(12)
More than five years	5(8)
After a graft rejection	3(4)

4.2 Demographic characteristics of the ESRD participant

Descriptive statistics was used to interpret the demographic data which include age, gender, marital status, area of residence, source of drinking water, BMI, causes of ESRD, duration of ESRD, monthly income, type of transport and location to HD facility, occupation and available medical support systems. A total of 66 patients included in the study forty-seven (71%) were males and nineteen (29%) were females. Many of them 59 almost 90% are dialyzed in the capital city where the referral hospitals are based, 11(17%) aged less than 30 years old whereas 13(20%) were older than 60 years old hence almost 65%are aged between 30 to 60 years old.

Anthropometrically many participants almost 70% were in normal range of weight based on Body Mass Index(BMI) calculation, 19% were over weighed while only 12 % were underweight range thus none was obese,26% are still single compared to 62% married however attended the school 15% were educated at the college/university level. Almost 95% were Christian, 4 % were Muslim since one believe traditionally.

The majority population of this study 29(44%), (n=66) reside in the medium density area, fifteen (23%) reside in low density area, thirteen (20%) reside in high density area and nine (13.6) reside in rural area. However forty-four (67%) were unemployed, fourteen (21%) are self employed while seven (10.6%) remain at their work as the skilled employees and one (1.5%) still trying to complete his secondary school. In respect to monthly income only 27(41%) can earn more than 100000Rfw~100USD hence many of these participants45(68%) got medical help through the particularly medical insurance considered as government/private medical insurance that include Rwanda Social Security Board (RSSB) which provide the support to the government employees. FARG (Fondsd'Assistant Réscapés du Génocide against Tutsi 1994) genocide survivors funds and MMI (Military Medical Insurances) whilst Mutuel de sante which is community based health insurances covers less than (10%), 13(20%) are being assisted by family, friends, NGOs, to get hemodialysis therapy, two (3%) are paying hemodialysis therapy themselves yet again forty four (67%) used public transport while twenty- two (33%) used private transport to the hemodialysis facility.

Approximately 50(65%) covered more than 40kms to reach to the hemodialysis facility at the beginning of their renal replacement therapy modality but 15(65%) of them shifted from their home to lent nearby HD facility, currently 27(41%) covered at least 10km to reach to the HD facility, still almost 60% should cover more than 20km to reach to their dialysis facilities. Nevertheless 21(32%) consumed packaged water compared to 45(68%)consumed tap water. so far hypertension 26(39%)is the first leading cause of ESRD followed by diabetes mellitus 21(31%)glomerular diseases accounts for five cases (8%), other cases are related to unknown causes and malaria. Furthermore fifty, greater than (75%) have been with ESRD less than two years while twenty –one (32%) have been with this disease less than one year, 5(12%) have

been dialyzed more than five years and only three(5%) have been dialyzed after a graft rejection.(Tables4.1).

4.2 Level of Hemodialysis adequacy

TABLE 4.2: LEVEL OF HEMODIALYSIS ADEQUACY (N = 66)

Variables	Kt/v values	Frequency (%)	Cumulative %	Level of dialysis adequacy
Kt/v less than 0.8	.05 0.60 0.7	1(1.5) 2(3.0) 3(4.5)	1.5 4.5 9.1	Less than optimal HDA
Kt/v 0.8 to 1.19	0.80 0.90 1.00 1.07 1.09 1.10 1.17 1.18 1.19	1(1.5) 1(1.5) 4(6.1) 1(1.5) 1(1.5) 7(10.6) 1(1.5) 1(1.5) 2(3.0)	10.6 12.1 18.2 19.7 21.2 31 33.3 34.8 37.9	Near optimal HDA
Kt/v equal/ greater than 1.2	1.20 1.25 1.29 1.30 1.32 1.33 1.34 1.35 1.40 1.50 1.60 1.70 1.80 2.00 2.10	6(9.1) 1(1.5) 1(1.5) 10(15.2) 1(1.5) 1(1.5) 1(1.5) 2(3.0) 5(7.6) 2(3.0) 3(4.5) 2(3.0) 1(1.5) 3(4.5) 2(3.0)		Optimal HDA

According to these findings , the mean of adequacy of dialysis in the patients under the study was 1.26± 0.34 the range of dialysis adequacy for the entire study population was 1.60. The minimum of dialysis adequacy was 0.50 and maximum was 2.1.Majority of the participants 41(62%) had optimal kt/v of equal and greater than to 1.2, 19(29%) had near optimal HDA (0.8 - 1.2kt/v)

whilst 6(9%) had less than optimal HDA, (kt/v <0.8).; males experienced the better kt/v than females at rate of 66% to 53% respectively.

3. FACTORS TO HEMODIALYSIS ADEQUACY

TABLE 3.3: CLINICAL PROFILE AND THERAPY RELATED FACTORS (N=66)

Parameters	**Mean value(unit)**
Hemoglobin levels	10.5±1.93(g/dl)
Potassium level	5.2±0.93(mmol/l)
Creatinine levels	559.7±217.95(µmo/l)
Blood flow rate	303±30.77(mls/min)

Variables	Values	Frequency (%)
Frequency of taking erythropoietin (EPO)	Every HD session Once in a week Once in two weeks Not taken	33(50.0) 9(14) 2(3.0) 22(33.0)
EPO root of administration	Not taking EPO Taking IV Taking Sc	21(32) 40(60) 5(8)
Blood pressure levels	Very high BP BP don't frustrate often Normal BP	23(35) 21(32) 22(30)
Type of vascular access used in HD	Central venous catheter(CVC) Arterio-venous fistulae(AVF) Arterio venous graft	50(76) 15(23) 1(1)
Blood flow rate	BFR between 100 to 200mls/min BFR between 200 to 300mls/min BFR between 300 to 400mls/min BFR greater than 400mls/min	1(1) 44(67) 19(29) 2(3)

A. CLINICAL PROFILE AND THERAPYRELATED FACTORS

The calculated mean from the clinical parameters of potassium, Creatinine and blood flow rate during hemodialysis therapies were 5.2mmol/l,559.7µmol/l,303ml/min respectively while the range of hemoglobin level was 8.7g per dl, the mean hemoglobin level of the participants was 10.5g per dl, the smallest mode was8.9g per dl with minimum of 6.1 g per dl and a maximum of 14.8g per dl. A half of participant have less 34(62%) have less targeted Hemoglobin in ESRD on maintenance HD of less than 10.5g per dl compared to 19(29%) with normal targeted hemoglobin of 10.5g to 12.5g per dl and 13(20) had an hemoglobin level greater than 12.5g per dl. However approximately 45(70%) undertook EPO stimulating agent for boosting their blood hemoglobin levels whom 40(60%) used IV as administration root whilst 22(30%) were free of EPO stimulating agents.

Central venous catheter (CVC) remains the vascular access for the majority 50(76%), Arterio-venous fistulae (AVF) account for 15(24%) whom 44(67%) underwent HD with blood flow rate ranging from200 to 300 mls per minute. Nineteen (29%) experienced a blood flow rate of 300 to 400 mls per minute while 23(35%) experienced a very high blood pressure against to 22(30) with normal range of blood pressure compared to 21(32%) with frustrating blood pressure.

TABLE4.4: PATIENTS KNOWLEDGE RELATED FACTORS (N=66)

Variables	Values	Frequency (%)
Interdialytic weight gain	Additional weight for more than 3.1kgs Additional weight from 2.1kgs to 3kgs Additional weight from1.1kg to2kgs Additional weight from 0.1kg to 1kg	5(8) 23(35) 22(33) 16(24)
Information about kt/v	Having information about kt/v Do not have information about kt/v	4(6) 62(94)
Experience about their potassium levels	Not know Low level Normal range High level	29(44) 3(5) 28(42) 6(9)

B. PATIENTS KNOWLEDGE RELATED FACTORS

The most of participants in this study 62(94%) did hear any information relating to either hemodialysis weight or kt//v but 22(33%) can manage their interdialytic weight at 2kgs based on their respective dry weight between two consecutive sessions, 23(35%) manage to come with three more additional weight while only 5(8%) can manage their weight since they come with more than 3.1kgs between two consecutive sessions. Twenty- nine(44%) did not know how much potassium that they experiencing often compared to 28(42) who experienced normal range of potassium whilst 3(5%), 6(9%) experienced low and high level of potassium respectively. (The table 4.4)

TABLE 4.5: HEALTH CARE PROVIDERS RELATED FACTORS (N=66)

Variables	Values	Frequency (%)
Frequency in monitoring patients' blood	Who check blood regularly one month Who do not check blood regularly Who do not comply blood check unless severe emergency crisis	53(80) 6(9) 7(11)
Feedback about the results from lab	Who received the feedback from their lab results Who do not receive the feedback from the lab results	53(80) 13(20)
Information about proper nutrition	Who have thought about adequate nutrition Who have not thought about adequate nutrition	65(98) 1(2)
Information about fluids restriction	Who have thought about fluids restriction Who have not thought about fluids restriction	64(97) 2(3)
Information about HDA	Who have thought about HDA Who have not thought about HDA	7(11) 59(89)

C. HEALTH CAREPROVIDERS RELATED FACTORS

Greater than 97% of the participants in this study had enough information about the proper nutrition and fluids restriction as well yet only 7(11%) heard information about both dialysis adequacy and the kt/v.53(80%)of our participants monitor their blood investigation once in a month contrary to 7(11%)who do blood check in case of severe emergency crisis ,fortunately 53(80%)followed up the laboratory lab results from their blood while 13(20%) are not aware of the situation of blood results .

TABLE4.6: ADHERENCE TO THE HEMODIALYSIS RELATED FACTORS (N=66)

Variables	Values	Frequency (%)
Compliance to Prescription of HD sessions per week	Thrice in a week Twice in a week Irregular	46(70) 17(26) 3(4)
HD treatment hours	Who treated 3-4hours/session Who treated less than 3hours/per session	64(97) 2(3)
Shortening of dialysis time during last month	Who shortened HD treatment last month Who did not shorten HD treatment last month	12(12) 54(82)
Frequency shorted their HD treatment during last month	Who shortened more than 3 sessions Who shortened 2 to 3 sessions Who shortened one session Who did not shorten any session	1(1.5) 1(1.5) 10(15) 54(82)
Convenient about the scheduled time for HD	Who consider their schedule as convenient Who do not consider their schedule as inconvenient	60(91) 6(9)
Education to comply with the time given for HD treatment	Never talked Talked less frequently Talked frequently Most frequently	4(6) 15(23) 23(35) 24(36)
Difficulty in staying the prescribed time for HD treatment	Very difficult to stay the entire 4hous Moderate difficult to stay entire 4 hours A little difficult to stay the entire 4 hour No difficult to stay the entire 4 hours	16(25) 22(33) 10(15) 18(27)
Missing session during last month	Who missed more than three session Who missed three sessions Who missed two sessions Who missed one session Who did not miss any session	5(7.5) 4(6) 7(11) 16(24) 34(51.5)

D. ADHERENCE TO HEMODIALYSIS RELATED FACTORS

The table bellow demonstrates that 46(70%) afford the thrice weekly hemodialysis while 17(26%) underwent twice weekly hemodialysis session and 4%are neither comply to thrice nor to twice weekly regimen. Sixty- four (97%) last 4 hours of their dialysis session while two(3%) were treated less than three hours per session. However 12(12%) reported that had shortened their hemodialysis session whom greater than 10(80%) shortened at least one session during the previous mouth when the study was conducted. Furthermore only a half 34(51%) did not miss any session the previous month where the data was conducting that means 49%used to miss any dialysis session. Sixty (91) saw their schedule as convenient for their treatment option while six (9%) considered their schedule as a barrier.

Forty –seven (71%) had enough information regarding complying to the hemodialysis regimen despite 38(58%) experiencing difficult to stay the entire 4 hours for hemodialysis therapy compared to 28(42%) who considered the hemodialysis time as not a big barrier .(table 4.6).

4.3. Factors associated with hemodialysis adequacy

TABLE4.7: DEMOGRAPHIC FACTORS ASSOCIATED WITH HEMODIALYSIS ADEQUACY (N=66)

Demographic Characteristics	**Chi square**	**Value**	**Degree of freedom (df)**	**p- value**
Hospitals' origins**	Pearson Chi-Square	21.587	9	**.001**
Gender	Pearson Chi-Square	2.281	3	.233
Age **	Pearson Chi-Square	27.445	12	**.007**
BMI**	Pearson Chi-Square	19.158	6	**.004**
Marital status	Pearson Chi-Square	13.608	12	.326
Level of education	Pearson Chi-Square	11.194	9	.263
Religion	Pearson Chi-Square	5.059	6	.536
Occupation	Pearson Chi-Square	9.884	9	.360

Monthly income*	Pearson Chi-Square	19.323	12	.081
Available medical support system	Pearson Chi-Square	12.158	9	.205
Area of residence**	Pearson Chi-Square	17.946	9	**.036**
Means of transport **	Pearson Chi-Square	8.813	3	0.32
Previous area of residence	Pearson Chi-Square	18.659	12	0.097
Current area of residence	Pearson Chi-Square	12.634	12	00.164
Types of drinking water**	Pearson Chi-Square	8.925	3	**0.030**
Causes of ESRD*	Pearson Chi-Square	18.786	12	0.094
Duration with ESRD*	Pearson Chi-Square	26.338	18	0.092

**: variable statistically significant

*: variables that are most likely to link with HDA.

4.3.1 Demographic factors associated with hemodialysis adequacy

In this study, Pearson Chi-Square statistic test was conducted to examine relationship between demographic characteristics and hemodialysis adequacy; there was a significant relationship with origin's hospital and HDA (P-value .010), Age and BMI were statically significant to associate with HDA (P-value.007 and .004) respectively. Mean of transport and type of drinking water link significantly with HDA (P-value 0.032 and 0.030) respectively. However monthly income generation, causes, duration of ESRD exhibit to associate with HDA with the (P- Value .08, .09, .09) respectively. Other demographic characteristics such as gender, occupation, type of medical support system and religion have not statistically link with HDA.

TABLE4.8: RELATIONSHIP BETWEEN CLINICAL PROFILE AND HEMODIALYSIS ADEQUACY (N=66)

Clinical profiles	**Chi square**	**Value**	**Degree of freedom (df)**	**p- value**
Potassium levels	Pearson Chi-Square	7.267	9	.609
Creatinine levels	Pearson Chi-Square	3.453	3	.327
Hemoglobin levels	Pearson Chi-Square	7.859	6	.249

4.3.2 Clinical factors associated with hemodialysis adequacy

A Pearson chi-square test was conducted to examine whether there was a relationship between hemodialysis adequacy and clinical profile. The results revealed that there was no significant statistical relationship between the three clinical parameters (potassium, Creatinine and hemoglobin levels), P-value: .609, .327, .249 respectively.

TABLE 4.10: OTHER FACTORS ASSOCIATED WITH THE HEMODIALYSIS ADEQUACY (N=66)

Other factors	Chi square	Value	Degree of freedom (df)	p- value
Taking EPO	Pearson Chi-Square	5.907	9	0.749
EPO roots of administration	Pearson Chi-Square	3.799	6	0.707
Blood pressure levels	Pearson Chi-Square	15.287	6	0.018*
Vascular access types	Pearson Chi-Square	3.691	6	0.718
Blood flow rate	Pearson Chi-Square	6.997	9	0.637
Interdialytic weight gain	Pearson Chi-Square	11.092	9	0.269
Information towards kt/v	Pearson Chi-Square	2.849	3	0.415
Knowledge towards K levels	Pearson Chi-Square	9.638	9	0.381
Blood checking	Pearson Chi-Square	7.159	3	0.306
Knowledge about lab results	Pearson Chi-Square	5.632	3	0.131
Knowledge towards nutrition	Pearson Chi-Square	1.777	3	0.620
Knowledge towards fluids	Pearson Chi-Square	3.609	3	0.307
Knowledge about HDA	Pearson Chi-Square	1.838	3	0.607
Complying to HD prescription	Pearson Chi-Square	9.928	9	0.356
HD time	Pearson Chi-Square	6.445	3	0.92
Shortening HD time	Pearson Chi-Square	5.593	3	0.133
Frequency shortened HD time	Pearson Chi-Square		9	0.521
HD schedule	Pearson Chi-Square	1.131	3	0.770
Freq	Pearson Chi-Square	15.616	12	0.209

Important	Pearson Chi-Square	9.586	9	0.385
Difficult	Pearson Chi-Square	19.452	15	0.194
Missing session	Pearson Chi-Square	15.625	15	0.407

4.3.3 Other factors related to hemodialysis adequacy

Several factors have been studied and tested if have associated with HDA, but only blood pressure show the statistically significant with hemodialysis adequacy (p-value.018). However There was no statistical significant difference between dialysis adequacy and taking EPO, type of vascular access, blood flow rate, having knowledge about proper nutrition, adequate fluids intake (p> 0.05);the table 4.9 bellow demonstrates several variables studied and their respective p value.

TABLE 9: MULTIPLE REGRESSIONS ANALYSIS OF THE DEMOGRAPHIC FACTORS ASSOCIATED WITH HEMODIALYSIS ADEQUACY

R squared = .495	F Change = 2.556		Significant F change = .005				
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	4.522	1.092		4.142	.000	2.326	6.719
Hospital**	-.057	.147	-.055	-.387	.701	-.351	.238
Age**	.059	.113	.082	.523	.604	-.168	.287
BMI**	-.535	.224	-.299	-2.385	.021	-.986	-.084
Residence*	-.424	.150	-.414	-2.832	.007	-.724	-.123
Transport**	-.340	.401	-.164	-.848	.401	-1.146	.466
Sources of water**	-.016	.087	-.030	-.184	.855	-.191	.159
Duration of ESRD*	.288	.122	.316	2.366	.022	.043	.534
BP levels**	.137	.153	.116	.898	.374	-.170	.444

Dependent Variable: Heamodialysis Adequacy

(**): variables that are statically associated with HDA,

(*): variables that are most likely exhibit to HDA.

A multiple regression analysis was done to reveal the contribution of all the associated demographic covariates towards HDA. The results highlighted that demographic covariates contributed nearly 49.5% variance towards hemodialysis adequacy with a significant F change of p = .005. Moreover, using the beta coefficient, the table below shows that hospital of origin, mode of transport, type of drinking water and BIM are contributing negatively to hemodialysis adequacy. However, duration of ESRD, age and blood pressure levels were affecting hemodialysis adequacy positively.

Conclusion of the results

The results of the study revealed most participants (62%) having optimal hemodialysis HDA kt/v of equal or greater than to 1.2, 19(29%) had near optimal HDA (0.8 - 1.2 kt/v) whilst 6(9%) had less than optimal hemodialysis adequacy (kt/v <0.8). Factors associated with HDA were name of hospital (p = .010), age (p = .007), BMI (p =.004) and blood pressure level ((p = .018). Moreover, mode of transport and type of drinking water was also significantly associated with HDA (p = 0.032 and 0.030 respectively).

CHAPTER FIVE DISCUSSION

5.1 Introduction

The HDA is the cornerstone for the well-being of each patient. Achievement of HDA is the paramount importance to improve quality of life, decrease healthcare cost and also decrease morbidity and mortality rates in HD patients. This study was assessing the level ofHDA among ESRD patients on maintenance HD. The discussion is according to results obtained for demographic characteristics, level of HDA and factors associated with HDA.

5.2 Demographic Data

The hospitals of origin significantly exhibit the level of HDA among the participants of this study; this confirms that patients benefited from a higher quality of hemodialysis settings. Our findings proved that males were almost three times to female 47(71%), 19(29%) respectively. The gender and ESRD patients on maintenance HD have been reported by (Hosein et al., 2016),as 58.60% were male, study by (Ozra et al., 2016)reported 135(66.8%) were men and 67 (33.2%) were women consistently to (Manfred et al., 2014) found fewer women than men undergoing HD treatment. Almost 65% of our participants were between 30 to 60 years old similar to (Hosein et al., 2016) in their study the mean age was 48years, in another study revealed that the age of the study population was 53 years by (Sheikh & Ghazaly, 2016), consistently to (Adremi et al.,2017) and (Dana et al., 217) reported the mean age of 46and 54 years respectively. But contrary to a studyin Uganda by (Kalyesubula et al., 2017) where majority (67%) were female and (Brett et al., 2017) who found that more than half of patients were over 50 years.

The most causes of ESRD are HTN,DM, Glomerular diseases whereas in our participants were hypertension(HTN) (39%), diabetes mellitus(DM) (31%), glomerular diseases(8%)and others causes(unknowns,malariaand polycystic kidney disease (PKD)).Same in Kenya hypertensive sclerosis was the main cause of ESRD (16%), followed by diabetic nephropathy (15%), chronic glomerulonephritis (13%), tubule interstitial/ obstructive (8%), primary glomerular diseases (6%), systemic lupus erythematosus (3%) and polycystic kidney disease (3%). Consistently to a study by (Naiker et al.,2013) noted HTN as a leading cause of ESRD in SSA, ranging from25% in Senegal to 29.8% in Nigeria, 45.6% in South Africa,and 48.7% in Ghana, especially in black patients. HTN affects about 25% of the adult population and is thecause of ESRD in 21% of patients on RRT in South Africa while in developed countries like USA major causes for ESRD are diabetic nephropathy (43.2%), HTN (23%), glomerulonephritis(12.3%), and polycystic kidney disease (2.9%), (Somnath,2016). In Germany HTN and diabetes mellitus (DM) come in front (Girndt& Markau,2016) Whereas in north Africa major risk factors are interstitial nephritis (14 to 32%), glomerulonephritis (11 to 24%), mostly mesangioproliferative and focal segmental sclerosis; diabetes (5 to 20%) and nephrosclerosis (5 to 21%).

Approximately 65% of the patients with ESRD in Rwanda travelled more than 40kms to reach to the hemodialysis facility which means live in rural areas yet many HD facilities located at the capital city; about 60% can earn only less than 100000 Rwf (100USD).Moreover 68% got medical help through the particularly medical insurance thus most of this respondent cannot afford HD treatment since, a Rwandan GDP per capita is 776USD(World Bank,2019)thus farone session of HD costs as a much as USD 100 – 200 (Taslim,2014). This explains why there are few people with ESRD on maintenance HD because those with community health based insurance and those without insurance should pay out of pocket for HD treatment. However most patients with ESRD have to rely on financial support from their extended families, religious organizations and philanthropists to be able to pay for hemodialysis in Rwanda .Many patients with ESRD are denied access to maintenance HD because of rationing policies that limit provision of hemodialysis to patient with few co-morbidity.

5.3 Level of Hemodialysis Adequacy

These findings demonstrate that only 62% (=66) had optimal hemodialysis adequacy (kt/v equal/greater than 1.2). However the study conducted by (Ozra et al., 2016) based on kt/v and URR showed 56.4% of the patients had desirable HDA, in Egypt a study conducted by(Mabrouk& Ghada, 2016) showed that around 60% of the study population had Kt/V values less than 1.2.Therefore, these results indicated that the HDA were favorable compared to the mentioned studies. It appears that the increased awareness of the patients and frequent education of the hemodialysis personnel provided favorable conditions; consequently the mean of HDA for the entire population was 1.26 ±0.34; the mode was 1.3.The same values for HDA have been reported as 1.73± 0.41 (Debowska et al., 2014), 1.72± 0.21 in the study (Ashvandi et al., 2014) and 1.15 ± 0.31 in the study (Samakoosh et al., 2013) consistently to (Heba et al., 2014) the mean Kt/V for the studied patients were 1.06 ± 0.05.

5.4 Factors associated with hemodialysis adequacy

Until recently, elderly patients were offered renal replacement therapy. In the current study age is negatively associated with the HDA.(Ozra etal., 2016) noted that HDA had an inverse relationship with the variables of age contrary to a study conducted by (Hebaet al., 2014)where was no significant association between HDA and any of the variables such as sex, age, presence

of chronic diseases or BMI. The current study conducted by (Tezcan et al., 2016) on Relationship between the target dose of HDA and nutritional assessment showed that prevalence of malnutrition in patients with target dose hemodialysis (Kt/V $\geq$ 1.4) was significantly higher according to body mass index (BMI). Similar as the results from this study showed that BMI associated negatively with hemodialysis adequacy but (Hebaet al., 2014) reported insignificant association between BMI and HDA.

The results from this study revealed that mean of transport and type of drinking water which goes hands in hands with monthly income exhibit negative impacts to the results of HDA, those parameters are depressing significantly with HDA. Nevertheless no literature discovered discussing about the same variables, although most data available currently emanates from developed world and this may not accurately reflect to our situation due to major socio-cultural, economic and environmental differences.

Along with other factors affecting the adequacy of hemodialysis was blood pressure. The results of this study showed a positive relationship with HDA sincethe normal the blood pressure during HD, the greater optimal HDA. Yet (Ozra et al., 2016) studies' showed a significant correlation between HDA and pre HD systolic blood pressure and diastolic blood pressure.

Taking EPO, type of vascular access, blood flow rate, having knowledge about proper nutrition, adequate fluids intake and having information about HDA are not significantly related to HDA in this current study; probably because most of all participants have been dialyzed with the better blood flow rate in all settings with a mean BFR of 303±30.77 (mls/min). Again the mean hemoglobin levels in the entire population were 10.5±1.93 (g/dl) which is a minimum range recommended level of hemoglobin for ESRD on maintenance HD.

CHAPTER SIX: CONCLUSION AND RECOMMANDATION

6.1 Introduction

There are many factors that can affect dialysis adequacy; assessment of the hemodialysis adequacy is one of the key factors for the measurement of the quality of life in end stage renal disease since it can predict outcome of this disease. This study established the level of hemodialysis adequacy and put forward the recommendations.

6.2 Conclusion

The study aimed at assessing the factors associated with dialysis adequacy in ESRD patients on maintenance in Rwanda. The specific objectives of the study were to establish the level of hemodialysis adequacy (HDA) in ESRD on maintenance Hemodialysis in Rwanda and to identify factors associated with HDA in ESRD on maintenances hemodialysis in Rwanda. A cross-sectional design was study conducted. A sample size of on 66 Hemodialysis patients was selected using purposive sampling strategy. An interview scheduled guide was used to collect data. Data was coded and entered into SPSS version 21 in preparation for was used for data analysis. Descriptive statistical methods and inferential statistics of, chi square, and multiple regressions were used to analyse the data. The mean of HDA of dialysis in the patients under the study was 1.26± 0.34. Most participants (62%) had optimal HDA kt/v of equal or greater than to 1.2, 19(29%) had near optimal hemodialysis adequacy HDA (0.8 - 1.2 kt/v) whilst 6(9%) had less than optimal HDA, (kt/v<0.8). Factors associated with HDA were name of hospital (p = .010), age (p = .007), BMI (p =.004) and blood pressure level ((p = .018). Moreover, mode of transport and type of drinking water was also significantly associated with HDA (p = 0.032 and 0.030 respectively).

6.3 Recommendations

With regards to the results obtained, the following recommendations were made:

Recommendations for nephrology practice

- Health care personnel in renal unit settings should consider maintaining the blood pressure of ESRD patients in the acceptable limits by implementing Kidney Disease

Outcomes Quality Initiative (KDOQI) since blood pressure found to contribute positively to the level of hemodialysis adequacy.

- Measures to maintain the Body Mass Index (BMI) within the normal ranges should be implemented and strictly monitored because this study proved that a high BMI level leads negatively to hemodialysis adequacy which results in poor outcome among end stage renal disease patients.
- Implementation of evidence based practice towards hemodialysis adequacy should be adopted and harmonized based to the facilities settings.
- Regular measurement of hemodialysis adequacy in our renal units as per Kidney Disease Outcomes Quality initiatives guidelines.
- To elaborate the national social demographic evaluation before initiating the renal replacement therapy because it has been noted that many patients should travel more than40 kms to reach to the HD facility.

Recommendations for research

- Further research is recommended to endeavor more effort into a large retrospective study to assess technical factors and hemodialysis inadequacy in Rwanda.
- A cohort study to assess the impact of hemodialysis adequacy on quality of life among end stage renal disease patients should be conducted in these settings.

Recommendations for administration

- The government of Rwanda through the water sanitation and corporation authority in collaboration with Rwanda bureau of standards agency should monitor and evaluate the quality of the packaged drinking water in the country.

- The ministry of health in collaboration with the hospital administration should establish the same protocol measures towards management of ESRD in view of the fact that patients benefited from a higher quality of hemodialysis settings.
- The ministry of health with other concerned sectors should decentralize the HD facilities to the district level in order to enhance the holistic care without far distance.

Recommendation for education

- "Nurses have new and expanding roles'' nurses knowledge results in better patients outcomes though in increasing the number of trained nephrology nurses will results in better quality of life of end stage renal disease patients.

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APPENDICES

Appendix I: INVITATION PARTICIPATE IN A RESEARCH STUDY

CONSENT FORM

Introduction

My name is NDAHAYO Didace; I am Rwandese, a student undertaking master‘s degree in nephrology nursing. You are being asked to participate in a research study on hemodialysis adequacy in Rwanda. You were selected as a possible participant in this study because you are on hemodialysis more than three months

Purpose of the study

The purpose of the study is to assess the factors associated with dialysis adequacy in ESRD patients on maintenance in Rwanda

Description of the study procedures

You are expected to be in the study for 15 to 40 minutes for each stage and notes taken as well with your permission. The questions asked in this study will assess the level of hemodialysis adequacy and factors associated with hemodialysis adequacy.

Right to refuse or withdraw from the study

Participants are allowed to refuse or withdraw at any stage of the study. Also, you will have the option of not participating in any part or the full interview, without any consequences on your hemodialysis treatment at the study facility.

Minimal risk is expected in this study.

There may be unknown risks and reasonable foreseeable (or expected) risks. The researcher will ensure that there are no risks or harms associated with participating in this study as the human rights will not be violated. Risks will be minimized throughout the study. I realize you might be exhausted after your hemodialysis session and you are free to reschedule the interview.

Benefits of Being in the Study

By participating in the study, you will not receive any direct benefits. There will no monetary compensation for participating and the study is for the academic achievement. However, you will receive the satisfaction of knowing that participation in this research may help patients on hemodialysis in all hospitals of Rwanda.

Confidentiality

Confidentiality will be assured as no names will appear on the interview scheduled guide at any stage of data collection as they will be coded. Signed consent forms will not be attached to instruments to ensure anonymity. If you are willing to participate, a consent form will be signed to indicate acceptance. Data will be stored in a locked cabinet and not be accessible to any other person other than the investigator.

However, absolute confidentiality cannot be guaranteed and personal information may be disclosed if required by the law. The study staff will have access to all the information collected in this study. Moreover there are organizations that may inspect or copy your research records for quality assurance and data analysis and these include the institutional review board (IRB). All the documents for the study will be destroyed after 2 years of study completion.

Contact details

For further information or reporting of study related adverse events, contact me or my supervisor On the following address and numbers:

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DrChironda: +250789924956

In case of reporting complaints relating to the study, contact the IRB Chairperson

Institutional Review Board
Research Office
University of Rwanda
Kigali, Rwanda
Tel…**+250 7885-63312**

CONSENT TO PARTICIPATE

Your signature below indicates that you have decided to volunteer as a research participant for this study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form to keep, along with any other printed materials deemed necessary by the researcher.

Subject's code (print):_____

Sign……Date……

Researcher‘s sign……Date……...

Contact of the researcher

NDAHAYO Didace

Mobile No: +205788515433

Email: didasdidace@gmail.com

Thank you

APPENDIX II STUDY TOOL

SECTION ONE- DEMOGRAPHIC CHARACTERISTICS OF THE ESRD PATIENTS IN RWANDA

1. In which health facility offers you dialysis services?

a. CHUK ☐
b. CHUB
c. KFH ☐
d. RMH ☐

2-Age group

a. 18-30 years ☐
b. 31-40 years ☐
c. 41-50 years ☐
d. 51-60 years ☐
e. Greater than 60 years ☐

3-gender

a. Male ☐
b. Female ☐

4-What is the current weight?

Weight	
Height	
BMI	

Category	
Underweight (under 18.5)	
Normal weight(18.5-24.9)	
Overweight 25-29.9	
Obesity over 30	

5- What is your marital status?

a. Married ☐
b. Single ☐
c. Divorced ☐
d. Separated ☐
e. Widowed ☐

6- What is your level of Education?

a. Not educated ☐
b. Primary school ☐
c. Secondary school ☐
d. College or University ☐

7- What is your religion?

a. Christianity ☐
b. Muslim ☐
c. Traditional ☐

8- What is your occupation?

a. Self employed ☐
b. Skilled worker ☐
c. Unemployed ☐
d. Student

9- What is your monthly family income?

a. Zero ☐
b. From zero to 50000frw ☐
c. 50 000 to 100 000 Rwanda franc ☐
d. more than 100000 to 200 000 Rwanda franc ☐
e. More than 200000 Rwanda Franc ☐

10- What are the available support systems?

a. Community medical aid ☐
b. Private medical insurances ☐
c. Family support ☐
d. self suponsored ☐

11- Area of residence?

a. Low density ☐
b. Medium density ☐
c. High density ☐
d. Communal or rural ☐

12- What is your mode of transport from and to the hospital?

a. Public transport ☐
b. private transport ☐

13- Previous area of residence to hemodialysis facility

a. 0 to 10kms ☐
b. 11- 20kms ☐
c. 21- 30kms ☐
d. 31 to 40kms ☐
e. Greater than 40kms ☐

14. Current area of residence to the hemodialysis center

a. 0 to 10kms
b. 11- 20kms ☐
c. 21- 30 kms ☐
d. 31 to 40kms ☐
e. Greater than 40kms ☐

15- What is the mode of water supply?

a. Tap water ☐
b. Packed water ☐

16. How long have you been with ESRD?

a. Between 3 months to 1 year ☐
b. Between 1 year to 3 years ☐
c. Between 3 years to 5 years ☐
d. More than 5 years ☐
e. After a graft rejection ☐

17- What was the cause of your ESRD?

a. Hypertension ☐

b. Diabetes mellitus ☐
c. Glomerulonephritis ☐
d. Diabetes and hypertension ☐
e. Others ☐

SECTION TWO LEVEL OF HEMODIALYSIS ADEQUACY

18 Kt/V Calculation

a. Pre dialysis urea
b. Post dialysis urea
c. UF removal
d. Time
e. BFR
f. Estimated kt/v
g. Estimated URR
h. Creatinine
i. Hemogrobine
j. potassium

SECTION THREE FACTORS RELATED TO HD ADEQUACY

A. THERAPY RELATED FACTORS

19. How often do you take EPO stimulating agent for your HB?

a. Every dialysis session ☐
b. Once a week
c. Once two weeks ☐
d. Every months ☐

20. Which root used for EPO stimulating agent?

a. Iv ☐

b. Sc ☐

21. How is your blood pressure level since you started dialysis treatment?

a. Normal BP ☐
b. Frustrating BP ☐
c. High BP ☐

22. What is the type of your vascular access?

a. Central venous catheter (CVC) ☐
b. Arterio venous fistulae(AVF) ☐
c. Arterio venous graft (AVG ☐

23. What rate of blood flow are you experiencing during your dialysis treatment?

a. BFR of 100mls/min - 200mls/min ☐
b. BFR of 201mls/min – 300mls/min ☐
c. BFR of 301mls/min – 400mls/min ☐
d. BFR of Greater than 401mls/min ☐

B.PATIENTS KNOWLEDGE RELATED FACTORS

24. What is your usual interdialytic weight gain?

a. None ☐
b. 0.1kg to 1kg ☐
c. 1.1kg to 2kg ☐
d. 2.1kg to 3kg ☐
e. Above to 3.1 kg ☐

25. Have you heard the term KT/V?

a. Yes ☐
b. No ☐

26. How is your potassium level?

a. Very high ☐
b. Normal ☐
c. Less normal range ☐

d. Not know ☐

C.HEALTH CAREPROVIDERS RELATED FACTORS

27. How often does health care professional monitor your blood investigation?

a. Before and after each dialysis treatment session ☐
b. Three time in a week ☐
c. Once in a week ☐
d. Once every two weeks ☐
e. Once in months ☐
f. Once every three months ☐

g Not scheduled ☐

28. Do health providers provide you the lab results?

a. Yes ☐
b. No ☐

29. Which topics do health acre profession taught you since you started dialysis therapy?

a. Proper nutrition ☐

b. Fluids restriction ☐

c. Hemodialysis adequacy ☐

D .ADHERENCE to hemodialysis

30.How many times in a week do your doctor prescribed for your dialysis treatment?

a. Once per week ☐
b. twice per week ☐
c. thrice per week ☐

31**.** How many hours are you treated for dialysis per session?

a. 2hours ☐

b. 3hours

c. 3-4 hours ☐

32. Have you shortened the dialysis time?

a. Yes ☐

b. No ☐

33- During the last month, how many times have you shortened the dialysis time?

a. More than thrice ☐

b. Thrice ☐

c. Twice ☐

d. Once ☐

e. None ☐

34. Is your dialysis schedule convenient for you?

a. Yes ☐

b. No ☐

35- How frequent a health-care worker talks to you about the regular dialysis sessions?

a. most frequently ☐

b. Frequently ☐

c. Less frequently ☐

d. Never talked ☐

36-How important do you think it is to follow your dialysis schedule

a. Not important ☐

b. Little important ☐

c. moderate important ☐

d. Very important ☐

e. Highly important ☐

37- How much difficulty have you had for staying your entire dialysis session as prescribed by your doctor?

a. A lot of difficulty ☐

b. Moderate difficulty ☐

c. Little difficulty ☐

d. No difficulty ☐

38. During the last months, how many dialysis sessions did you miss?

a. Missed more than 3 ☐
b. Missed three ☐
c. Missed two ☐
d. Missed one ☐
e. None ☐

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March 29, 2019 **Ref.: RMH IRB/017/2019**

REVIEW APPROVAL NOTICE

Dear **NDAHAYO Didace**
School of Nursing and Midwifery, CMHS
University of Rwanda

Your Research Project: **"Factors Associated with Hemodialysis Adequacy among End Stage Renal Disease Patients on Maintenance Hemodialysis in Rwanda".**

With respect to your application for ethical approval to conduct the above stated study at Rwanda Military Hospital, I am pleased to confirm that the RMH/Institutional Review Board (IRB) has approved your study. This approval lasts for a period of **12 months** from the date of this notice, and after which, you will be required to seek another approval if the study is not yet completed.

You are welcome to seek other support or report any other study related matter to the Research office at Rwanda Military Hospital during the period of approval.

You will be required to **submit the progress report** and any major changes made in the proposal during the implementation stage. In addition, you are required to **present the results** of your study to the RMH/IRB before publication.

Sincerely,

Prof. Alex M. Buteera
Colonel
Chairperson Institutional Review Board, RMH

CENTRE HOSPITALIER UNIVERSITAIRE
UNIVERSITY TEACHING HOSPITAL

Quality Health Care
Training & Research

Ethics Committee / Comité d'éthique

April 05th, 2019 **Ref.: EC/CHUK/058/2019**

Review Approval Notice

Dear Ndahayo Didace,

Your research project: "***Factors associated with hemodialysis adequacy among end stage renal disease patients on maintenance hemodialysis at CHUK"***

During the meeting of the Ethics Committee of University Teaching Hospital of Kigali (CHUK) that was held on 5th April, 2019 to evaluate your request for ethical approval of the above mentioned research project, we are pleased to inform you that the Ethics Committee/CHUK has approved your research project.

You are required to present the results of your study to CHUK Ethics Committee before publication.

PS: Please note that the present approval is valid for 12 months.

Yours sincerely,

ETHICS COMMITTEE
CHUK

Dr. RUSINGIZA KAMANZI Emmanuel
The chairperson, Ethics Committee,
University Teaching Hospital of Kigali

<<University teaching hospital of Kigali Ethics committee operates according to standard operating procedures (Sops) which are updated on an annual basis and in compliance with GCP and Ethics guidelines and regulations>>

KING FAISAL HOSPITAL KIGALI

KING FAISAL HOSPITAL, KIGALI

Patient Centered Care

27th March, 2019

NDAHAYO, Didace
Post-graduate student
Masters of Nursing General Nursing- Nephrologist
School of Nursing and Midwifery
College of Medicine and Health Sciences- CMHS
University of Rwanda (UR)
Phone: 0788515433
Email: didasdidace@gmail.com

We acknowledge receipt of your study protocol: **"Factors associated with haemodialysis adequacy among end stage renal disease patients on maintenance haemodialysis in Rwanda"**

After a thorough review; the reviewers of KFH Ethics research Committee consider the proposed research to be useful as it will add to what is already known about the subject especially the true impact of 2 or 3 sessions per week. The researcher out to give due recognition of the work already done in the subject both in the region and Rwanda.

Therefore; It is recommended that the postgraduate should address the issues raised by the reviewers and deposit the response to the secretariat of the Committee found in the continuing Quality Improvement Office of the hospital in due course of his work. He can in the meantime be permitted to commence the research at KFH Immediately.

N.B. It is a requirement that you deposit a final copy of your research in the office of Continuous Quality Improvement in King Faisal Hospital, Kigali for our records.

Best Regards

King Faisal Hospital
Managed by OSHEN Healthcare I Rwanda

Prof. Samuel Lutalo
Clinical Professor of Medicine;
Chief Consultant Physician and
Chairperson KFH, K Ethics Research Committee

CC:
- Chief Executive Officer, Oshen- KFH
- All KFH, K Ethics-Research Committee Members.

CENTRE HOSPITALIER UNIVERSITAIRE
UNIVERSITY TEACHING HOSPITAL

CENTRE HOSPITALIER UNIVERSITAIRE DE BUTARE (CHUB)
OFFICE OF DIRECTOR GENERAL

Huye, 17/05/2019

N° Ref: CHUB/DG/SA/05/0815/2019

Didace Ndahayo
Phone: +250788515433
Email: didasdidace@gmail.com

Dear Ndahayo

Re: Your request for data collection

Reference made to your letter requesting for permission to collect the data within University Teaching Hospital of Butare for your research proposal entitled ***"Factors associated with hemodialysis adequacy among end stage renal disease patients on maintenance hemodialysis in rwanda"***, based to the approvals No: CMHS/IRB/079/2019 from Institution Review Board of University of Rwanda and No: RC/UTHB/037/2019 from our Research-Ethics committee, we are pleased to inform you that you are accepted to collect data within University Teaching Hospital of Butare. Please note that your final document will be submitted in our Research Office.

Sincerely,

Dr. Augustin SENDEGEYA
Director General of CHUB

Cc:

- Ag. Head of Clinical Education and Research Division
- Ag. Director of Research
- Chairperson of Research-Ethics Committee
- Ag. Research officer

CHUB