



THE UNIVERSITY OF NAIROBI, COLLEGE OF HEALTH SCIENCES

DEPARTMENT OF CLINICAL MEDICINE AND THERAPEUTICS

DETERMINANTS OF VACCINATION UPTAKE AMONG PATIENTS WITH END-STAGE KIDNEY DISEASE ON HAEMODIALYSIS AT THE KENYATTA NATIONAL HOSPITAL

DR. SIRAJA IBRAHIM ISSACK

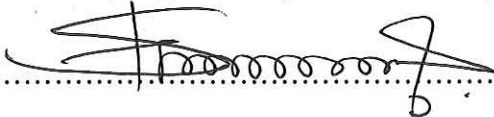
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**A DISSERTATION SUBMITTED IN PART FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF A MASTER'S IN MEDICINE DEGREE IN INTERNAL
MEDICINE**

DECLARATION

This dissertation is my original work and has been presented as a prerequisite to the award of a master's degree in Internal Medicine from the University of Nairobi. All resources and materials used or quoted have been indicated and acknowledged appropriately. This dissertation has not been presented for any degree to any other university to the best of my knowledge.

Signature..........Date.....02 | 11 | 2023

Dr. Siraja Ibrahim Issack

H58/37598/2020

Resident Internal medicine

Department of Clinical Medicine and Therapeutics

Faculty of Health Sciences

University of Nairobi

SUPERVISORS

APPROVAL BY SUPERVISORS

I hereby confirm that this dissertation is my original work and has been submitted with the approval of my supervisors and chairman of department.

Prof. MCLIGEYO SETH O

Professor of Medicine

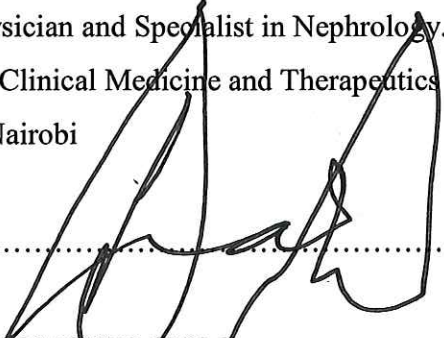
Consultant Physician and Specialist in Nephrology.

Department of Clinical Medicine and Therapeutics

University of Nairobi

Signature.....

Date.....


19/11/2023

Prof. GEORGE OMONDLOYOO

Professor of medicine

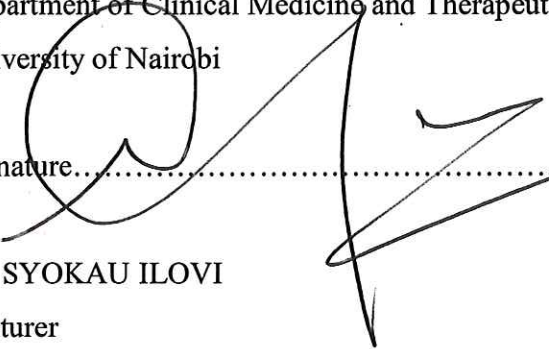
Consultant Physician and Rheumatologist

Department of Clinical Medicine and Therapeutics

University of Nairobi

Signature.....

Date.....


22/11/2023

Dr. SYOKAU ILOVI

Lecturer

Consultant Physician & Clinical Geneticist

Department of Clinical Medicine and Therapeutics

University of Nairobi

Signature.....

Date.....



10.11.2023

APPROVAL BY CHAIRMAN OF DEPARTMENT

Prof. E.O Amayo

Chairman of the Department of Clinical Medicine and Therapeutics

Professor, Consultant Physician and Neurologist, Department of Clinical Medicine and Therapeutics.

Signature  Date 23/6/2022

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
DEPARTMENT OF CLINICAL MEDICINE & THERAPEUTICS
P.O. Box 19676-00202 NAIROBI

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LIST OF ABBREVIATIONS

AIDS	Acquired immunodeficiency syndrome
Anti-HBsAg	Antibodies to hepatitis B surface antigen
CHF	Chronic heart failure
CKD	Chronic kidney disease
CLD	Chronic liver disease
COPD	Chronic obstructive pulmonary disease
CVD	Cardiovascular disease
DVT	Deep venous thrombosis
ESKD	End-stage kidney disease
GFR	Glomerular filtration rate
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HCW	Healthcare workers
HD	Haemodialysis
HIV	Human immunodeficiency virus
IDI	In-depth interviews
KDIGO	Kidney disease improving global outcomes
KNH	Kenyatta National Hospital

NSI	Needlestick injuries
OBS/GNY	Obstetrics and gynaecologist
UVIS	Unit of vaccines and immunization services
VPD	Vaccine-preventable disease
WHO	World Health Organization

TABLE OF CONTENTS

Contents

DECLARATION.....	ii
SUPERVISORS	iii
ACKNOWLEDGEMENT	iv
LIST OF ABBREVIATIONS	v
TABLE OF CONTENTS.....	vii
LIST OF TABLES	x
LIST OF FIGURES.....	x
ABSTRACT.....	xi
CHAPTER ONE: INTRODUCTION.....	1
1.1 Background.....	1
1.2 Problem Statement	2
CHAPTER TWO: LITERATURE REVIEW	3
2.1 Burden of Chronic Kidney Disease.....	3
2.2 Risk of Infection and its Implications in CKD	3
2.3 Recommended Vaccines for CKD	4
2.4 Vaccine Uptake among Patients with CKD.....	6
2.5 Awareness and Practice of Healthcare Workers on the Recommended Vaccination among Patients with CKD.....	7
2.5.1 Healthcare Workers' Level of Awareness	7
2.5.2 Healthcare Workers' Practice.....	8
2.6 Patient-Related Factors.....	9
2.7 Study Questionnaire Review	10
2.8 In-Depth Interview Guide	10
2.9 Conceptual Framework	11
2.10 Justification.....	12
2.11 Research Question.....	12
2.12 Objectives	12
2.12.1 Broad Objective	12
2.12.2 Specific Objectives	13
CHAPTER THREE: METHODOLOGY	14

3.1	Study Design.....	14
3.2	Study Setting.....	14
3.3	Study Population.....	14
3.4	Definitions for Study Populations.....	14
3.5	Case Definitions.....	15
3.6	Eligibility Criteria.....	15
3.6.1	Inclusion Criteria for Healthcare Workers.....	15
3.6.2	Exclusion Criteria for Healthcare Workers.....	15
3.6.3	Inclusion Criteria for Patients.....	16
3.6.4	Exclusion Criteria for Patients.....	16
3.7	Sample Size Estimation.....	16
3.7.1	Sample Size for Healthcare Workers.....	16
3.7.2	Sample Size for Patients.....	17
3.8	Study Flow Chart for Quantitative arm of Patients.....	18
3.9	Sampling.....	18
3.9.1	Sampling and Recruitment of Healthcare Professionals.....	18
3.9.2	Sampling and Recruitment of Patients.....	19
3.10	Data Collection Process.....	19
3.11	Study Variables.....	21
3.12	Data Analysis and Management.....	22
3.13	Quality Assurance.....	22
3.14	Ethical Considerations.....	23
CHAPTER FOUR: RESULTS.....		24
4.1	Respondents' Characteristics.....	24
4.2	Patient Vaccination Status.....	25
4.3	Healthcare Workers' Characteristics.....	26
4.4	Healthcare Workers Knowledge.....	27
4.5	Healthcare Workers' Practice.....	28
4.6	Patients Awareness, Attitude and Perspectives on Vaccination.....	29
CHAPTER FIVE: DISCUSSION.....		33
5.1	Discussion of Key Findings.....	33
5.2	Strengths of the Study.....	36
5.3	Limitations of the Study.....	37

5.4	Conclusion	37
5.5	Results dissemination plan	37
5.6	Recommendations	37
	REFERENCES.....	38
	APPENDICES.....	47
	Appendix I: Study Questionnaire for Healthcare Workers	47
	Appendix II: Patients Data Collection Form.....	49
	Appendix III: IDI Guide	50
	Appendix IV: Consent Form	51
	Appendix V: Fomu ya Idhini.....	53
	Appendix VI: Results – Dummy Tables	55
	Appendix VII: Mwongozo wa IDI	56

LIST OF TABLES

Table 1. Patient characteristics	24
Table 2. Patients' vaccination status	26
Table 3. Healthcare worker's characteristics	26
Table 4. Healthcare workers knowledge.....	28
Table 5. Healthcare workers practice.....	29

LIST OF FIGURES

Figure 1. Conceptual framework	11
Figure 2. Study flow chart for quantitative arm of patients.....	18
Figure 3. Bar chart representation of patients' vaccination status	25

ABSTRACT

Background: End-stage kidney disease patients are at increased risk of infection due to their dysfunctional immune system. The practice of vaccination among ESKD was poor despite its proven effectiveness in reducing morbidity and mortality.

Objective: To assess the extent and determinants of vaccination uptake among end-stage kidney disease patients on haemodialysis at Kenyatta National Hospital.

Materials and Methods: This was a hospital-based descriptive cross-sectional mixed-method study involving both HCWs and patients conducted at the KNH renal unit and renal ward. The study tools comprised a self-administered questionnaire for HCWs assessing knowledge and practice and in-depth interviews for patients assessing awareness, attitude, and perspectives. Data analysis was done using SPSS version 25.

Results: We recruited 121 HCWs and 146 patients. Among the HCWs, 70 (57.9%) were female with a mean age of 35.2. A majority had 5 to 10 years of practice. The average group performance for consultants, nephrology fellows, registrars, renal and regular nurses were 98.3%, 96.9%, 81.9%, 65.2%, and 71.5% respectively. The practice of vaccination was good. Among patients, both genders were well represented with a majority being dependents. Diabetes was noted as the most common cause of ESKD. Out of the 146 patients, only 78 (53.4%) had received one or more of the vaccines while 68 (46.6%) did not receive any of the vaccinations. Moreover, only 1 patient had received all 4 recommended vaccines.

Conclusion: The vaccination uptake among ESKD patients on haemodialysis was very low. This was mainly attributed to lack of information. HCWs' knowledge on matters of vaccination was adequate, and their practice was equally good.

CHAPTER ONE: INTRODUCTION

1.1 Background

Chronic kidney disease (CKD) is defined as aberrations of kidney structure or function persisting for more than 3 months with implications for health (1). It has been noted as a worldwide major public health problem with significant morbidity and mortality (2). The high global prevalence of CKD is mainly contributed to an increase in the incidence of diabetes and hypertension (2).

After cardiovascular disease, infections are the second most common cause of death in ESKD patients. The risk of infections among ESKD patients is three to four times higher than in the general population (1). Similarly, lower estimated glomerular filtration rate (eGFR) categories have been associated with a greater risk of all-cause infection-related hospitalizations and an increased risk for infection-related mortality (3).

Vaccination is one of the most effective and efficient strategies to reduce morbidity and mortality due to infections. Various studies have proven vaccine effectiveness in CKD and haemodialysis patients (4–6). However, vaccination remains underutilized in these immunocompromised groups of patients mainly due to; not being aware of recommendations, lack of recommendation from healthcare professionals, lack of vaccination protocols in hospitals, high costs of vaccines, vaccine hypo-responsiveness, vaccine side effects, system failure, cultural and religious attitudes towards vaccination and lack of trust in health systems (7,8).

Several determinants have been shown to influence vaccination coverage among CKD patients. Healthcare factors such as; physician reimbursement for administering vaccination, physician education/training, use of reminders by both physician and nurses and recommendations from healthcare professionals, patient-related factors such as increased awareness through health education, mass media, and vaccination campaigns, positive attitude, and system factors such as; stable vaccine supply with subsidized prices have been positively associated with improved vaccine receipt among patients (9–11).

Globally, there are few studies evaluating vaccination practices among ESKD patients. Across Europe, vaccination practices are advanced with most countries approaching the recommended

targets (12). Likewise, several dialysis centres in the United States report higher vaccination rates among ESKD patients with the adoption of practices such as standing orders (13).

In Africa, a study done in Nigeria to assess vaccination practices among healthcare workers across different hospital settings including both public and private facilities found poor outcomes in both settings (14). A similar study in Nigeria assessing vaccination status and awareness of vaccination among haemodialysis patients also found inadequate knowledge with low vaccine uptake (7). The Kenyan Ministry of Health Policy Guidelines on vaccination state that there will be efficient and high-quality immunization services that are accessible, equitable and affordable to every Kenyan. The Ministry of Health under the Unit of Vaccines and Immunization Services (UVIS) mandates to ensure equitable access to appropriate vaccination services for all persons in Kenya (15).

1.2 Problem Statement

Chronic kidney disease is a major public health problem with significant morbidity and mortality. The global rise of ESKD has been associated with an increased incidence of hypertension and diabetes. These patients are at increased risk of infectious complications and vaccination has been proven to be effective in reducing morbidity and mortality from infections. The practice of vaccination among ESKD patients is very low despite its proven effectiveness. Previous studies have alluded to low vaccination rates secondary to lack of recommendation from HCWs, reduced vaccine responsiveness, and vaccine associated side effects, vaccine-associated costs and defective healthcare systems (7,14).

Little is known about the determinants of vaccination uptake among ESKD patients on haemodialysis in resource-limited settings with a growing burden of ESKD. This study will bridge the existing knowledge gap in the practice of vaccination among ESKD patients on haemodialysis at KNH. The results will form a basis to guide protocols for early implementation of immunization and monitoring strategies to improve adherence and increase vaccination uptake. Furthermore, the study will raise awareness of our current practice and identify areas that need improvement.

CHAPTER TWO: LITERATURE REVIEW

2.1 Burden of Chronic Kidney Disease

Chronic kidney disease is a global health problem with increased risks of cardiovascular morbidity, premature mortality, and/or decreased quality of life. The mean global CKD prevalence is high (16). In 2017, approximately 1.2 million people succumbed to CKD (17). To combat this global epidemic, a change in the approach to CKD from the treatment of ESKD to exhaustive primary and secondary prevention is, therefore, paramount (18).

In sub-Saharan Africa, CKD is a significant health burden with risk factors that include both communicable and non-communicable diseases, and the estimated overall prevalence is equally high (19). Moreover, the risk is even higher in patients with chronic diseases such as HIV, diabetes, and hypertension (20). ESKD has profound implications for people living in sub-Saharan Africa since renal replacement therapies such as dialysis and transplantation are not promptly available and for the few who access the cost is high (21).

In Kenya, the overall prevalence of CKD is unknown; however, the estimated prevalence in rural settings ranges from 0.41% to 3.7% in studies done in Kericho county and western Kenya respectively (22,23). Higher prevalence estimates of 11.5% to 26% were noted among the high-risk groups (24–26). Renal disease has been noted as an independent risk factor for worse outcomes in HIV-infected Kenyan adults (27).

2.2 Risk of Infection and its Implications in CKD

End-stage kidney disease is associated with significant major infectious complications which occur at rates three to four times that of the general population and infections are recognized as the second most common cause of death only second to CVD in ESKD patients (1). Even mild to moderate stages of CKD considerably increase the risk of community-acquired infection among the general population (28). The occurrence of acute bacterial infections is high in CKD patients with even higher rates noted in the haemodialysis group despite the many developments in dialysis techniques and infection control practices (28). The three most common infections noted in these patients are pneumonia, sepsis and urinary tract infections in order of prevalence with sepsis as the

leading cause of death (32). *Streptococcus pneumoniae* is noted as the most common causative organism of pneumonia (29). In addition to bacterial infections, ESKD patients on haemodialysis are at increased risk of Hepatitis B and C infections (30,31).

Regarding the risk of hospitalization, infections were second to cardiovascular disease as the cause of hospitalization for all-cause hospitalization among patients with chronic kidney disease with the lower the eGFR the higher the risk of hospitalization (28). Major infections such as pneumonia and sepsis are common antecedents of new cardiovascular events and deaths in dialysis patients (32,33).

All stages of CKD and more so the advanced stages of CKD (stages four and five) are associated with a higher risk of all-cause mortality and cardiovascular morbidity and mortality (3). Concerning infections and risk of mortality; there is a graded increased risk of all-cause mortality with declining GFR (1,28,34). The increased risk of infections in these patients has been attributed to their dysfunctional immune system including impaired function of T-cells, B-cells, and Neutrophils together with multiple risk factors such as vascular access and immunosuppressant use (3,28).

End-stage kidney disease patients are at increased risk of severe COVID-19 disease (35) because of their defective immune systems and associated comorbid conditions. A retrospective study evaluating the outcomes of ESKD patients hospitalized with COVID-19 demonstrated a higher rate of in-hospital mortality (31.7% vs 25.4%) compared to those without ESKD. Risk factors associated with increased in-hospital mortality are increased age, mechanical ventilation, lymphopenia, elevated blood urea nitrogen level and high serum ferritin level (35). A similar study evaluating mortality and associated risk factors of COVID-19 infection in dialysis patients in Qatar demonstrated a 15% mortality. Significant risk factors for the high risk of mortality include; increasing age, CHF and COPD, history of DVT, atrial fibrillation, hypoxia, ICU admission, mechanical ventilation and use of inotropes (36).

2.3 Recommended Vaccines for CKD

Vaccination is one of the most significant and cost-effective public health measures in reducing the burden of infectious disease yet it is underrated and under-utilized throughout the globe (37).

Vaccines are efficient tools to reduce disease, disability, death, and inequities in health worldwide (38). Vaccinations remain an important preventive measure in CKD patients as several studies did show lower infection risk and a remarkable reduction in morbidity and mortality in centres adopting vaccination protocols (39). Influenza vaccinations among ESRD patients were associated with a lower risk of hospitalization and death (40). Efforts should therefore be scaled up to increase vaccination rates in these patients.

Generally, ESKD patients have poor response to vaccine more so the haemodialysis group (41). In the Carr et al study that compared immune response between dialysis and health controls, antibody levels were significantly lower in the dialysis group. Factors thought to be associated with the lower antibody response include, older age with coexisting comorbidity, immunosuppressant use, lower serum albumin, lower dialysis vintage, and higher intravenous iron sucrose doses (41,42). Even though the vaccine response in CKD patients is low, various strategies to enhance this response have been fronted. These measures include a proper route of administration, higher vaccine dosage and frequent dosing, and the use of adjuvants (43–45).

KDIGO Recommendations for vaccinations among CKD and ESRD patients include; an annual influenza vaccine for all adults with CKD, a polyvalent pneumococcal vaccine for all adults with eGFR $<30\text{ml}/\text{min}/1.73\text{m}^2$, and those at risk of pneumococcal infections such as nephrotic syndrome, diabetes, and those receiving immunosuppression, revaccination with the pneumococcal vaccine within five years for all adults with CKD who have received pneumococcal vaccination, and hepatitis B vaccination for all adults with GFR $<30\text{ml}/\text{min}/1.73\text{m}^2$ and at high risk of CKD progression and the response confirmed by appropriate serologic testing (1).

In light of the current pandemic, COVID-19 vaccines are also recommended for all patients with chronic diseases because of adverse outcomes associated with Covid-19 in these high-risk groups (46). A study evaluating humoral and cellular immunity to sars-cov-2 vaccination in both dialysis and renal transplant patients demonstrated exceptionally high seroconversion rates of 95% after booster vaccination in dialysis patients compared to kidney transplant recipients (42%) (47). A similar study evaluating COVID-19 Vaccine Efficacy and Immunogenicity in ESKD patients and Kidney Transplant Recipients has shown increased seropositivity and higher antibody production after the third and fourth vaccine doses (48).

The Ministry of Health under the unit of vaccines and immunization services (UVIS) aims to promote and guide the provision of high-quality immunization services to all Kenyans. The unit of UVIS mandates to coordinate vaccination services for all vaccine-preventable diseases through the provision of guidelines and selected priority vaccines and related biologicals. Among the recommended guidelines are vaccinating pregnant women with inactivated influenza vaccine, tetanus vaccine (TT), tetanus-diphtheria (Td), Hepatitis B and Meningococcal polysaccharide, vaccinating HIV positive Infant/Children and immunocompromised individuals who are non-HIV infected such as the diabetics, sicklers, renal failure, asthmatics, alcoholic cirrhosis and asplenia patients. The recommended vaccines for these cohorts of patients include; Hepatitis B, PCV13 vaccine, 23 valent pneumococcal vaccines, polyvalent pneumococcal vaccine and seasonal influenza vaccine (15).

In an attempt to reduce the burden of illness due to vaccine preventable diseases, the government under the ministry of health has increased the total health expenditure to 24.1 billion shillings in 2018/19 from 21.3 billion in 2016/17. The government also provides vaccines for the vaccine preventable diseases free of charge (49). To increase access to immunization services, the government approved immunization facilities to provide routine vaccination services from Monday to Friday, provide outreach immunization services and all government supported vaccines to be provided free of charge (50). The cost of vaccines in Kenya varies depending the type of vaccine and the place of vaccination whether public or private hospitals. The cost of hepatitis B vaccine (EUVAX) is approximately 1700 Kenyan shillings per dose (51).

2.4 Vaccine Uptake among Patients with CKD

Vaccination against vaccine-preventable diseases such as *Hepatitis B*, *Haemophilus influenza*, and *Streptococcus pneumoniae* are integral parts of CKD care. Despite the proven effectiveness of vaccines among CKD patients, vaccination rates remain low. (39). A study done in Vienna Austria evaluating influenza vaccine uptake among CKD/CLD (chronic liver disease) patients showed a low rate with factors such as graft injury, vaccine inefficiency, and vaccine side effects as the major barriers (52). A similar study evaluating vaccination coverage of recommended vaccines in at-risk groups (diabetes mellitus, CKD, chronic obstructive pulmonary disease, Human-Immunodeficiency Virus, and Heart Failure) illustrated a lower rate of vaccinations among these

patients. The main reasons for non-vaccination were concerns about the necessity and adverse effects of vaccines, vaccine effectiveness and unawareness of recommendations for vaccinations (8).

Adoption of practice-proven interventions such as vaccination-only clinics, standing orders, recommendations from healthcare workers, and reminder and recall efforts can be used to increase vaccination rates (53). Several dialysis clinics across the United States that adopted standing orders have reported better vaccination practices among CKD patients (13).

2.5 Awareness and Practice of Healthcare Workers on the Recommended Vaccination among Patients with CKD

2.5.1 Healthcare Workers' Level of Awareness

Generally, healthcare workers have illustrated good basic knowledge of vaccine-preventable diseases (VPD) like hepatitis B virus (HBV), although there were gaps with HBV immunology and lasting implications of resolved acute HBV infection. The majority were aware of the correct dosage and dosing interval for hepatitis B vaccination. Most healthcare professionals agreed that hepatitis B vaccination protects through an effective antibody response (54).

Healthcare worker's awareness of vaccination among ESKD patients is less than satisfactory as depicted in a study done in Nigeria; there were important knowledge gaps among all the healthcare workers groups regarding rescreening for HBV, immunization against other vaccine preventable diseases (VPD) besides HBV and dosing interval for all the vaccines (14). The healthcare worker's knowledge gap on rescreening for HBV is a cause for concern since end-stage renal disease (ESRD) patients on haemodialysis have been shown to seroconvert to HBV positive while on dialysis with poor outcomes (55).

In the Nigerian study evaluating healthcare worker's awareness on pre-dialysis screening for infections, the health worker's knowledge of pre-dialysis screening for HBV and Hepatitis C virus (HCV) was optimal. Most of the healthcare workers were aware of the recommendation that haemodialysis patients should be vaccinated against HBV, the majority were aware of the 3-dose regimen while a few were abreast with the new 4-dose regimen. This largely depicts the lack of

knowledge updates on vaccination protocols. On the aspect of counselling for vaccinations, the majority of healthcare workers were aware patients should be counselled for vaccination at the first diagnosis of CKD (14), this is key since higher seroconversion rates were noted with early vaccination (4).

Poor knowledge of the influenza vaccine has been associated with poor receipt of the vaccine (56,57). Healthcare workers' knowledge of vaccination of pneumococcal and influenza among the ESKD population was poor, translating into low vaccination rates among patients because of a lack of prescriptions and activism to get health systems to avail vaccines (14,58). A similar study evaluating healthcare workers' knowledge and attitudes toward the influenza vaccine among pregnant women and children demonstrated low recommendations were associated with poor knowledge of the Influenza vaccine (58).

General and subspecialist physicians caring for elderly and high-risk patients illustrated adequate knowledge of the safety and cost-effectiveness of both influenza and pneumococcal vaccine among elderly and high-risk patients (59).

2.5.2 Healthcare Workers' Practice

Vaccination of CKD patients across Europe is far more advanced and better developed with most states coming close to the targeted recommendations from European Centre for Disease Prevention and Control; most of the recommended vaccines are provided free of charge by National Health System for CKD and dialysis patients. In most of these centres, antibody titres are regularly checked for vaccines like hepatitis B and varicella and augmented doses are administered when titres diminish below protective levels (12). Similarly, better vaccination practices and higher vaccination rates were noted in dialysis centres in the United States with the adoption of standing orders (13).

The same cannot be said for the nephrology practice in sub-Saharan Africa as their dull performance in this aspect of CKD care is delineated by a lack of research on the topic. In matters of practice, approximately 10% of centres in Nigeria have existing and active vaccination

guidelines for HBV with none against influenza and pneumococcal, and most of these centres were privately run by affluent clients unlike public hospitals (14). Regarding pneumococcal and influenza vaccination practices among elderly and high-risk individuals, vaccination rates are infrequently done by healthcare workers as part of ongoing quality assurance. The practice-proven interventions to increase vaccination rates among patients were infrequently used by both general and subspecialist physicians, hence the need for further education among healthcare workers on the significance of such strategies (59). Similarly, a study done in Nigeria evaluating the practice of hepatitis B vaccination among healthcare workers reported poor practice with only a third completing the three doses, moreover, only a few did their antibody titres (54).

2.6 Patient-Related Factors

Awareness of chronic kidney disease patients on key aspects of kidney care is poor (60,61). A study evaluating patient awareness of VPD, and vaccinations demonstrated poor knowledge of VPD and low awareness of vaccine correct dosage. Moreover, only a few patients completed their vaccination against Hepatitis B while none had received any vaccination against pneumococcus and influenza (7). Increased awareness through health education among patients has been associated with increased vaccination coverage. Health education should focus on the self-perceived risks of infection and associated worse outcomes. It should also emphasize on benefits of vaccination, its safety, and its cost-effectiveness of vaccination (62). A similar study evaluating the impact of health education on the acceptance and willingness to pay for influenza vaccine among the elderly population demonstrated a positive impact on the acceptance and willingness to pay for influenza vaccine as well as enhancing knowledge and improving attitude in the elderly (10). Other methods such as phone reminders can also be used to increase the vaccination rate among patients as it has been shown to increase vaccination rates compared to mail reminders (63).

The positive attitude among patients has been associated with increased vaccine acceptance and uptake. Willingness to accept vaccination was associated with self-perceived risks of infections and related worse outcomes, a belief that vaccinations are effective, and increased comorbidity. Other reasons for accepting vaccination were recommendations from healthcare professionals, self-acquired knowledge and a history of previous vaccination (52,64).

The affordability of vaccines has been a major obstacle to patients' willingness to take vaccines. Vaccine-associated costs were notable reasons for refusing vaccinations. Other reasons for non-vaccination are lack of knowledge on the benefits of vaccination, fear of side-effects and complications following vaccinations, vaccine ineffectiveness in disease prevention, defective system (vaccine availability, affordability, and demand creation activities like provision of information) and lack of recommendation from healthcare professionals (7,52,64).

Patient literacy level and occupational status greatly influenced vaccination uptake among CKD patients. Patients with tertiary levels of education and white-collar jobs were more enlightened on aspects of vaccination compared to their counterparts (7). Similarly, a mother's education and occupation were significantly associated with better receipt of the pentavalent vaccine among children (65).

2.7 Study Questionnaire Review

The study tool used to assess healthcare worker's knowledge and practice was a provider administered questionnaire consisting of 3 sections. It was a validated questionnaire adapted from a similar study conducted in Nigeria evaluating awareness and practice of vaccination of chronic haemodialysis among various healthcare worker cadres. Permission to use the questionnaire was sought from the principal investigator and granted. The questionnaire was available in English.

SECTION A: captured demographic data of respondents

SECTION B: Had seven questions that assessed healthcare worker's knowledge

SECTION C: Had 2 questions that assessed healthcare workers practice

2.8 In-Depth Interview Guide

The key informant interview guide was generated with input from supervisors.

2.9 Conceptual Framework

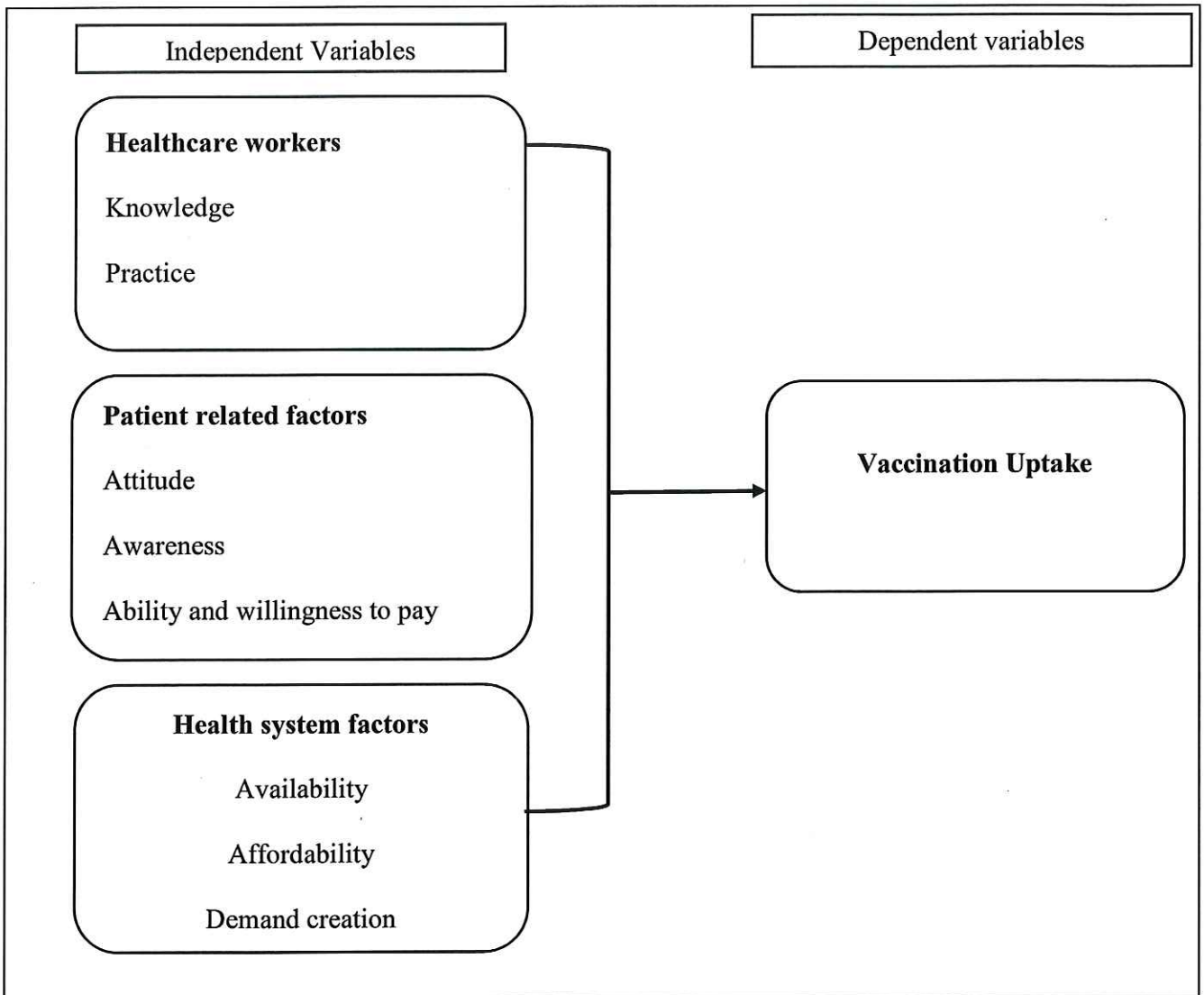


Figure 1. Conceptual framework

2.10 Justification

Chronic kidney disease is a major public health problem with significant morbidity and mortality (66). The rise in the global prevalence of CKD has been associated with increasing cases of hypertension and diabetes (2). ESKD patients are at increased risk of infectious complications such as pneumonias, sepsis and viral infections such as hepatitis B due to their dysfunctional immune system and other notable factors such as vascular access and increased hospital contact time. Infections increase the risk of hospitalizations and deaths among ESKD patients on HD. Major infections such as pneumonia and sepsis are common antecedents of new cardiovascular events and deaths in dialysis patients. Vaccinations (pneumococcal, influenza, hepatitis B & covid-19) have been proven to be effective in reducing these complications (28,39). Vaccination uptake among ESKD patients has been low. Notable factors for the low vaccination rates are concerns for vaccine effectiveness, vaccine side effects, high costs of vaccines, accessibility and availability of vaccines, inefficient & ineffective healthcare systems and lack of recommendations from healthcare professionals (8,52). Globally, minimal research has been done on the aspect of ESKD vaccination. The practice of ESKD vaccination is better in the developed world compared to middle and low-income countries mainly due to the lack of information and research on this topic (12–14). To address this knowledge gap; we evaluated the extent and determinants of vaccination uptake among end-stage kidney disease patients at Kenyatta National Hospital. The results of the study will inform on the vaccination coverage of our ESKD patients and help in formulating policies that govern the management of ESKD particularly the vaccination aspect.

2.11 Research Question

What is the practice of vaccination among end-stage kidney disease patients on haemodialysis at Kenyatta National Hospital?

2.12 Objectives

2.12.1 Broad Objective

To assess the extent and determinants of vaccination uptake among end-stage kidney disease patients on haemodialysis at Kenyatta National Hospital.

2.12.2 Specific Objectives

- i) To determine the proportion of patients who have received KDIGO-recommended vaccines (Hepatitis B, Influenza and Pneumococcal vaccine) and Covid-19 Vaccine among end-stage kidney disease patients on haemodialysis at Kenyatta National Hospital.
- ii) To assess healthcare workers' knowledge and practice of KDIGO-recommended vaccines among end-stage kidney disease patients on haemodialysis at Kenyatta National Hospital.
- iii) To determine patients' awareness, attitude and perspectives on vaccination in end-stage kidney disease patients on haemodialysis at Kenyatta National Hospital.

CHAPTER THREE: METHODOLOGY

3.1 Study Design

A mixed-method cross-sectional study with both quantitative and qualitative arms. Quantitative arm; patients' vaccination status and HCW knowledge and practice. Qualitative arm; patients' awareness, attitude and perspectives on vaccination.

3.2 Study Setting

The study was undertaken at Kenyatta National Hospital's renal ward, renal unit and dialysis clinic. Kenyatta National Hospital is a tertiary teaching hospital located in the city of Nairobi. It has eight inpatient specialized adult medical wards, two medical ICUs, and a renal unit. The inpatient wards together with specialized weekly clinics serve patients drawn from all over the country. The total bed capacity for both the renal ward and renal unit is 100 (60 for the renal ward and 40 for the renal unit). The total number of healthcare professionals from the University of Nairobi and Kenyatta National Hospital attending to patients with ESKD on haemodialysis seeking care at the Kenyatta National Hospital are 5 consultants, 10 nephrology fellows, 80 registrars and 75 nurses. On average 20 patients are seen in the dialysis clinic per week.

3.3 Study Population

The study population were 121 healthcare workers (HCW), (5 consultants, 8 nephrology fellows, 62 registrars, 34 renal nurses and 12 regular nurses) working at Kenyatta National Hospital renal ward, and the renal unit, as well as 146 ESKD patients on haemodialysis attending dialysis clinic.

3.4 Definitions for Study Populations

Nephrologist: A qualified internist with certified specialist training in nephrology and registered with Kenya Medical Practitioners and Dentist Board.

Nephrology Fellow: A qualified internist subspecialising in nephrology under the auspices of the University of Nairobi.

Registrar: A qualified medical doctor specializing in internal medicine under the auspices of the University of Nairobi.

Dialysis Nurse: A registered nursing officer with certified post-basic nephrology training and registered with the Nursing Council of Kenya.

General Nurse: A registered nursing officer with a basic degree or diploma in nursing and registered with the Nursing Council of Kenya.

3.5 Case Definitions

End-stage kidney disease: Is defined as CKD stage 5 patients undergoing haemodialysis at KNH renal unit.

HCW: Includes consultants' nephrologists, nephrology fellows, internal medicine registrars, dialysis nurses and regular nurses working in the renal ward and renal unit.

Vaccination status: Defined as completion of the basic series of any of the recommended vaccines. This was mainly based on self-reporting of vaccination by patients.

Knowledge: Defined as the awareness of vaccination as an integral part of ESKD management.

Practice: Defined as the provision or recommendation of vaccines to ESKD patients.

3.6 Eligibility Criteria

3.6.1 Inclusion Criteria for Healthcare Workers

HCW working in the renal ward and renal unit at Kenyatta National Hospital.

3.6.2 Exclusion Criteria for Healthcare Workers

Those who will not consent to the study.

3.6.3 Inclusion Criteria for Patients

Patients who are 18 years and above with CKD stage 5 on haemodialysis and who consent to participate will be included.

3.6.4 Exclusion Criteria for Patients

Patients who are too ill to give any responses to the interviewer-administered questionnaire or undertake in-depth interviews.

Patients with cognitive impairments such as dementia, psychosis and depression who are unlikely to recall or give an accurate response.

Patients who declined to give informed written consent.

3.7 Sample Size Estimation

3.7.1 Sample Size for Healthcare Workers

There were approximately 5 consultants, 10 nephrology fellows, 80 internal medicine registrars, 53 renal nurses and 22 regular nurses attending to ESKD patients on haemodialysis.

The sample size for healthcare workers was determined using the formula for the finite population.

$$n = N * X / (X + N - 1)$$

$$\text{where } X = (Z)^2 * p * (1 - P) / (\text{MOE})^2$$

where N= target population size= 170

Z= confidence interval of 95% (1.96)

Margin of error = 5%

p= estimated proportion of HCW with knowledge of vaccination of CKD patients = 50% (14).

$$X = 1.96^2 * 0.5 * (1 - 0.5) / 0.05^2 = 384$$

thus $n = 170 * 384 / (553)$ $n = 118$ healthcare workers.

The computed sample size came to 118 HCWs. It was assigned to different cadres using proportional allocation to size. The sample size was 4 consultants, 8 nephrology fellows, 58 internal medicine registrars, 34 renal nurses, and 14 regular nurses.

3.7.2 Sample Size for Patients

The sample size for patients was estimated using Cochran's formula (67).

$$N = Z^2 P (1 - P) / d^2$$

N = sample size required to estimate the proportion of CKD patients who meet the criteria for inclusion

Z = is the 95% confidence interval (standard value of 1.96).

P = is the estimated vaccination status among CKD patients from a previous study = 10%. This is based on a study by Akinbodewa et al in Nigeria which assessed awareness and practice of vaccination against infectious diseases in haemodialysis patients.

d = margin of error = 5%

With a confidence interval of 95% and a precision of 5%, the sample size was thus calculated as:

$$N = 1.96^2 \times 0.1 \times (1 - 0.1) / 0.05^2$$

$$N = 3.8416 \times (0.1 \times 0.9) / 0.0025$$

$$N = (3.8416 \times 0.09) / 0.0025$$

$$N = 138$$

A minimum of 138 patients was required to estimate the proportion of patients who received KDIGO-recommended vaccines and covid-19 vaccine.

3.8 Study Flow Chart for Quantitative arm of Patients

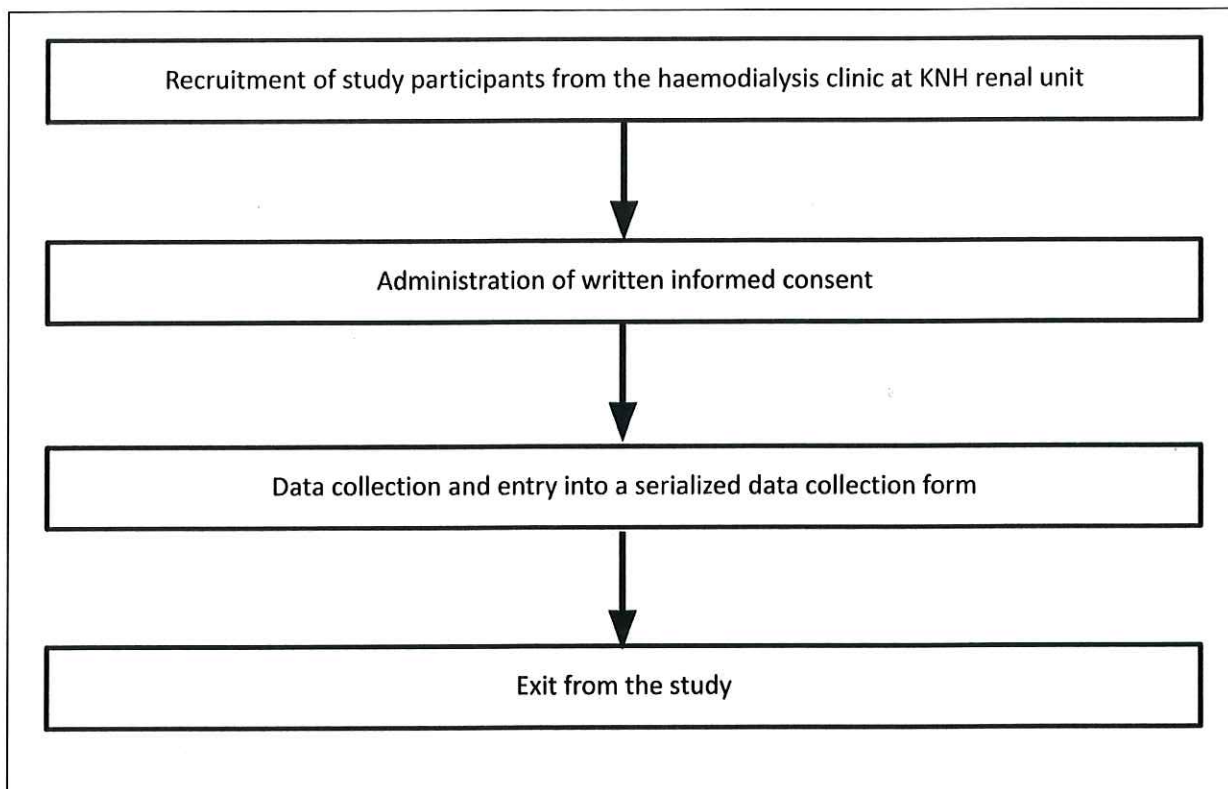


Figure 2. Study flow chart for quantitative arm of patients

3.9 Sampling

3.9.1 Sampling and Recruitment of Healthcare Professionals

A list of consultants, fellows, and nurses working in the renal ward and the renal unit was obtained from the nurse and doctor in charge of the renal ward and renal unit. The enrolment and consenting for consultants, fellows, and nurses were done in the renal ward (7A) and the renal unit five (5) working days a week over the study period. Then, they were consecutively sampled into the study until the desired sample size of 59 HCWs was reached. Similarly, the list of internal medicine registrars was obtained from the Department of Clinical Medicine and Therapeutics. There were

approximately 80 residents—22 in part one, 16 in part two(2A) and 42 in part two (2B). The allocated sample size sample of 58 was assigned to different classes using proportional allocation to size; 14 in part one, 10 in part 2A, and 34 in part 2B. The enrolment and consenting for internal medicine registrars were done in their respective medical wards five (5) days a week during the study period of approximately 10 weeks. Then, they were consecutively sampled into the study until the desired sample size of 62 was achieved. Sampled healthcare professionals were then administered the questionnaire in their respective wards.

3.9.2 Sampling and Recruitment of Patients

Patients' files at the dialysis clinic were reviewed to identify patients meeting the case definition. Once identified, the patients were then consecutively recruited into the study until the desired sample size of 146 was reached. We recruited 18 participants each week allowing the final sample to be met within 10 weeks of data collection. Sampled participants were then provided with consent forms. Once consented, the participants had the questionnaire administered to get data on their vaccination status and sociodemographic data.

Participants for IDI were purposively selected from those initially enrolled for vaccination status with the aim of including both vaccinated and unvaccinated participants, male and female participants. Three (3) in-depth interviews were conducted per week up to a total of 15 over the study period.

3.10 Data Collection Process

Quantitative data for HCW was collected using a structured self-administered questionnaire. The questionnaire had three sections; section one focused on the sociodemographic characteristics (age, sex, profession, years of practice) of the respondents, section two focused on the respondents' knowledge, while section three focused on respondents' practice regarding the KDIGO recommended vaccines for ESRD patients. The study tool was a validated questionnaire adapted from a study done on healthcare workers' knowledge and practice of vaccination of chronic haemodialysis patients in Nigeria by Akinbodewa et al (14). Permission to use the questionnaire was sought from the principal investigator of the study above and granted.

Knowledge was assessed in six thematic areas namely: screening for infections, re-screening for infections, the interval of re-screening, vaccines recommended, ideal time of vaccination, and required vaccine doses. The practice of HCWs was assessed in two thematic areas: recommendation/prescription of vaccines, and the timing of vaccination (before/after initiation of haemodialysis). The study tool contained closed-ended questions some of which were true/false responses while others required a single best choice or multiple choices out of the options provided. The questionnaire was administered by the principal investigator once informed consent was obtained from the healthcare professionals (consultants, fellows, internal medicine residents, renal nurses, and regular nurses).

Data on patients' vaccination status (Hepatitis B, Covid-19, Influenza & Pneumococcal) and basic sociodemographic variables such as patient's age, education level, and occupation were obtained using an interviewer-administered questionnaire, while additional demographic variables such as duration of ESKD, aetiology of ESKD, number of dialysis sessions per week, and comorbidity was extracted from the file. Permission to access the patient's files was sought from the KNH administration.

Data on patients' awareness, attitude and perceptions of vaccination was gathered using a total of 15 in-depth interviews conducted on different clinic days (three in-depth interviews per week) during the study period with each discussion done over 30 to 60 minutes. The topics of discussion were awareness of vaccine-preventable diseases in both children and adults, awareness of recommended vaccines, received vaccines and their experience, counselling for vaccination, the relevance of vaccination, reasons for/against vaccination, source of information, and willingness to accept all recommended vaccines. Data was collected by the principal investigator with the assistance of a qualified qualitative research assistant trained in in-depth interviews. The role of the research assistant was to record interviews and assist in data entry. This was a face-face interviews lasting about 60 minutes. The discussions were recorded using a tape recorder and then transcribed.

Piloting of data collection tools was done at the renal unit. Approximately 10 HCWs (2 fellows, 3 registrars and 5 nurses) in the renal unit were randomly sampled to participate in the pilot study. Consented participants were then administered the study questionnaire by the principal

investigator. Similarly, 20 patients were randomly sampled while attending dialysis clinic to assess vaccination status and only 10 were vaccinated against Covid-19 while none had received vaccines against other vaccine-preventable diseases.

3.11 Study Variables

Vaccination status: Defined as completion of the basic series of any of the recommended vaccines. (Hepatitis B, Influenza, Pneumococcal, and Covid-19 vaccine). It was calculated as a proportion of patients who received each specific vaccine.

Knowledge: Defined as awareness of vaccinations as an integral part of ESKD management. Knowledge of healthcare workers was assessed on 7 questions with a maximum score of 13. The correct answer was scored one while the incorrect answers or unanswered questions were scored zero. An average score for each HCW cadre was calculated by the sum total of group percentage scores divided by total scores multiplied by 100. A calculated score of $\geq 50\%$ was used to categorize knowledge as adequate while a score of less than 50% was deemed inadequate (68).

Practice: Defined as the provision or habitual recommendation of vaccines for ESKD patients (68). Practice for healthcare workers was assessed on 2 different domains—the provision/recommendation of vaccines to ESRD patients and timing of vaccination (before/after initiation of haemodialysis). Each domain was reported separately and analysed by use of frequencies and percentages.

Patients Awareness level: Knowledge of vaccination as an integral part of CKD management

Patients attitude: thoughts, feelings and behaviours toward vaccination.

Patients Perspectives: point of view, socio-cultural and religious beliefs on vaccinations.

The following baseline characteristics of patients were obtained using a study proforma; age, sex, education level, occupation level, aetiology of ESKD, duration of ESKD, and the number of dialysis sessions per week.

Similarly, the following HCW baseline characteristics were also collected; age, sex, profession (consultants, fellows, registrar, dialysis nurse and regular nurse) and duration of practice.

3.12 Data Analysis and Management

All completed questionnaires were assessed for completeness and consistency and data entered into a password-protected Microsoft Excel® worksheet. The worksheet was then imported into SPSS version 25 for analysis. Sociodemographic variables for study participants were analysed and presented as frequencies and percentages.

For objective one, data on the proportions of vaccinated patients was calculated as a proportion of patients who received each specific vaccine divided by the total number of patients and analysed by use of frequencies and percentages. For objective two, data on HCW knowledge and practice was equally analysed by use of frequencies and percentages. For objective three, data on patients' awareness, attitudes and perspectives were analysed according to emerging themes.

Audio recordings from in-depth interviews were transcribed verbatim and translated as needed. Transcripts were uploaded to Dedoose for coding, data organisation, and retrieval. An initial codebook was developed by two coders based on a subset of transcripts. The codebook was revised through an iterative process until a final codebook was agreed upon. Data were coded, and themes were derived using thematic analysis. We sought the assistance of an experienced qualitative researcher in analysing qualitative data.

Results of the quantitative arm were presented in tables and graphs while results for the qualitative arm were presented based on key themes deduced from IDI.

3.13 Quality Assurance

The research assistants were trained on the tool to be used in this study through role play and simulations. They were taught how to approach study participants, how to take informed consent, how to administer the questionnaire, and how to store data to maintain confidentiality throughout the data collection process.

3.14 Ethical Considerations

Approval to conduct this study was sought from the department of clinical medicine and therapeutics, the University of Nairobi and the KNH/UON Ethics Committee. Thereafter, permission was sought from the head of renal ward and renal unit to undertake the study in the respective departments. Permission to access the files of patients and to interview patients was sought from the KNH administration. Written and informed consent was obtained from every participant before administering the questionnaire. Participation in the study was voluntary. The anonymity of study participants was observed at all times. The collected data remains confidential.

CHAPTER FOUR: RESULTS

4.1 Respondents' Characteristics

The study was carried out between 24th October to 30th December 2022 at KNH Renal Unit. Data collection was done at the KNH Haemodialysis clinic running once weekly (Monday). Approximately 20 patients were seen at the Haemodialysis clinic on every visit. Eighteen (18) patients were recruited on every visit until the desired sample size of 146 was reached.

A total of 146 patients were recruited for the study. Of these 74 (50.7%) were female. A majority of the patients 110 (75.3%) were less than 64 years of age. Sixty-one (61) participants (41.8%) had attained a secondary level of education while only 37 (25.3%) had attained a tertiary level of education.

On occupation, the majority of the patients were dependents 65 (44.5%) with a minority (23%) being skilled, (16.4% were professionals while 6.8% were retired professionals). The most common cause of ESKD was diabetes (42.5%) followed by hypertension at 30.1%. All patients were undergoing two (2) sessions of dialysis per week.

Table 1. Patient characteristics

Characteristic	Frequency, (n=146)	Per cent
Age		
<45	58	39.7
45- 64	52	35.6
≥65	36	24.7
Sex		
Male	72	49.3
Female	74	50.7
Education level		
None	4	2.7
Primary	44	30.1
Secondary	61	41.8
Tertiary	37	25.3
Occupation		
Skilled, (n=34, 23.3%)		
Professionals	24	16.4
Retired persons	10	6.8
Unskilled, (n=36, 24.7%)		

Artisans	3	2.1
Farmers	14	9.6%
Self-employed	19	13.0
Others, (n=76, 52.1%)		
Dependents	65	44.5
Students	11	7.5
Duration of ESKD		
<1 year	77	52.7
>1 year	69	47.3
Number of dialysis sessions per week		
2 sessions	146	100.0
Aetiology of ESKD		
DM	62	42.5
HTN	44	30.1
Chronic Glomerulonephritis	27	18.5
Obstructive Uropathy	9	6.2
SLE	1	0.7
HIV/AIDS	3	2.1

4.2 Patient Vaccination Status

Out of the 146 patients, only 78 (53.4%) had received one or more of the recommended vaccines while 68 (46.6%) had not received any of the vaccinations. Sixty-six 66 (45.2%) patients received covid-19 vaccines while only 1 (0.7%) patient had received all four recommended vaccines.

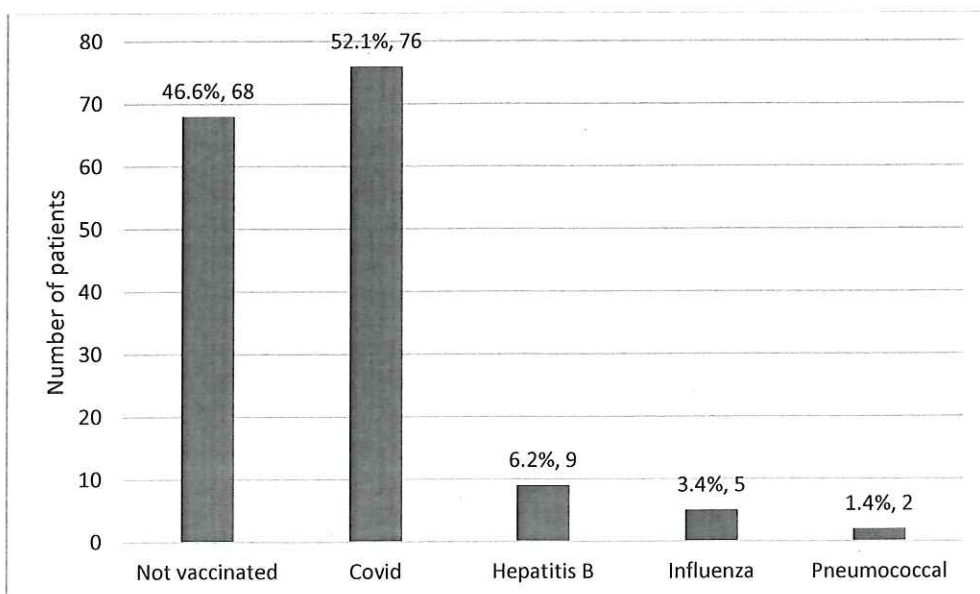


Figure 3. Bar chart representation of patients' vaccination status

Table 2. Patients' vaccination status

Vaccines received	Frequency, (n=146)	Per cent
Not vaccinated	68	46.6
Influenza only	1	0.7
Pneumococcal only	1	0.7
Covid-19 only	66	45.2
Influenza/Covid-19	1	0.7
Hep B/Influenza/Covid-19	2	1.4
Hep B/Covid-19	6	4.1
Hep B/Pneumococcal/Influenza/Covid-19	1	0.7

4.3 Healthcare Workers' Characteristics

One hundred and forty-one (141) questionnaires were issued to the various groups of healthcare workers in their respective wards. One hundred and twenty-one (121) respondents returned the questionnaire giving a response rate of 85.8%. A majority of the responders 62 (51.2%) were registrars. Of these, 70 (57.9%) were female with a mean age of 35.2 (SD 6.9). The minimum age for HCW was 21.0 years while the maximum age was 58.0 years old.

They comprised of five (4.1%) consultants, 8 (6.6%) fellows, 62 (51.2%) registrars, 34 (9.9%) renal nurses, and 12 (28.1%) regular nurses. The majority of the HCWs 65 (53.7%) had experience of between 5 and 10 years.

Table 3. Healthcare worker's characteristics

Characteristic	Frequency (n=121)	Per cent
Age		
≤30	30	24.8
31–40	69	57.0
>40	22	18.2
Sex		
Male	51	42.1
Female	70	57.9
Profession		
Consultant	5	4.1
Nephrology fellow	8	6.6
Registrar	62	51.2
Regular Nurse	12	9.9
Renal Nurse	34	28.1
Years of practice		
<5	33	27.3
5–10	65	53.7
>10	23	19.0

4.4 Healthcare Workers Knowledge

The average group performance scores for different HCWs (consultants, fellows, registrars, renal nurses and regular nurses) are 98.3%, 96.9%, 81.9%, 65.2% and 71.5% respectively. Almost all HCWs cadres were aware that patients with ESKD should be screened for Hepatitis B, Hepatitis C, and HIV before commencing haemodialysis.

Knowledge of rescreening for infections was excellent among all HCW groups but only 4 (80.0%) consultants, 6 (75.0%) fellows, 32 (51.6%) registrars, 22 (64.7%) renal nurses and 8 (66.7%) general nurses were aware of timely interval for rescreening of infections. Awareness of vaccination against hepatitis B, influenza, and pneumococcal was equally good among majority of HCW groups. Similarly, awareness of correct vaccine doses was above average for most of HCWs. Knowledge of the three-dose HBV vaccine regimen was higher compared to the four-dose regimen.

All 5 consultants and 8 nephrology fellows together with 36 (58.1%) registrars, 22 (64.7%) renal nurses and 10 (83.3%) were aware that counselling on vaccination should begin instantly once the diagnosis of ESKD is made. 5 registrars (8.1) and 1 (2.9%) renal nurse admitted that they didn't know when to commence counselling whereas 9 (14.5%) registrars and 3 (8.8%) renal nurses felt it should only commence once haemodialysis becomes inevitable.

Table 4. Healthcare worker's knowledge

Awareness domain	Consultants (n=5)	Fellows (n=8)	Registrars (n=62)	Renal Nurses (n=34)	General Nurses (n=12)
	n (%)	n (%)	n (%)	n (%)	n (%)
Pre-dialysis screening of infections					
Hepatitis B virus	5 (100.0)	8 (100.0)	62 (100.0)	33 (97.1)	12 (100.0)
HIV	5 (100.0)	8 (100.0)	62 (100.0)	34 (100.0)	11 (91.7)
Hepatitis C	5 (100.0)	8 (100.0)	61 (98.4)	31 (91.2)	11 (91.7)
Re-screening for Infections	5 (100.0)	8 (100.0)	62 (100.0)	33 (97.1)	12 (100.0)
Interval of rescreening	4 (80.0)	6 (75.0)	32 (51.6)	22 (64.7)	8 (66.7)
Recommended vaccines for ESKD patients					
Hepatitis B virus	5 (100.0)	8 (100.0)	58 (93.5)	33 (97.1)	12 (100.0)
Pneumococcus	5 (100.0)	8 (100.0)	53 (85.5)	10 (29.4)	4 (33.3)
Influenza	5 (100.0)	8 (100.0)	52 (83.9)	10 (29.4)	6 (50.0)
Ideal time for counselling	5 (100.0)	8 (100.0)	36 (58.1)	22 (64.7)	10 (83.3)
Correct number of vaccine doses					
Hepatitis B	5 (100.0)	8 (100.0)	53 (85.5)	23 (67.6)	7 (58.3)
Pneumococcus	5 (100.0)	7 (87.5)	34 (54.8)	7 (20.0)	4 (33.3)
Influenza	5 (100.0)	8 (100.0)	44 (71.0)	8 (23.5)	6 (50.0)
Average score	98.3	96.9	81.9	65.2	71.5

4.5 Healthcare Workers' Practice

In practice domains, almost all HCWs recommend vaccines to their ESKD patients. The majority of HCWs recommended vaccinations before the start of haemodialysis while only a minority (7 (11.3%) registrars, 8 (23.5%) renal nurses, and 4 (33.3%) regular nurses) recommended them after the start of haemodialysis.

Table 5. Healthcare workers practice on vaccination of ESKD patients on haemodialysis

Practice domain	Consultants (n=5)	Fellows (n=8)	Registrars (n=62)	Renal Nurses (n=34)	General Nurses (n=12)
	n (%)	n (%)	n (%)	n (%)	n (%)
Recommend/Prescribe vaccines (yes)	5 (100.0)	8 (100.0)	50 (80.6)	33 (97.1)	12 (100.0)
Timing of vaccine recommendation (before/after initiation of dialysis)	5 (100.0)	8 (100.0)	43 (69.4)	25 (73.5)	8 (66.7)

4.6 Patients Awareness, Attitude and Perspectives on Vaccination

We conducted 15 in-depth interviews among patients with end-stage kidney disease receiving care at Kenyatta National Hospital renal unit. Of those interviewed, eight were male, hypertensive, and diabetic kidney disease were the most common etiologies of ESKD. Our findings pointed to three main themes; knowledge of vaccination among patients with ESKD, the number who received either or both counselling and vaccinations, and participants' attitude and perspectives towards receiving information on vaccination and potentially getting vaccinated.

1. Some participants understand the concept of prevention by vaccination while others do not

Participants were aware of the concept of vaccination & its significance, and could even mention some of the vaccines they had received or heard about.

“Yes, COVID (vaccine). I even got it ... vaccine against cholera.” (Participant 2)

Others were unaware of vaccine-preventable diseases both in children and adults.

“Interviewer: Is there any other vaccination that you know that can prevent diseases in either adults or children? Respondent: I don't know.” (Participant 8)

A few participants had been informed by healthcare workers about the Hepatitis B vaccination, but they had not taken the time to follow up and get the vaccine.

“Respondent ... at the outpatient clinic they were talking about hepatitis, they are two? I and II. Interviewer: What did they say about it? Respondent: They said it is better if someone gets time, they are charging. If someone gets time, it will be good if someone gets the vaccination.” (Participant 6).

2. Participant’s lack of information on vaccination, a major barrier to vaccination uptake

Among the 15 participants interviewed, few had received information on the need to get a vaccination. Some participants had even suffered from pneumonia several times but had never been talked to about the pneumococcal or influenza vaccine.

“I have never been told about vaccination while receiving care here ... but I know vaccines are important in preventing disease” (Participant 9)

“I had pneumonia last year and I was treated, and I got healed, so I don't know whether I was vaccinated.” (Participant 7).

Furthermore, some participants acknowledged that they needed information on vaccination. They emphasized that while they know vaccines are important, it is good to be explained to benefits in a way that they can understand.

“They (vaccines) are relevant because if I can get someone to explain to me, with us humans when another person tells you the importance of something you might take time to understand but once you understand it is okay ... as in if you understand the benefit of the vaccine, the way you have explained to me.” (Participant 12).

3. Majority of the patients had only been informed about and received COVID vaccine

Among the patients interviewed, a minority had received information on the need to get the COVID vaccine both from HCWs and the media.

I was told by Dr. B, that I should get the covid vaccine though I still haven’t gone for it because of the things that people talk about such as side effects. (Participant 1).

"I heard about it on the radio in 2020 when COVID-19 killed many people in China and America. They later said that there is a vaccination that has been discovered in China and they were to finish there then it is brought to Kenya. When they came to Kenya, I did not dispute even though I was weak, but I was vaccinated." (Participant 5).

And even those who had not received it out of fear or other reasons were aware of its availability.

"People were fearful of the vaccine (COVID). I heard people would fall sick, tremble." (Participant 3).

"The nurses usually tell us to get COVID vaccination, but I haven't taken that step since I haven't found an appropriate time." (Participant 13).

4. Patients were positive about receiving information about vaccination and potentially receiving vaccines

It was evident that participants had not received adequate information on the benefits of vaccination among patients with CKD. They were open to receiving more information from their healthcare providers on vaccination.

"Well, you have to educate the people first of all so that they can understand what it (vaccination) is first because most of the people don't know what it is ... they have no knowledge about that. ... and sometimes, most of the people have no time for listening or perhaps they are ignorant or whatever but you as medics should not get tired of that, you should keep on talking about that and they will come to understand" (Participant 4).

"Interviewer: would you be willing to get another vaccine such as Hepatitis B, Pneumococcal, Influenza? Respondent: If I am well educated as they did with the COVID vaccine, I will agree to it." (Participant 1).

5. Affordability and access to vaccines is important for uptake among ESKD patients

Participants were keen to point out that the vaccines should be affordable since the treatment was already costly and often, they were dependent on other people's goodwill to travel as well as access

care. Another important aspect was that the vaccines should be made accessible as part of the services they are currently receiving.

“Interviewer: would you be willing to take some of these vaccinations? Respondent: If they are available and not very costly like now this disease has led us to be beggars. To say the truth, since 2019 I have not worked anywhere, what do you think I am eating, how have I been travelling to come here? It makes you a beggar all the time because you use your resources and then you remain as if you are a beggar.” (Participant 4).

“Vaccination is relevant but should mainly be given within the renal unit because if someone is told to get it away from here, they may feel that it’s not that useful. Just make it part of the treatment” (Participant 11).

“If they are available, I can accept to get them (vaccines) my only challenge is that it is difficult to find time; I come from far and by the time I get here, I am very tired and when I go back home, I am very weak and I need to rest for about two days.” (Participant 13).

6. Participants had positive experience with vaccination and were willing to recommend to other patients with ESKD.

Having had a positive experience with the COVID vaccination, the participants noted that they would recommend it to others suffering from chronic kidney disease.

“Interviewer: What about those suffering from chronic diseases as you are, can you advise them to get vaccinated? Respondent: Yes, because I also got vaccinated (COVID vaccine) but it did not affect me.” (Participant 10).

7. Vaccine side effects another barrier to vaccine uptake

However, some, perceive their poor health status as a barrier to vaccine uptake.

“So, my body became so weak, and I don't feel strong, so I fear the vaccination because I know it has side effects. My sister was vaccinated, and it was so bad, she almost died.” (Participant 7).

CHAPTER FIVE: DISCUSSION

5.1 Discussion of Key Findings

We set out to document the practice of vaccination among ESKD patients on haemodialysis at the KNH renal unit. We went ahead and assessed three main domains: vaccination uptake among ESKD patients, healthcare workers' knowledge and practice on vaccination in ESKD patients, and patients' awareness, attitude and perspectives on vaccination.

Out of the 146 patients recruited into the study, both genders were well represented contrary to other studies showing a higher male preponderance (7,52). This could be explained by higher health-seeking behaviour noted among the female gender. A good number of the patients were literate with only a quarter of them having attained a tertiary level of education and a sixth were professionals. Moreover, majority of them were dependent (unemployed). This could be explained by the poor quality of life faced by the ESKD patients on haemodialysis which is unmeasured in majority of the cases. This is contrary to the Nigerian study where half of the patients had white-collar jobs and only a few were dependants (7).

The most common cause of ESKD in our patients was diabetes followed by hypertension with chronic glomerulonephritis contributing only 18%. This is also supported by various studies depicting diabetes as a common cause of ESKD (7,20,25,69). Moreover, all patients underwent 2 sessions of haemodialysis in a week, although not ideal could be attributed to the high cost of dialysis. Contrary to this, only a third of patients in the Nigerian study had 2 sessions of dialysis per week while the majority had 3 sessions of dialysis per week (7).

On vaccination status, only 78 (53.4%) patients had received one or more of the vaccines while 68 (46.6%) had not received any of the recommended vaccines. Low vaccine uptake was mainly attributed to lack of information/recommendation, side effects, high cost of vaccines and vaccine inaccessibility. This is in agreement with other studies showing low vaccination uptake among ESKD patients and other high-risk groups of patients such as diabetes, HIV, COPD and solid organ transplant patients with the main reasons for reduced uptake of vaccines being unawareness of recommendation, side effects and high costs of vaccines (7,8,52,64). The low vaccination rate for hepatitis B is quite striking considering its relatively high prevalence generally in sub-Saharan

Africa and even in Kenya (30,70). Furthermore, a high prevalence of viral hepatitis seroconversion was noted among ESKD patients on haemodialysis (71). The majority of the patients (52.1%) were vaccinated against covid-19 compared to other VPD diseases. The increased uptake of covid-19 vaccines was mainly attributed to increased awareness, fear of infection, the vaccine was readily accessible and free of charge. Similar studies have also shown that increased acceptance of covid-19 vaccine was mainly attributed to increased awareness from healthcare workers and the media. Another primary motivator for covid-19 vaccine acceptance was fear of infection (72,73).

The awareness level of HCW was adequate on most aspects of vaccination. High performance scores was noted among consultants and nephrology fellows. There were notable knowledge gaps among all the HCW groups in the basic areas of the interval of rescreening, vaccination against other VPDs other than HBV, and the vaccine dosage other than hepatitis B vaccine. This could be due to the complex nature of CKD management where most HCWs concentrate on the more striking aspects of CKD management such as anaemia, uraemia and cardiovascular complications at the expense of equally important aspects of immunization. Similarly, Other studies evaluating HBV knowledge and vaccination practices showed only doctors had a good understanding of HBV while Abiola et al showed fair knowledge but poor practice among nurses and doctors (54,74).

The participants had an excellent understanding of pre-dialysis screening for HIV, HBV and HCV. This is to be expected as HCWs are quite familiar with HIV, HBV and HCV screening before blood donation and transfusion as well as before surgical procedures. Similarly, HCWs were well appraised with re-screening and interval of re-screening of the above infections which is paramount since haemodialysis patients have been shown to seroconvert with significantly poor outcomes. Contrary to this, the Nigerian study showed poor performance in both re-screening and interval of re-screening for hepatitis B (14). This is worrying considering the high prevalence of hepatitis B in Nigeria, as well as haemodialysis patients, who are known to seroconvert with bad outcomes (75,76). Moreover, HCWs working in high-risk units such as HD units need to be vigilant and adhere to the rescreening protocol for HIV and HBV/HCV which by doing so will lead to early detection and isolation of “infection-free” patients hence protecting fellow patients and medical staff from the risk of HBV/HCV acquisition.

All participants were aware that haemodialysis patients should be vaccinated against hepatitis B. Majority were aware of the 3 dose regimen compared to the relatively newer four-dose regimen. This reflects the lack of knowledge updates on vaccination protocols. One undeniable outcome of this study is that the majority HCWs were aware counselling for vaccination should be done at first diagnosis of CKD. This is crucial because KDIGO 2012 recommendation indicates better seroconversion rates when vaccination is done in the early stages of CKD (1).

In terms of practice, the majority of HCWs reported prescribing/recommending vaccines to their patients and more so before initiation of dialysis. This is in line with KDIGO recommendations indicating better seroconversion rates if vaccination is commenced in the earlier stages of CKD before initiation of dialysis (1).

On patients' awareness of vaccination, participants had varied knowledge of the concept of prevention by vaccination. Some were aware of the idea of vaccination and could even mention some of the vaccines they received like the Covid-19 and the cholera vaccines while others were unaware of the vaccine-preventable diseases in both children and adults. For the ones who were aware of the concept of vaccination, the majority confirmed to have received information only on covid-19 vaccine both from healthcare workers and the media and were even vaccinated against covid-19. While for the non-vaccinated participants, lack of information was the main reason cited by patients for the reduced uptake of vaccines. Some even affirmed to have suffered pneumonia several times and were never informed of the need to take pneumococcal or influenza vaccine. Apart from the lack of information, other reasons cited by patients were vaccine side effects, vaccine-associated costs and inaccessibility for their inability to receive vaccines. A comparable study in Naples, Italy evaluating knowledge, attitudes and vaccine uptake among adults with chronic conditions illustrated that a high percentage of the respondents had a good understanding of vaccines as a means of protection against serious infectious diseases. Moreover, more than half of the participants knew influenza can be prevented by a vaccine. Similarly, for non-vaccinated, the main reasons postulated were fear of side effects followed by lack of recommendations from physicians (77). This is alarming as poor knowledge of immunization among healthcare professionals resulted in missed immunization opportunities in children (78).

Nevertheless, all HCWs should strive to raise awareness about the risks of developing severe VPDs among individuals with underlying chronic conditions and hence increasing vaccination uptake. An endorsement from a trusted healthcare professional would likely result in greater adherence to vaccination.

On patients' attitudes towards vaccination, participants were positive about receiving information about vaccination and potentially getting vaccinated if they were well educated as they did with the covid-19 vaccine. Some even proclaimed to recommend it to other patients suffering from chronic diseases since they had a good experience with the covid-19 vaccine. This is key as a positive attitude will improve vaccine receipt. Moreover, this result is very important because it brings out the need to improve policy interventions to improve adherence to vaccination among these high-risk individuals. Bertoldo et al demonstrated a favourable attitude towards the usefulness of the influenza vaccine among adults with chronic diseases in Nepal and Italy. Other studies in the US, Italy and France have shown a positive attitude towards the use of influenza vaccination was significantly associated with vaccine uptake (79–81).

From patients' perspectives towards vaccination, participants believed that the vaccines are relevant and are willing to receive them if they are available and not very costly. Some even suggested that the vaccine should be available within the renal unit and be made part of the treatment to make it more accessible since some of the patients come from far to access dialysis. This is a positive pointer towards efforts to sensitize the patients towards vaccination as a prevention strategy for VPDs among ESKD on haemodialysis.

5.2 Strengths of the Study

This is the first study at KNH assessing the practice of vaccination among ESKD patients on haemodialysis. The study has highlighted deficiencies in the management of ESKD patients on haemodialysis both in terms of knowledge and practice most of which can be systematically addressed. KNH is a learning institution and most of the participants are available for updates on recommended guideline management of vaccination among ESKD patients on haemodialysis.

5.3 Limitations of the Study

Some healthcare professionals may have answered the questions with information bias.

Information on patients' vaccination status was limited by recall bias.

5.4 Conclusion

The vaccination uptake low, this is mainly attributed to a lack of sensitization and awareness among ESKD patients on haemodialysis. There was variable performance across most aspects of vaccination among HCWs caring for ESKD patients on haemodialysis where consultants and fellows performed better than other HCW cadres. The majority of the patients were sensitized and vaccinated against covid-19 compared to other VPDs. We concluded that the practice of vaccination among ESKD patients on haemodialysis was poor likely due to a lack of awareness.

5.5 Results dissemination plan

The results, conclusion, and recommendations of this study will be forwarded to the head of the renal unit shortly after the final dissertation is presented to the department of clinical medicine and therapeutics. Similarly, the results from this study will also be published in a peer-reviewed journal and presented at professional conferences soon after.

5.6 Recommendations

We recommend that:

1. Active immunization protocol be developed and institutionalized.
2. Organize regular education programme among HCWs caring for ESKD patients on HD on aspects of vaccination and guideline directed management.
3. Incorporate vaccine education in frequent education sessions with patients on HD.
4. Subsidize costs of vaccines and laboratory tests for monitoring antibody titres with the aim of increasing patient's compliance to vaccination.
5. Schedule regular audits with clear performance indicators as this will improve adherence to stipulated guidelines.

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APPENDICES

Appendix I: Study Questionnaire for Healthcare Workers

Questionnaire on the awareness and practice of Healthcare Workers on Immunization of Chronic Kidney Disease Patients at Kenyatta National Hospital.

Dear Sir/Madam,

Please be kind enough to fill out this questionnaire that will enable us to collect data on the knowledge and practice of healthcare on immunization of chronic kidney patients against important infections. We hope this study will improve the practice of nephrology at KNH and in Kenya at large.

Thank you.

SECTION A: SOCIO-DEMOGRAPHIC PROFILE

1. Sex:
 - A. Male
 - B. Female
2. Age in years: _____
3. Profession:
 - A. Registrar
 - B. Renal Nurse
 - C. Regular Nurse
 - D. Consultant
 - E. Nephrology Fellow
4. Years of practice: _____ year

SECTION B: KNOWLEDGE OF HCW.

5. Should ESKD patients be screened for infections before commencing haemodialysis?
 - A. Yes
 - B. No
6. If yes which ones?
 - A. Hepatitis B virus
 - B. HIV
 - C. Hepatitis C
7. Should ESKD patients on haemodialysis be re-screened for HBV, HIV and HCV?
 - A. Yes
 - B. No

8. If yes, how long after commencing haemodialysis?
- A. 3 months
 - B. 6 months
 - C. Others, please specify
9. ESKD patients on haemodialysis should be vaccinated against?
- A. Hepatitis B
 - B. Pneumococcus
 - C. Influenza
10. When is the best time to counsel ESKD patients on haemodialysis for vaccination?
- A. When haemodialysis becomes inevitable
 - B. As soon as a diagnosis of CKD is made
 - C. When a patient reaches the end-stage of kidney disease
 - D. Just before the start of the first haemodialysis session
 - E. I don't know
11. How many doses of vaccines does an ESKD patient on haemodialysis need for complete immunization against the following infection?
- A. Hepatitis B 1 / 2 / 3 / 4 / 5
 - B. Pneumococcus 1 / 2 / 3 / 4 / 5
 - C. Influenza 1 / 2 / 3 / 4 / 5

SECTION C: PRACTICE OF HCW

12. Do you recommend/prescribe vaccines to your ESKD patients on haemodialysis?
- A. Yes
 - B. No
13. If yes when?
- A. Before the start of haemodialysis
 - B. After the start of haemodialysis

Appendix II: Patients Data Collection Form

Patients number	Frequency	Percentage
Age a) <45 b) 45-64 c) >65		
Sex a) M b) F		
Education Level a) None b) Primary c) Secondary d) Tertiary		
Occupation a) Skilled (professionals, retired persons) b) Unskilled (farmers, traders, artisans self-employed) c) Others (clergy, students, dependents)		
Duration of ESKD a) <1 year b) >1 year		
Number of Dialysis sessions per week a) 1 b) 2 c) 3		
Aetiology of ESKD a) Chronic Glomerulonephritis b) Diabetic Kidney Disease c) Hypertensive Kidney Disease d) Obstructive Uropathy e) HIVAN f) SLE g) ADPKD h) Others		
Vaccination Status a) Hepatitis B b) Pneumococcal c) Influenza d) Covid-19		

Appendix III: IDI Guide

Hi, my name is Dr. Siraja Ibrahim Issack. Thank you for agreeing to talk to me today. As mentioned earlier, am interested in understanding your thoughts, experiences, and opinions about vaccinations among patients with chronic kidney disease. I will ask you questions that you are free to answer in any way you wish. Feel free to elaborate on any of your points. If a question is unclear to you, please feel free to ask me to explain it to you. This IDI will take no more than 60 minutes and I will be taking notes on what we are discussing. I would like to audio record the interview, so I do not miss anything that you say. I will not include your names in any documents or the recording. Your answers will be kept confidential.

Before we start, I would like to remind you that there are no wrong answers in this discussion. We are interested in knowing what you know, think, and feel so please feel free, to be honest, and share your point of view. It is very important that we hear your opinion. You do not have to answer all the questions. If you want to stop the interview at any time, just tell me and we can stop.

1. How long have you been receiving care at KNH renal clinic?
2. Which diseases can be prevented by vaccination?
 - a) In children
 - b) In adults
3. Since your diagnosis of CKD, have you received any vaccines?
4. If so, which ones? What was your experience? What could be improved? Would you recommend it to other patients?
5. If not, Why? Has a healthcare provider talked to you about vaccination? What did the healthcare provider discuss with you?
6. Have you heard about covid-19 vaccination for patients with CKD? Where did you get the information? Probes: Healthcare provider, internet, another source.
7. What information did you receive? Potential side effects? Benefits?
8. Do you think vaccination is relevant to you and other patients diagnosed with CKD?
Would you be willing to accept the following vaccines (Hepatitis B, Pneumococcal, Influenza, Covid-19) if made available? If not, why?

Appendix IV: Consent Form

Study background: Chronic kidney disease is a chronic disease with many complications including infections. To reduce the risk of infections, CKD patients are recommended to be vaccinated. To understand vaccination practices, we would like to assess healthcare workers' related determinants, patient-related determinants, and structural-related factors that influence vaccine uptake.

Broad objective: To assess the extent and determinants of vaccine uptake among chronic kidney disease patients at KNH.

Study procedure: if you choose to participate in the study, you will be assigned a random number that will be used throughout the study to screen your identity. The responses from your questionnaire will only be available to authorized persons and the results will only be used for statistical data analysis.

Benefits: The results of the study will help in improving nephrology practices at Kenyatta National Hospital

Confidentiality: We bind to keep your data private and no particulars about you will appear on the results.

Risk of participation: There are no anticipated risks to you for participating in the study.

Voluntariness of participation: your participation in this study is purely voluntary. You will not be coerced to participate in this study. you will not receive any payment to participate in this study.

I, the participant has been explained to and have understood, and willingly accept to participate in the study.

Signature _____ Date _____

I, the researcher having explained the motive of this study hereby commit that the secrecy of the information collected will be maintained.

If you have any questions about your participation in the study please call Dr. Siraja Ibrahim tel 0712945757, the principal investigator.

Researcher: Dr. Siraja Ibrahim Issack

Email: sirajasiman09@gmail.com

Tel: 0712945757

Signature _____ Date _____

Lead supervisor: Prof McLigeyo Seth O

Email: mcligeyo@uonbi.ac.ke

Tel: +254 (0) 722 525 722

If you have a question about your rights as a study volunteer please contact Dr. Beatrice Amugune, Tel 020 726300-9, EXT 44355, the secretary to the KNH/UON-ERC.

Secretary, KNH-UON ERC

P.O Box 20723-00202

KNH, Nairobi,

Tel: 020 726300-9, EXT 44355

Email: uonknh_erc@uonbi.ac.ke

Appendix V: Fomu ya Idhini

Usuli wa masomo: Ugonjwa wa figo sugu ni ugonjwa sugu wenye matatizo mengi yakiwemo maambukizi. Ili kupunguza hatari ya kuambukizwa, wagonjwa wa CKD wanapendekezwa kupewa chanjo. Ili kuelewa mazoea ya chanjo tungependa kutathmini viambuzi vinavyohusiana vya wafanyikazi wa afya, viambishi vinavyohusiana na mgonjwa na vipengele vya kimuundo vinavyoathiri uchukuaji wa chanjo.

Lengo pana: Kutathmini viashiria vya uchukuaji wa chanjo miongoni mwa wagonjwa sugu wa ugonjwa wa figo katika KNH.

Utaratibu wa kusoma: ukichagua kushiriki katika utafiti, utapewa nambari ya nasibu ambayo itatumika katika kipindi chote cha utafiti kuchunguza utambulisho wako. Majibu kutoka kwa dodoso yako yatapatikana kwa watu walioidhinishwa pekee na matokeo yatumika tu kwa uchanganuzi wa data ya takwimu.

Manufaa: Matokeo ya utafiti yatasaidia katika kuboresha mbinu za nephrology katika Hospitali ya Kitaifa ya Kenyatta.

Usiri: Tunalazimika kuweka data yako kuwa ya faragha na hakuna maelezo kuhusu wewe yataonekana kwenye matokeo.

Hatari ya ushiriki: Hakuna hatari zinazotarajiwa kwako kwa kushiriki katika utafiti.

Kujitolea kwa ushiriki: ushiriki wako katika utafiti huu ni wa hiari tu. Hutilazimishwa kushiriki katika utafiti huu. hutapokea malipo yoyote ili kushiriki katika utafiti huu.

Mimi, mshiriki nimeelezwa na nimeelewa, na nimekubali kwa hiari kushiriki katika utafiti.

Sahihi _____ Tarehe _____

Mimi, mtafiti baada ya kueleza nia ya utafiti huu naahidi kwamba usiri wa taarifa zilizokusanywa utadumishwa.

Kama una swali lolote kuhusu ushiriki wako katika utafiti huu tafadhali pigia simu Dr. Siraja Ibrahim tel 0712945757, mtafiti mkuu.

Mtafiti: Dr. Siraja Ibrahim Issack

Barua pepe: sirajasiman09@gmail.com

Simu: 0712945757

Sahihi _____ Tarehe _____

Msimamizi kiongozi: Prof McLigeyo Seth O

Barua pepe: mcligeyo@uonbi.ac.ke

Simu: 0722525722

Ijapo una swali kuhusu haki zako kama mshiriki katika utafiti huu tafadhali pigia simu Dr. Beatrice Amugune tel 020 726300-9, EXT 44355, katibu KNH/UON/ERC.

Katibu, KNH-UON ERC

P.O Box 20723-00202

KNH, Nairobi,

Simu;020 726300-9, EXT 44355

Barua pepe: uonknh_erc@uonbi.ac.ke

Appendix VI: Results – Dummy Tables

Percentage of correct responses.

Awareness Domains	Consultants %	Fellows %	Registrar %	Renal Nurse %	General Nurses %
Pre-dialysis screening of infections					
Re-screening for Infections					
Interval of rescreening					
Recommended vaccines for ESKD patients					
Ideal time for counselling					
Correct number of vaccine doses					
Average score					

Appendix VII: Mwongozo wa IDI

Hamjambo, jina langu ni Dk. Siraja Ibrahim Issack. Asante kwa kukubali kuzungumza nami leo. Kama tulivyosema hapo awali, nina nia ya kuelewa mawazo yako, uzoefu, na maoni yako juu ya chanjo kati ya wagonjwa wenye ugonjwa sugu wa figo. Nitakuuliza maswali kuwa uko huru kujibu kwa njia yoyote unayotaka. Jisikie huru kufafanua juu ya maoni yako yoyote. Ikiwa swali halieleweki, tafadhali jisikie huru kuniuliza nikueleze. Idi hii haitachukua zaidi ya dakika 60 na nitafanya.

Kabla ya kuanza, ningependa kukukumbusha kuwa hakuna majibu mabaya katika majadiliano haya. Tunavutiwa kujua kile unachojua, fikiria, na jisikie kwa hivyo tafadhali jisikie huru, kuwa waaminifu, na kushiriki maoni yako. Ni muhimu sana kusikia maoni yako. Sio lazima kujibu maswali yote. Ikiwa unataka kuacha mahojiano wakati wowote, niambie tu na tunaweza kuacha.

1. Je! Umekuwa ukipokea huduma kwa muda gani katika Kliniki ya Renal ya KNH?
2. Ni magonjwa gani yanayoweza kuzuiwa na chanjo?
 - A) kwa Watoto
 - B) kwa watu wazima
3. Tangu utambuzi wako wa CKD, umepokea chanjo yoyote?
4. Ikiwa ni hivyo, zipi? Uzoefu wako ulikuwa nini? Ni nini kinachoweza kuboreshwa? Je! Ungependekeza kwa wagonjwa wengine?
5. Ikiwa sivyo, kwa nini? Je! Mtoaji wa huduma ya afya amezungumza nawe juu ya chanjo? Je! Mtoaji wa huduma ya afya alijadili nini na wewe?
6. Je! Umesikia juu ya chanjo ya Covid-19 kwa wagonjwa walio na CKD? Ulipata wapi habari hiyo? Inachunguza mtoaji wa huduma ya afya, mtandao, chanzo kingine.
7. Ulipokea habari gani? Athari mbaya? Faida?
8. Je! Unafikiri chanjo ni muhimu kwako na wagonjwa wengine wanaopatikana na CKD?
9. Je! Ungekuwa tayari kukubali chanjo zifuatazo (hepatitis B, pneumococcal, mafua, covid-19) ikiwa inapatikana? Ikiwa sivyo, kwa nini?

DETERMINANTS OF VACCINATION UPTAKE AMONG PATIENTS WITH END-STAGE KIDNEY DISEASE ON HAEMODIALYSIS AT THE KENYATTA NATIONAL HOSPITAL

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LEAD SUPERVISOR AND CHAIRMAN OF DEPARTMENT APPROVAL

This dissertation has been submitted with the approval of my lead supervisor and chairman of the Department of Clinical Medicine and Therapeutics.

Lead Supervisor

Prof. Seth O Mcligeyo

Professor, Consultant Physician and Nephrologist, Department of Clinical Medicine and Therapeutics.

Signature..........Date.....6/11/23.....

Chairman of Department

Prof. E.O Amayo

Chairman of the Department of Clinical Medicine and Therapeutics

Professor, Consultant Physician and Neurologist, Department of Clinical Medicine and Therapeutics.

Signature..........Date.....23/10/2023.....

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
DEPARTMENT OF CLINICAL MEDICINE AND THERAPEUTICS
P.O. BOX 19676-00102 NAIROBI