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Compliance to Treatment Regimen among Hemodialysis Patients in Selected Private Tertiary Referral Hospitals in Kenya

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ABSTRACT

Purpose: This study aimed to evaluate the level of adherence to the hemodialysis treatment regimen including session attendance, medication use, fluid intake and dietary restrictions and to identify associated factors among End Stage Renal Disease Patients receiving maintenance hemodialysis in three selected facilities.

Methodology: A mixed-method study was conducted between April and June 2024, involving 129 adult patients and 7 key informants. Participants were grouped into site A (Thika, n=54) and site B (Nairobi and Kisumu, n=75). Data collection included a modified End-stage Renal Disease Adherence Questionnaire (ESRD-AQ), a self-administered questionnaire, and interviews using a Key Informant Interview Guide. Data were analyzed using SPSS version 27 and N-VIVO version 11. Univariate variables were analyzed using measures of central tendency and dispersion, while binary and multivariate logistic regression were used to assess associations between independent and dependent variables, with statistical significance set at <0.05.

Results: Adherence was low with 81.5% of patients at site A and 73.3% at site B demonstrating poor compliance. In site A, factors associated with compliance to HD were primary education (A.O.R=0.008, P=0.008), secondary education (A.O.R=0.040, P=0.028), and level of practice of HD treatment regimen (A.O.R=0.028, P=0.028). In site B, knowledge of HD treatment regimen (P=0.033) and practice of HD treatment regimen (P=0.038) were negatively linked to adherence.

Unique contribution to theory, practice and policy: The study concluded that adherence to HD regimen was suboptimal, driven by modifiable factors such as education level, income, knowledge, and behavioral practices. The findings highlight the need for a structured, innovative training program targeting determinants like knowledge and practice of HD treatment regimen to improve compliance thereby enhancing patient outcomes and informing clinical practice and policy.

Keywords: *End-Stage Renal Disease, Hemodialysis, Compliance*

JEL Codes: *I18, I12, I15*

1. INTRODUCTION

Chronic Kidney Disease (CKD) affects approximately 13.4% of the global population, with 7.08 million people requiring kidney replacement therapies such as HD (Cheng & Zhang, 2019). According to the World Health Organization (WHO), CKD is a growing global health concern, predicted to become the 5th leading cause of death by 2040 (Foreman *et al.*, 2018). Prevalence varies across regions, with high rates in South America (9%-35%), Asia (9.5%-18%), and Africa (10.1%-15.8%) (Ulasi *et al.*, 2023).

In South America, the incidence of CKD has doubled over the past decade and is expected to affect 10 million people by 2030. In Asia, 434.3 million adults have CKD, with 65.6 million suffering from End-Stage Renal Disease (ESRD). CKD prevalence is 7% in South Korea and 34.3% in Singapore. In Africa, Northern Africa, Western Africa, Eastern Africa, Central Africa and Southern Africa have a prevalence of 4%, 16.5%, 11%, 12.2% and 16% respectively (Ulasi *et al.*, 2023). In Kenya, over 10,000 CKD cases are diagnosed annually, with 4.8 million Kenyans expected to have CKD by 2030 (Sokwala, 2018).

HD is the most common treatment (Naalweh *et al.*, 2017), but poor adherence to the complex regimen covering dialysis sessions, medication, fluid, and diet is widespread (Beerapa & Chandrababu, 2019). Non-adherence to this treatment regimen significantly increases mortality risk, with around 50% of patients globally failing to comply (Duong *et al.*, 2015). Estimates show varying rates of non-adherence: 0–18% of patients miss dialysis sessions, 0–22.4% shorten their treatment, 3–80% miss medications, 9.8–75.3% do not follow fluid restrictions, and 2–81.4% do not adhere to dietary guidelines (Beerapa & Chandrababu, 2019).

Regional studies show that 50% & 49% of patients on maintenance HD in Zimbabwe and Rwanda respectively, were not adherent to HD (Chironda *et al.*, 2016; Mukakarangwa *et al.*, 2018). In Kenya, non-adherence to HD was found to be 52.6%, 11.1% & 46.6% among patients on maintenance HD in three hospitals (Choge, 2020; Kilonzo *et al.*, 2021; Chege *et al.*, 2022).

Though studies abound on non-adherence to HD in Kenya, there is a dearth of empirical literature in Avenue Hospitals. Thus, prompting this study to evaluate local adherence using the validated ESRD-AQ tool and establish the factors affecting adherence to HD among patients with ESRD at Avenue Hospitals, Thika, Nairobi and Kisumu.

2. MATERIALS AND METHODS

2.1 Study design and area

This study used a concurrent mixed-method approach, combining both qualitative and quantitative methods, conducted between April and June 2024 at renal units of Avenue Hospitals Thika, Nairobi, and Kisumu. The three hospitals are tertiary referrals hospital in Kiambu, Nairobi and Kisumu Counties. The units, are some of the largest in Kiambu, Nairobi and Kisumu Counties, and manage 167 dialysis patients, performing around 1200 sessions monthly. The units are staffed

by a nephrologist, trained renal nurses, and healthcare assistants. The ancillary services include a laboratory and out-patient pharmacy for patient support.

2.2 Study population

The study focused on ESRD patients on maintenance HD and employed a census approach. Included in the study were all adult outpatient CKD patients who had been on HD for at least three months, were literate, provided informed consent and were available during the study period along with seven key informants. Patients with acute kidney injury, critical illness, or cognitive disorders were excluded. Initially, 170 patients met eligibility criteria. However, after assessment, 54 patients in site A (Avenue hospital Thika) and 75 patients in site B (Avenue Hospitals in Kisumu and Nairobi) were included and analyzed for adherence to the HD treatment regimen and its associated factors. Based on the exclusion criteria, 14 patients were excluded from site A: 3 were illiterate, 3 were hospitalized during the study, 6 had been on dialysis for less than 3 months, and 2 missed their dialysis sessions. In site B, 27 patients were excluded: 4 were illiterate, 6 were admitted during the study period, 10 had been on HD for less than 3 months and 7 did not attend their dialysis sessions. This is summarized in the figure 1 below.

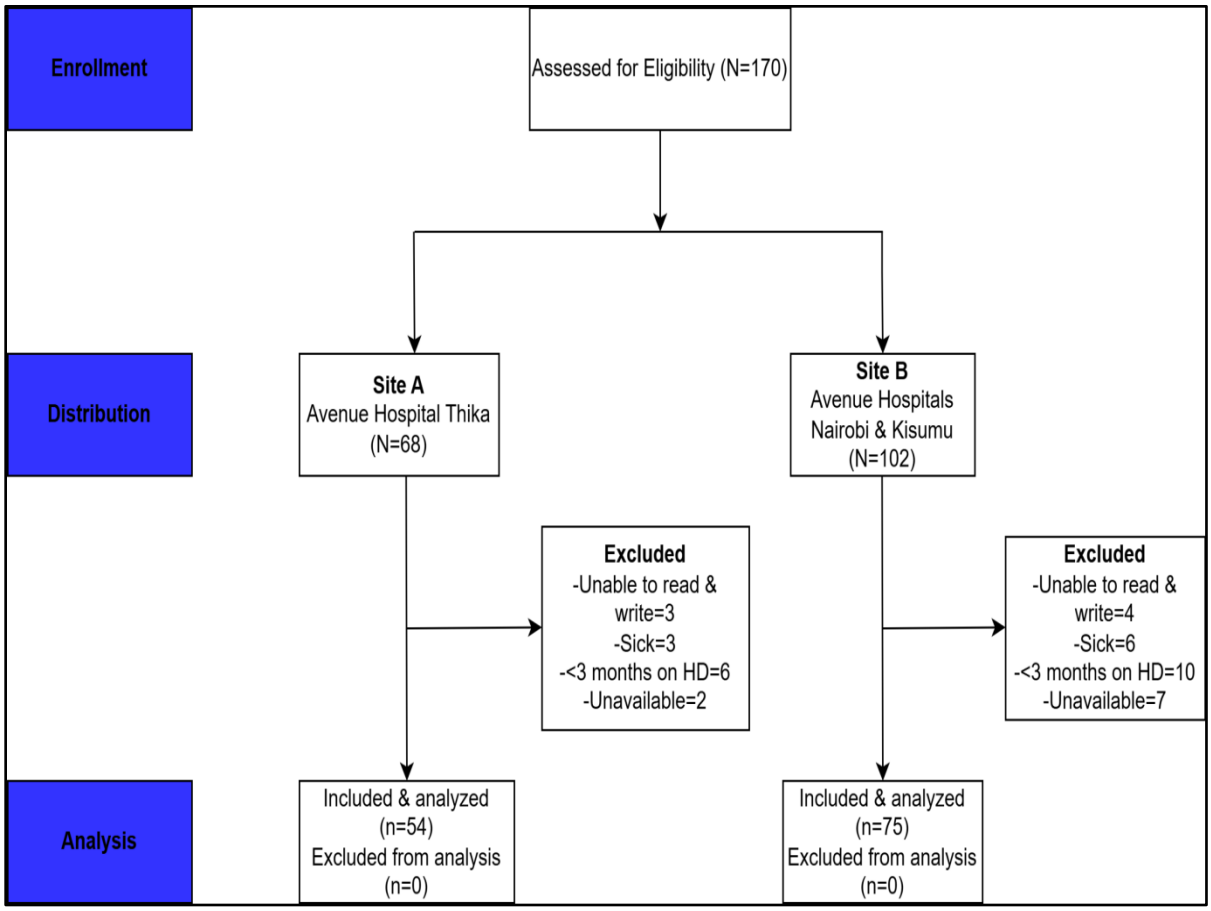

Figure 1: Flow diagram of the study

2.3 Study Variables

The primary outcome of the study was adherence to HD treatment regimen which was assessed through four key components: HD session attendance, medication adherence, fluid restriction and dietary compliance. Adherence was measured using the ESRD-AQ tool with satisfactory adherence defined as a score of ≥70%. The predictors of adherence included patient-related factors (age, gender, level of education, knowledge and practice of HD treatment regimen, income status, and forgetfulness) and therapy related factors (muscle cramps, intradialytic hypotension or hypertension, side effects of medication, and communication with healthcare professionals). The potential confounders in the study included duration on dialysis, availability of social support, and facility based factors like hospital policies on dialysis care. These were adjusted for in statistical analysis using multivariate logistic regression.

2.4 Study tools

The study employed a modified ESRD-AQ questionnaire, a self-administered questionnaire, and a Key Informant Guide (KII) for comprehensive data collection. The modified ESRD-AQ was crafted by integrating components from the original ESRD-AQ and relevant literature. The self-administered questionnaire focused on participants' knowledge and practices regarding their HD treatment regimen, while the KII facilitated qualitative insights.

Quality assurance was a priority; the validity of the quantitative tool was established through pretesting with 5 patients (10% of the sample) undergoing maintenance dialysis at Kenol Hospital. The knowledge and practice questionnaire were structured into three parts: socio-demographics, knowledge of HD treatment, and practice of HD treatment.

The modified ESRD-AQ consisted of four sections covering HD frequency adherence, medication adherence, fluid adherence, and diet adherence. Construct validity was confirmed by aligning items in the data collection instruments with the study objectives, ensuring comprehensive coverage of the constructs. Reliability was assessed using Cronbach's alpha, yielding scores of 0.712 for HD frequency adherence, 0.7 for medication adherence, 0.871 for fluid adherence, and 0.746 for diet adherence, indicating that the instrument was reliable for measuring adherence to the HD regimen.

2.5 Study procedure

Data collection was carried out by the principal investigator (PI) and trained research assistants, with nephrology nursing experience, all registered by the Nursing Council of Kenya, and possessing 8-12 years of renal care expertise. Prior to data collection, they received training on the study's objectives, data collection tools, the informed consent, procedures, and research ethics.

The researcher began collection by explaining the study and getting informed consent from eligible participants. Participants first completed the self-administered questionnaire on patient-related factors such as demographics, dialysis duration, and knowledge and practices on HD treatment. This was followed by a researcher administered ESRD-AQ assessing adherence to HD treatment

(session attendance, medication, fluid & diet adherence) and therapy-related compliance factors. Completed questionnaires were then assessed for completeness.

KII were conducted by the PI with informed consent, to explore patient and therapy-related factors influencing compliance to the HD treatment regimen for triangulation purpose. Each interview lasting 15 to 30 minutes, was recorded using the Teams software application. The were subsequently downloaded, cleaned, coded and stored securely on a password protected computer to ensure confidentiality.

2.6 Data analysis

Quantitative data were analyzed using SPSS version 27.0, while qualitative data were processed with NVIVO version 11. Afterwards, data cleaning and coding was done to address any missing data. Descriptive statistics and Kolmogorov-Smirnov were used to assess normality of data, and summarize adherence and socio-demographic characteristics with compliance measured via a Likert scale and classified as satisfactory and unsatisfactory on a 70% threshold. To get the percentage score, the attained score for each participant was divided by the maximum attainable scores of 167 for HD treatment regimen, 42 for HD frequency, 43 for medication, 47 for fluid and 35 for diet and then multiplied by a hundred. Inferential analysis involved binary logistic regression to identify independent predictors of compliance, with both binary and multivariate analyses conducted at a significance level of t $P < 0.05$.

2.7 Ethical considerations

The research was formally approved by the Nairobi Hospital Bioethics and Research Committee (NHBRC) under approval number TNH/DMSR/ISERC/RP/001/24 and licensed by the National Commission of Science and Technology (NACOSTI) with permit number NACOSTI/P/24/33924. Additionally, permission was obtained from Avenue Hospital administration. The study adhered to ethical principles outlined in the Declaration of Helsinki and the Belmont Report.

3. RESULTS

3.1 Demographic characteristics of the participants

As shown in table 1, A total of 129 participants were enrolled for the study. The mean age was 57.2 (SD± 13.2 years) for site A and 52.5 (SD± 13.8 years) for site B.

Table 1: Socio-demographic characteristics

	Site A		Site B	
Variable	**Frequency (n)**	**Percentage (%)**	**Frequency(n)**	**Percentage (%)**
Age	N-54, Mean-57.2, Median-57.5, Range-28-85, SD± 13.2		N-75, Mean-52.5, Median-54, Range-24-86, SD± 13.8	
Gender				
Male	39	72	50	66.7
Female	15	27.8	25	33.3
Education level				
Primary	17	31.5	15	20
Secondary	20	37	20	26.7
Tertiary	17	31.5	40	53.3
Employment status				
Self-employed	18	33.3	17	22.7
Unemployed	25	46.3	39	52
Employed	11	20.4	19	25.3
Income				
Kes. 0-50,000	37	68.5	51	68
Kes. 50,000-100,000	9	16.7	13	17.3
Kes. > 100,000	8	14.8	11	14.7

3.2 Compliance with HD Treatment Regimen

Table 2 indicates that in site A, 44 (81.5%) participants had unsatisfactory adherence to the HD treatment regimen while in site B, 55 (73.3%) had unsatisfactory adherence to the HD treatment regimen.

Table 2: Compliance to the HD treatment regimen

	Site A		Site	
Component	**Satisfactory adherence**	**Unsatisfactory adherence**	**Satisfactory adherence**	**Unsatisfactory adherence**
	n (%)	**n (%)**	**n (%)**	**n (%)**
HD Frequency	18(33.3)	36(66.7)	19(25.3)	56(74.7)
Medication	40(74.1)	14(25.9)	56(74.7)	19(25.3)
Fluid	3(5.6)	51(94.4)	3(4)	72(96)
Diet	4(7.4)	50(92.6)	13(17.3)	62(82.7)
Composite adherence	10(18.5)	44(81.5)	20(26.7)	55(73.3)

3.3 Qualitative data analysis on compliance to HD treatment regimen

Two of the key informants agreed that compliance of HD treatment regimen was either poor or fair among the patients on maintenance dialysis in Avenue hospitals. Some of the participants had this to say:

"If I am given a scale of one 1 to 10, I would rate the level of adherence and knowledge at between 5-7. This would then imply it is poor to fair adherence". (KII 3).

"For practice, I would say it is fair. There are some patients who are not compliant to treatment and especially to diet". (KII 5).

3.4 Patient related factors associated with compliance to HD treatment regimen

Table 3 below indicates that in site A, factors such as education level (C.O.R=0.07, 95% C.I=0.008-0.656, P=0.020), income status (C.O.R=0.166, 95% C.I=0.032-0.846, P=0.031), knowledge of the HD regimen (C.O.R=0.173, 95% C.I=0.038-0.791, P=0.024), and practice of the HD regimen (C.O.R=0.178, 95% C.I=0.038-0.938, P=0.042) were significantly associated with compliance to the HD treatment regimen. In site B, knowledge of the HD regimen (C.O.R=0.183, 95% C.I=0.045-0.740, P=0.017) and practice of the regimen (C.O.R=0.151, 95% C.I=0.025-0.901, P=0.038) were significantly linked to compliance.

Table 3: Patient related factors associated with compliance to HD treatment regimen

	Site A					Site B				
Variable	**Cross tabulation**		**P-value**	**C.O. R (95% CI)**		**Cross tabulation**		**P-value**	**C.O. R (95% CI)**	
	Unsatisfactory	**Satisfactory**				**Unsatisfactory**	**Satisfactory**			
Age			0.145	0.964	(0.917-1.013)			0.234	1.024	(0.985-1.064)
Gender										
Male	29(74.3)	10(25.6)	0.665	1.379	(0.322-5.910)	35(70)	15(30)	0.359	1.714	(0.542-5.423)
Female	12(80)	3(20)				20(80)	5(20)			
Education										
Primary	16(94.1)	1(5.9%)	0.020	0.07	(0.008-0.656)	12(80)	3(20)	0.368	0.519	(0.125-2.165)
Secondary	16(80)	4(20)	0.087	0.281	(0.066-1.201)	16(80)	4(20)	0.316	0.519	(0.144-1.867)
Tertiary	9(52.9)	8(47.1)				27(67.5)	13(32.5)			
Employment										
Self-employed	15(83.3)	3(16.7)	0.103	0.240	(0.043-1.335)	14(82.4)	3(17.6)	0.341	0.464	(0.096-2.250)

Employed	6(54.5)	5(45.5)	0.125	0.300	(0.064-1.398)	13(68.4)	6(31.6)	0.791	0.851 (0.258-2.805)
Unemployed	20(80)	5(20)				28(71.8)	11(28.2)		
Income status									
Kes. 0-50,000	29(78.4)	8(21.6)	0.031	0.166	(0.032-0.846)	41(80.4)	10(19.6)	0.080	0.293 (0.074-1.156)
Kes. 50,000-100,000	9(100)	0(0)	0.999	0.000 (0-0.729)		8(61.5)	5(38.5)	0.729	0.750 (0.147-3.828)
Kes. >100,000	3(37.5)	5(62.5)				6(54.5)	5(45.5)		
Duration on HD									
3 months-1 year	7(87.5)	1(12.5)	0.529	0.429	(0.031-5.985)	8(80)	2(20)	0.708	0.708 (0.116-4.318)
1 year-2 years	13 (65)	7(35)	0.610	1.615	(0.255-10.226)	9(69.2)	4(30.8)	0.763	1.259 (0.281-5.650)
2 years-3 years	6(85.7)	1(14.3)	0.609	0.500	(0.035-7.104)	4(66.7)	2(33.3)	0.724	1.417 (0.204-9.817)
3 years-5 years	9(81.8)	2(18.2)	0.720	0.667	(0.073-6.111)	17(73.9)	6(26.1)	1.000	1.000 (0.268-3.729)
>5 years	6(75)	2(25)				17(73.9)	6(26.1)		
Level of knowledge									
Unsatisfactory	37(82.2)	8(17.8)	0.024	0.173	(0.038-0.791)	51(78.5)	14(21.5)	0.017	0.183 (0.045-0.740)
Satisfactory	4(44.4)	5(55.6)				4(40)	6(60)		
Level of practice									
Unsatisfactory	38(80.9)	9(19.1)	0.042	0.178	(0.034-0.938)	53(76.8)	16(23.2)	0.038	0.151 (0.025-0.901)
Satisfactory	3(42.9)	4(57.1)				2(33.3)	4(66.7)		
Forgetfulness									
Yes	5(100)	0(0)	0.999	0.000 (0.000-.)		5(100)	0(0)	0.999	0.000 (0.000-0.999)
No	36(73.5)	13(26.5)				50(71.4)	20(28.6)		
Cost of medication									
Yes	1(100)	0(0)	1.000	0.000		8(100)	0(0)	0.999	0.000 (0.000-0.999)
No	40(75.5)	13(24.5)				47(70.1)	20(29.9)		

Key: C.O.R-Crude Odds Ratio, C.I.-Confidence Interval

3.5 Qualitative data analysis on patient related factors affecting compliance to HD treatment regimen

The key sub-theme under patient related factors affecting compliance to HD was low knowledge of different components of the HD treatment. The following statements illustrated this:

"The main factor is knowledge gap. Some of the patients have not even been to school. They are semi-illiterate and do not understand some aspects of adherence to dialysis". (KII 2).

"Some patients do not have enough knowledge as far as nutrition is concerned, so you find that some of them take some diet, and they don't have knowledge that it can harm them". (KII 4).

3.6 Multivariate logistic regression for factors associated with compliance to HD treatment regimen

A binomial logit model was used to adjust for confounders in both groups. For Site A, the model demonstrated a strong goodness of fit (Omnibus Test: χ^2=26.507, P<0.001; Hosmer & Lemeshow: χ^2=0.743, P=0.994), with sensitivity, specificity, and accuracy of 92.7%, 61.5%, and 85.2%, respectively. The variance explained by the model ranged from 38.8% to 58% (Cox and Snell R^2=0.388; Nagelkerke R^2=0.58). For site B, the model also showed a good fit (Omnibus Test: χ^2=9.155, P=0.010; Hosmer & Lemeshow: χ^2=0.322, P=0.571), with sensitivity, specificity, and accuracy of 90.9%, 45%, and 78.7%, respectively. The explained variance ranged from 11.5% to 16.7% (Cox and Snell R^2=0.115; Nagelkerke R^2=0.167).

After controlling for confounding factors, the analysis showed that in Site A, lower education levels (primary: A.O.R=0.007, 95% C.I.=0.000-0.286, P=0.008; secondary: A.O.R=0.056, 95% C.I.=0.004-0.878, P=0.040) and inadequate practice of the HD regimen (A.O.R=0.056, 95% C.I.=0.004-0.730, P=0.028) were negatively associated with compliance to the treatment. In site B, poor knowledge of the HD regimen (A.O.R=0.208, 95% C.I.=0.049-0.882, P=0.033) was found to negatively impact compliance (Tables 4 & 5).

Table 4: Multivariate logistic regression for factors associated with compliance to HD treatment in Site A

							95% CI	
Variable	**B**	**S.E.**	**Wald**	**Df**	**P-value**	**A.O.R**	**Lower**	**Upper**
Level of education			7.150	2	0.028			
Primary	-4.907	1.865	6.926	1	0.008	0.007	0.000	0.286
Secondary	-2.887	1.406	4.213	1	0.040	0.056	0.004	0.878
Tertiary	**Ref**							
Income status			0.461	2	0.794			
Kes. 0-50,000	0.967	1.425	0.461	1	0.497	2.631	0.161	42.925
Kes. 50,000-100,00	-20.806	12009.116	.000	1	.999	0.000	.000	.
Kes. > 100,000	**Ref**							
Level of knowledge								
Unsatisfactory	-0.848	1.147	0.546	1	0.460	0.428	0.045	4.056
Satisfactory	Ref							
Level of practice								
Unsatisfactory	-2.878	1.307	4.845	1	0.028	0.056	0.004	0.730
Satisfactory	**Ref**							

Key: B-estimate, Std. Err-standard error, Df-degree of freedom, A.O.R.- adjusted odds ratio, P-value=significance, CI-Confidence interval

Table 5: Multivariate logistic regression for factors associated with compliance to HD treatment in site B

							95% CI	
Variable	**B**	**S.E.**	**Wald**	**Df**	**P-value**	**A.O.R**	**Lower**	**Upper**
Level of knowledge								
Unsatisfactory	-1.572	0.738	4.534	1	0.033	0.208	0.049	0.882
Satisfactory	Ref.							
Level of practice								
Unsatisfactory	-1.710	1.085	3.215	1	0.073	0.181	0.028	1.172
Satisfactory	Ref.							

Key: B-estimate, Std. Err-standard error, Df-degree of freedom, A.O.R.- adjusted odds ratio, P-value=significance, CI-Confidence interval

4. DISCUSSION

Both quantitative and qualitative studies indicate that participants had inadequate compliance to the HD treatment regimen. 81.5% (44 participants) showed unsatisfactory compliance in site A. Key informants corroborated these findings, noting that compliance ranged from poor to fair. These results align with global studies, such as that of Griva *et al.* (2014), which report poor compliance rates between 2% and 50%, and Duong *et al.* (2015), which states that about 50% of patients on maintenance HD are non-adherent.

Regionally, similar findings were noted in Nigeria, where 73.5% of patients had poor compliance, and in Zimbabwe and Rwanda, with non-compliance rates of 50% and 49%, respectively (Chironda *et al.*, 2016; Mukakarangwa *et al.*, 2018; Toroitich *et al.*, 2020). Locally, studies at Kenyatta National Hospital and Nyeri County reported non-compliance rates of 52.6% and 46.6%, respectively (Choge, 2020; Chege *et al.*, 2022).

Specific components of compliance also showed concern, with 92.6% (50 patients) in site A demonstrating unsatisfactory compliance to dietary restrictions. This aligns with findings from Toroitich *et al.,* 2020 and Choge, 2020 who reported similar issues with dietary compliance among patients in other hospitals.

The overall low compliance rates, despite care from dialysis centres, suggest potential gaps in patient education by healthcare providers. This may indicate either a lack of adequate education from physicians and nurses or that patients do not fully understand the information provided, highlighting an issue in patient-provider communication.

The study's quantitative findings reveal that education level, knowledge of the HD treatment regimen, practice of the regimen, and income status significantly correlate with compliance to HD. Qualitative results also indicate low levels of knowledge, practice, and adherence to HD. Specifically, having primary or secondary education increases the likelihood of compliance to HD treatment by 97.3% and 94.2%, respectively. This aligns with Alikari *et al.,* 2019, who found that higher education levels are associated with better compliance, suggesting that more educated patients understand the importance of therapy better than those with lower education levels.

The study further indicates that increased knowledge and practice of HD treatment correspond to improved compliance, consistent with findings by Toroitich *et al.,* 2020, who noted that low knowledge marginally affected dietary compliance ($p=0.07$) and fluid compliance ($p=0.06$) [15]. Low practice levels significantly impacted dietary compliance ($p=0.03$) and fluid compliance ($p<0.001$). This emphasizes the need for healthcare practitioners to enhance patients' understanding of HD treatment requirements.

Additionally, the study found that patients earning over Kes. 50,000 were 2.631 times more likely to be compliant, although this was not statistically significant in multivariate regression. This supports Timothy & Blessing, 2021 findings in Nigeria, who noted that higher earners were more likely to comply to HD. Higher income likely provides more disposable income for renal nutrition, aiding adherence.

The study provides generalizable insights into compliance to HD treatment regimen. The use of validated compliance measurement tools and diverse study sites across multiple hospitals enhances its applicability to similar private healthcare settings. Additionally, the results align with global and regional studies, that suggest that hurdles to HD compliance such as patient knowledge, financial constraints and therapy related factors are consistent across different populations.

Despite these findings being broadly applicable, additional inquiry is required to assess the generalizability to public and rural setup hospitals and clinics where resource limitations may further hinder compliance.

5. LIMITATIONS

While this study provides valuable insights, one limitation must be acknowledged. The self-reported data was collected using the modified ESRD-AQ tool which may be subject to recall bias, interviewer and social desirability bias. In this regard, participants may have over reported compliance to medication, fluid and diet due to the fear of judgement or perceived expectations from healthcare providers. This bias may have led to an overestimation of compliance rates, making non-compliance less severe than it truly is the case. To overcome this bias, the three trained research assistants were used to collect data. Meanwhile, information bias was mitigated by sticking to the research instrument.

6. CONCLUSION

Overall based on the results, there is a low compliance with the HD treatment regimen, with factors such as education level, income, knowledge, and practice of the regimen playing a significant role in this low adherence.

7. IMPLICATIONS

Based on the results, the high non-compliance to HD treatment regimen and particularly fluid and and dietary restrictions, suggests that many patients may be at risk of complications such as fluid overload, electrolyte imbalances and cardiovascular events, thus is the need for targeted educational interventions to enhance compliance to HD treatment regimen. Moreover, nurses should routinely assess compliance to HD treatment regimen using structured tools like ESRD-AQ to identify at-risk patients early in treatment. Finally, the planning and designing of dialysis programs and policies should consider the capacity building of clinicians and the provision of well-coordinated patient support groups in dialysis facilities.

8. DATA AVAILABILITY

The data supporting the findings of this study can be obtained from the corresponding author upon request

9. CONFLICT OF INTEREST

The authors declare no conflicts of interest related to this study.

10. FUNDING

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12. AUTHOR CONTRIBUTION

Gabriel N; Conceptualization, methodology, investigation, data curation, formal analysis, original draft, review & editing writing, & project administration. **Dr. Elijah M;** supervision, methodology, review & editing writing. **Dr. Drusilla M;** supervision, methodology, review & editing writing. **Dr. Ermia T;** supervision, methodology, review & editing writing.

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