



Article

Hemodialysis Therapy Adherence and Contributing Factors among End-Stage Renal Disease Patients at Muhimbili National Hospital, Dar es Salaam, Tanzania

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Abstract: Maintenance hemodialysis services continue to rise globally. We evaluated adherence to hemodialysis therapy and contributing factors among end-stage renal disease patients at Muhimbili National Hospital, Dar es Salaam, Tanzania. A cross-sectional study was done involving 265 end-stage renal disease patients who were being treated at Muhimbili National Hospital, in Dar es Salaam. The study population selected included adult patients (18 years and above) with end-stage renal disease (ESRD) who were on hemodialysis. Data were entered into SPSS and imported into STATA for analysis. Numeric variables were summarized using the mean and standard deviation, and categorical variables were summarized using frequencies and proportions. A log-binomial regression model was used to estimate the risk factors associated with non-adherence, while multi-variable log-binomial regression was used to control for confounders and test for the effect modifiers. All tests were two-tailed and the significance level was set at 5%. The parameters used to assess non-adherence to hemodialysis therapy in this study were the skipping of one or more hemodialysis sessions within the most recent 1 month or shortening one or more hemodialysis sessions by 10 or more minutes within the most recent 1 month. A session missed due to hospitalization or other medical reasons was not considered as non-adherence. All 265 patients were included in the analysis, of whom 191 (72.1%) were males. The rate of full adherence to the hemodialysis sessions was 64.2%. However, factors associated with the adherence to hemodialysis were the source of funding for hemodialysis (RR = 0.70, 95% CI: 0.48, 0.96), the occupation of the respondents (RR = 1.59, 95% CI: 1.44, 1.94), marital status (RR = 1.97, 95% CI: 1.03, 3.77), and monthly income (RR = 0.92, 95% CI: 0.62, 1.51). Adherence to hemodialysis therapy among ESRD patients at Muhimbili National Hospital was high and within the range of most published studies. Hemodialysis attendance among participants depended on the source of funding, marital status, occupation, and monthly income. Patients should be informed by the health care workers on the importance of adhering to hemodialysis sessions. Further studies should be done to explore the factors influencing adherence to hemodialysis, as it was noted that adherence was low among some patients.

Keywords: hemodialysis therapy; adherence; end-stage renal disease; chronic kidney disease; Muhimbili National Hospital; Dar es Salaam, Tanzania



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1. Introduction

About 500 million people are reported to have chronic kidney disease (CKD) globally, and most of them (80%) live in developing countries [1–3]. Due to this high burden, it is suggested that at least 70% of the patients with end-stage renal disease (ESRD) will be residents in low-income countries by the year 2030 [4].

The burden of CKD in developing countries, such as those in sub-Saharan Africa, approximates or exceeds that of developed countries, with prevalence estimates ranging

between 5% and 17%. In Tanzania, CKD is reported to be present in 7% of the general population, while in urban areas, the prevalence among adults is estimated to be 15%. However, despite this high burden of CKD, awareness about it and its implications is still very low [5].

Several factors are associated with kidney diseases in Tanzania. For example, a study performed in Dodoma, the country's capital, revealed that of 116 patients on hemodialysis 32 (27.6%) had acute kidney injury (AKI), which was mainly caused by intoxication from herbs and drugs (43.8%). Other studies in the same setting reported that pre-eclampsia was the cause of AKI in 21.8%; while infectious disease with parasitic or bacterial organisms and postpartum hemorrhage accounted for 18.8% and 15.6%, respectively [6].

There are 28 hemodialysis centers in Tanzania, which is equivalent to 0.5 centers per 1 million people. However, these are either located in hospitals or stand-alone facilities, such as consultation rooms, medical laboratories, and dialysis service centers. Furthermore, these centers are located in 7 out of 30 (23.3%) urban areas in Tanzania. Notably, out of 259 hemodialysis machines present in Tanzania, 164 (63.3%) are located in Dar es Salaam, the largest commercial city [7]. Studies have shown that regular attendance and the completion of hemodialysis (HD) sessions by patients is a very important indicator of adherence to a hemodialysis regimen [8,9].

The recommended number of hemodialysis sessions is three times per week (each session is 4 h long) to provide adequate depuration. In 2017, Tanzania, through the Ministry of Health, developed a national guideline for hemodialysis services, which shows, among other information, that adequate hemodialysis should consist of 3 to 5 h sessions conducted three times per week to reduce mortality and improve wellbeing [10].

Non-adherence to hemodialysis attendance is associated with increased mortality. Studies have shown that up to 50% of HD patients do not adhere to the recommended regimen, thereby increasing morbidity and mortality [11–16]. Furthermore, a study done in the United States revealed that non-adherence to hemodialysis increased the risk of mortality by 20% to 25% and increased the risk of hospitalization by 16% [16]. Another study on the same issue in Kigali, Rwanda documented 51% non-adherence to HD treatment. It showed that non-adherence was strongly associated with age, religious beliefs, HD education by health care providers, perceived benefits of HD, and negative experiences during the procedure [11].

Despite several interventions carried out in Tanzania that were aimed at improving adherence to HD, including an increase in the number of hemodialysis facilities and nephrologists in the country, adherence to HD is still poor, suggesting that other factors could be responsible for non-adherence [7].

Therefore, this study was designed to assess adherence to HD and associated factors among ESRD patients at Muhimbili National Hospital in Dar es Salaam, Tanzania. The findings are expected to increase the knowledge among healthcare providers on the magnitude and factors influencing adherence to HD and enable them to plan and implement rational interventions. Moreover, the findings may highlight knowledge gaps to be filled in future studies.

2. Materials and Methods

A cross-sectional study was conducted from June to July 2021 using a quantitative data collection technique. The design allows for multiple exposures as well as outcomes to be assessed at the same time. This study was conducted at Muhimbili National Hospital (MNH), a tertiary public hospital providing hemodialysis services in Dar es Salaam, Tanzania. Out of 933 hemodialysis patients in Tanzania, 620 (66.4%) receive HD from the facilities in Dar es Salaam. Muhimbili National Hospital is one of the 15 facilities providing HD services in Dar es Salaam (out of 28 facilities in Tanzania). Being in a tertiary public hospital, patients included were either health-insured, cost-sharing, or fully exempted from treatment costs [7]. Convenient sampling was used to recruit a total number of

265 adult patients with end-stage renal disease attending HD sessions at Muhimbili National Hospital for at least one month prior to this study.

2.1. Recruitment and Training of Research Assistants

Two dialysis nurses working at Muhimbili National Hospital were used as research assistants for the study. They were trained on the study objectives, data collection, and research procedures.

A questionnaire was developed in English, translated into Kiswahili, and used to collect data. It comprised questions about socio-demographic characteristics, adherence to hemodialysis attendance and the completion of hemodialysis sessions, patients' knowledge on the importance of hemodialysis, and factors influencing adherence to hemodialysis. The questionnaire was pretested in another hospital, using HD patients at the Regency Hospital in Dar es Salaam, to ensure data validity and reliability with reference to the study objectives. After pretesting, the questions were adjusted accordingly.

On average, the administration of the questionnaire took a maximum of 20 min.

Study participants were approached while they were waiting for HD at the HD unit. The study objectives were explained to the patients, who were also informed that their participation in the study was voluntary. They were also informed that even if they refused to participate they would continue to receive the same services that they were getting from the hospital. After agreeing to participate and signing the consent forms, the patients were approached by the PI and the research assistants while they were receiving HD therapy and interviewed.

The collected data were checked for errors, corrected, and entered into SPSS statistical package version 24 before they were imported into STATA for analysis.

Numeric variables were summarized using the mean and standard deviation, while categorical variables were summarized using frequencies and proportions. A log-binomial regression model was used to estimate the associations with non-adherence. This was applied to avoid an overestimation of the risks since the prevalence of non-adherence was greater than 10% [17]. Multivariable log-binomial regression was employed to control for confounders and test for effect modifiers. All tests were two-tailed and the significant level was set at 5%.

2.2. Ethical Issues

Ethical approval (Ref No. DA.282/298/01.C/) was obtained from the Institutional Review Board (IRB) of Muhimbili University of Health and Allied Sciences (MUHAS). Further permission to conduct the study was sought from the Director of MNH. Informed written consents were sought from the study participants. All collected information was securely kept confidential.

3. Results

3.1. Adherence to Hemodialysis Therapy among ESRD Patients

The study found that 95 (35.8%) of the patients reported to have purposely missed hemodialysis sessions at least once per month (Figure 1), while 21 (7.9%) reported to have purposely shortened the sessions on their own initiative at least once per month (Figure 1). Respondents in the age group of 41–50 years were more non-adherent than other age groups. In addition, patients who had attained only a primary school education had higher levels of non-adherence than those who had attained higher education. Additionally, self-employed patients were more non-adherent to hemodialysis than public employees. With regard to marital status, those who were widows or separated were more non-adherent than those who were married or single, while patients who did not have health insurance had lower adherence compared to insured patients (see Table 1).

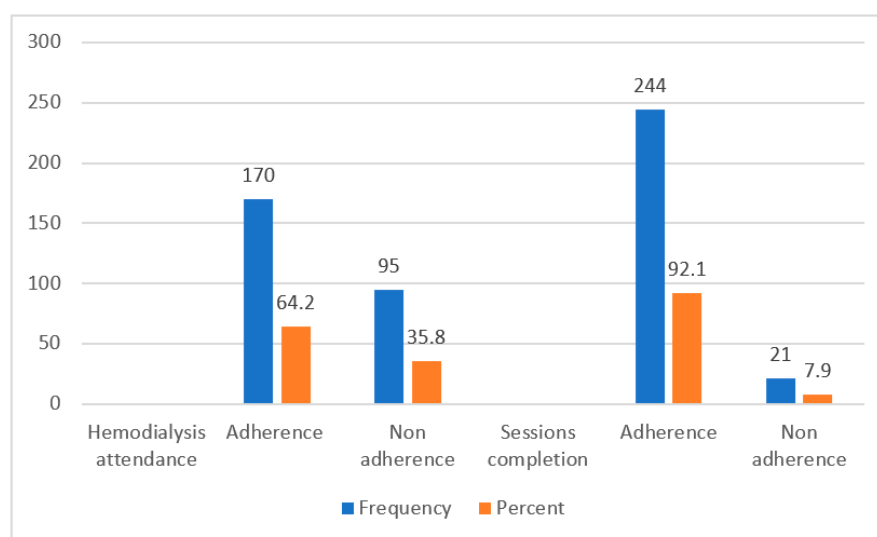


Figure 1. Adherence to hemodialysis attendance and hemodialysis session completion among ESRD patients.

Table 1. Proportion of ESRD patient adherence to hemodialysis therapy at MNH by respondents background characteristics ($n = 265$).

Variable	Adherence Status		<i>p</i> Value
	Non-Adherence	Adherence	
Age group (in years)			
19–30	13 (43.3)	17 (56.7)	0.021
31–40	13 (32.5)	27 (67.5)	
41–50	30 (52.6)	27 (47.4)	
51–60	20 (30.3)	46 (69.7)	
61–99	19 (26.4)	53 (73.6)	
Sex			
Male	70 (36.6)	121 (63.4)	0.663
Female	25 (33.8)	49 (66.2)	
Marital status			
Single	14 (35.9)	25 (64.1)	0.459
Married/cohabiting	68 (34.3)	130 (65.7)	
Widow/separated	13 (46.4)	15 (53.6)	
Faith			
Christian	52 (31.7)	112 (68.3)	0.059
Muslim	43 (43.9)	55 (56.1)	
Other	0 (0)	3 (100)	
Education level			
No formal school	2 (33.3)	4 (66.7)	0.543
Primary school	35 (42.2)	48 (57.8)	
Secondary school	31 (33.7)	61 (66.3)	
Higher education level	27 (32.1)	57 (67.9)	
Occupation			
Public servant	17 (30.4)	39 (69.6)	0.029
Self employed	50 (45.0)	61 (55.0)	
Unemployed	28 (28.6)	70 (71.4)	
Monthly income level (TZS)			
Less than 135,000	42 (35.6)	76 (64.4)	0.480
135,000–270,000	10 (26.3)	28 (73.7)	
270,000–540,000	21 (36.8)	36 (63.2)	
More than 540,000	22 (42.3)	30 (57.7)	
Source of funding for dialysis			
Self	41 (45.1)	50 (54.9)	0.02
Insurance	54 (31.0)	120 (69.0)	

3.2. Factors Contributing to Adherence to Hemodialysis among ESRD Patients

This study assessed factors influencing adherence to hemodialysis therapy among ESRD patients. The findings revealed that age, sex, educational level, and religious beliefs were not associated with adherence to hemodialysis therapy. However, respondents who were health-insured for HD therapy had a 70% lower risk of non-adherence (RR = 0.70, 95% CI: 0.48, 0.96) compared to those who were not insured. Regarding occupation, respondents who were self-employed had a 59% higher risk of non-adherence compared to the patients who were public employees (RR = 1.59, 95% CI: 1.44, 1.94). Respondents who were either widows or separated had a 97% higher risk of non-adherence compared to respondents who were married or cohabiting (RR = 1.97, 95% CI: 1.03, 3.77). Concerning monthly income, respondents who had an income of more than 540,000 Tanzanian Shillings (TZS) per month had a 92% lower risk of non-adherence to hemodialysis compared to patients who had monthly incomes of less than 135,000 TZS (RR = 0.92, 95% CI: 0.62, 1.51) (Table 2).

Table 2. Factors associated with adherence to hemodialysis among ESRD patients ($n = 265$).

Variable	cRR (95%)	<i>p</i> Value	aRR (95% CI)	<i>p</i> Value	<i>p</i> Trend
Age group (in years)					
18–30	1		1		
31–40	1.19 (0.81,1.74)	0.367	1.49 (0.65, 3.36)	0.338	0.049
41–50	0.84 (0.55,1.27)	0.399	1.09 (0.47, 2.55)	0.834	
51–60	1.23 (0.87,1.75)	0.249	1.48 (0.67, 3.30)	0.335	
61–99	1.3 (0.92,1.83)	0.135	1.49 (0.66, 3.38)	0.337	
Sex					
Male	1		1		
Female	1.05 (0.86,1.27)	0.658	1.09 (0.74, 1.59)	0.665	
Marital status					
Married/cohabiting	1		1		
Single	1.02 (0.79,1.32)	0.855	1.22 (0.73, 2.05)	0.636	
Widow/separated	0.83 (0.55,0.81)	0.400	1.97 (1.03, 3.77)	0.040	
Faith					
Christian	1		1		
Muslim	0.82 (0.67,0.01)	0.06	1.41 (0.97, 2.04)	0.067	
Education level					
No formal school	1		1		
Primary school	0.87 (0.48,1.57)	0.639	0.73 (0.25, 2.15)	0.573	0.224
Secondary school	0.99 (0.55,1.78)	0.985	0.90 (0.31, 2.65)	0.846	
Higher education	1.02 (0.57,1.83)	0.953	0.88 (0.29, 2.72)	0.829	
Occupation					
Public servant	1		1		
Self employed	0.79 (0.62,1.00)	0.055	1.59 (1.44, 1.94)	0.048	
Unemployed	1.03 (0.59,0.83)	0.817	1.09 (0.55, 2.14)	0.896	
Monthly income (TZS)					
Less than 135,000	1		1		
135,000–270,000	1.14 (0.91,1.44)	0.257	0.64 (0.35, 1.15)	0.133	0.416
270,000–540,000	0.90 (0.68,1.17)	0.422	1.65 (1.02, 2.69)	0.884	
More than 540,0000	0.98 (0.77,1.25)	0.873	0.92 (0.62, 1.51)	0.041	
Source of funding					
Non-insured	1		1		
Insurance	0.69 (0.50,0.95)	0.021	0.70 (0.48, 0.96)	0.044	
Duration on dialysis					
1 month to 1 year	1		1		
More than 1–2 years	1.03 (0.34,3.07)	0.96	1.13 (0.73, 1.74)	0.594	
More than 2–3 years	0.59 (0.14, 2.56)	0.48	0.83 (0.51, 1.35)	0.447	
More than 3 to 5 years	1.14 (0.34, 3.86)	0.83	0.48 (0.24, 0.97)	0.042	
More than 5 years	0.66 (0.09, 4.81)	0.68	0.38 (0.13, 1.14)	0.087	

4. Discussion

The aim of this study was to assess adherence to HD therapy and contributing factors among ESRD patients at MNH, Tanzania. The main finding from this study is that 95 (35.8%) of the ESRD participants missed their hemodialysis sessions on their own initiative at least once a month. This finding is in line with findings from studies done in Makkah, Palestine, and Rwanda, which documented rates of 44%, 45%, and 51% of non-adherence to hemodialysis therapy among ESRD patients in a month, respectively [11,18,19]. Additionally, it was also noted that 21 (7.9%) of the participants shortened their HD sessions by at least 10 min a month. This finding is consistent with other studies that have documented that shortening HD sessions among ESRD patients ranges between 5% and 20.3% [18,20,21]. However, the data are more heterogeneous, as, for instance, a study done in Brazil reported a shortening of dialysis sessions in 49% of patients. Most studies have reported repeated shortening of HD sessions, possibly because HD has an established dependence on the few available machines; hence, the tendency to shorten HD sessions can reflect the struggle of restoring a sense of control over the treatment and self-reliance [22].

Regarding the contributing factors for adherence, this study revealed that age, sex, educational level, and religious beliefs were not statistically associated with adherence to HD therapy in our patients. These findings are in line with the studies done in Rwanda, Cameroon, and Makah City in Saudi Arabia, which showed that the level of education, occupation, and monthly income were not significantly associated with adherence to HD among ESRD patients. Other studies have reported, however, an association of adherence with sex and religious beliefs [8,11,18,23]. For instance, being male was associated with an increased risk of poor adherence to HD. Men tend to believe that HD is associated with a failure to fulfill household duties, as HD patients experience fatigue and weakness after sessions.

Moreover, our study revealed that the source of funding for HD has a high impact on adherence. Patients who were paying out of pocket had lower adherence than those with health insurance. This finding corresponds to a study done in Dodoma, which reported that about 44% of patients were lost to follow-up mostly due to financial barriers. Similarly, other studies have revealed that the high costs of HD and poor access to health insurance increases the chance of poor adherence and that, in this context, the majority of patients die, skip, or even stop dialysis within the first three months due to financial problems [22]. Health insurance helps to cover the costs of HD and the associated costs of medications and consultation charges, something that is different for patients without health insurance [22,23].

Respondents who had a longer duration of treatment had higher adherence to HD, whereby those who were on HD for 3 to 5 years had a 48% lower risk of non-adherence than those who were on hemodialysis for 1 month to 1 year (RR = 48 95% CI: 0.24,0.97). This finding corresponds to a study performed in Turkey, which reported a decrease in non-adherence to hemodialysis with an increase in the duration of hemodialysis therapy, possibly due to a selection by mortality, which is higher in non-compliant patients [10]. In contrast to our findings, however, a study from Iran disclosed that a long duration of HD was associated with decreased adherence [13]. The difference may be caused by differences in the study design or the cultural ethnicity of the study population. Since HD is a long-term therapy, when the duration increases, the self-confidence of the patients may decrease, with increases in a sense of loneliness and dependency; lack of adequate support may lead to poor adherence to dialysis therapy [13].

5. Study Limitations and Strengths

This study had a cross-sectional design and was done in a single unit, which could limit the generalization of its findings. A selection bias may be present due to the fact that only patients who were generally healthier and more conscious might have been selected to participate in the study. However, this study revealed several important findings that require more investigations using a larger sample size and a stronger research design. Being

the first study in the region, the results can act as baseline information on HD adherence and contributing factors among ESRD patients in our area.

6. Conclusions and Recommendation

Adherence to HD therapy among ESRD patients at MNH was high and within the range of most published studies. The majority of study participants acknowledged the importance of HD adherence. Hemodialysis attendance among participants depended on the source of funding, marital status, occupation, and monthly income. Hemodialysis attendance among participants depended on the source of funding, marital status, occupation, and monthly income.

ESRD patients should be informed by the health personnel about the importance of adhering to HD sessions. Furthermore, health insurance coverage among ESRD patients should be increased to improve adherence, as patients without health insurance were found to have lower adherence than insured patients.

Further studies should be carried out to explore additional factors influencing adherence to hemodialysis, as it was noted that adherence was low among some patients despite having high knowledge about the importance of adherence to HD therapy.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by Institutional Review Board of MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES (protocol code DA.282/298/01.C approved on 17 June 2021).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

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Conflicts of Interest: The authors declare that they have no competing interests.

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