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Health-Related Quality of Life and its Determinants Among Patients Undergoing Hemodialysis at a Tertiary Care Hospital in Western Province, Sri Lanka

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Abstract

Chronic kidney disease (CKD) is a significant global health challenge. This condition is particularly prevalent in developing nations like Sri Lanka, where the burden of CKD necessitates hemodialysis (HD) as a life-sustaining therapy. This study aims to assess the health-related quality of life (HRQOL) among HD patients in Sri Lanka and identify key determinants influencing their well-being. A descriptive cross-sectional study was conducted

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at two dialysis units involving 110 CKD patients undergoing HD. Data were collected using interviewer-administered questionnaires, including the validated kidney disease and quality of life (KDQOL-36™) tool, which assess both generic and disease-specific HRQOL domains. Findings indicate that the overall HRQOL of participants was below average, with mean scores of 41.91 ± 12.25. The scores across the five subscales of symptoms and problems of kidney disease, effects of kidney disease, burden of kidney disease, physical component summary, and mental component summary were 75.15±14.33, 46.73±20.57, 22.10±19.42, 34.00±8.79 and 31.56±9.74 respectively. Significant associations were identified between HRQOL subscales and various factors, including gender, education level, income, and comorbidities ($p<0.05$). Male patients reported lower perceived burdens from CKD ($p=0.009$), while those with higher education levels exhibited better HRQOL scores ($p<0.05$). Additionally, a higher income was associated with improved HRQOL ($p<0.05$). Urine output ≥500 ml/day and measuring daily intake were associated with higher HRQOL ($p<0.05$). Heart failure and symptoms like shortness of breath, edema, ascites, and pulmonary edema were linked to lower HRQOL ($p<0.05$). These findings underscore the necessity for targeted interventions that address both medical and psychosocial aspects of care to enhance the HRQOL of CKD patients undergoing HD in Sri Lanka.

Keywords: *Chronic kidney disease, health-related quality of life, hemodialysis, determinants, patients, Sri Lanka*

Introduction

Chronic kidney disease (CKD) has become a significant global health challenge, affecting approximately 850 million individuals worldwide (Jager et al., 2019). Epidemiological research has demonstrated that kidney disease is more prevalent in developing nations than in developed countries (Kovesdy, 2022). The burden of CKD is highest in Asia, with the prevalence between 7.0% to 34.3%, and an estimated 434 million people suffering across

Eastern, Southern, and Southeastern regions (Liyanage et al., 2022). In Sri Lankan context, the prevalence of CKD was reported as 14.4% in early 2025 (Abeysekera et al., 2025).

Chronic kidney disease is characterized by the gradual loss of kidney function over time, eventually leading to end-stage renal disease (ESRD), which requires renal replacement therapy, either through dialysis or kidney transplantation (Vaidya & Aeddula, 2024). Hemodialysis (HD) is the most common form of dialysis used to manage ESRD patients, providing life-sustaining therapy by mechanically filtering waste products and excess fluids from the blood (BagaRao & Ghista, 2023). However, the burden of CKD and the necessity for HD can severely impair the physical, emotional, and social well-being of patients, impacting their health-related quality of life (HRQOL) (Aljawadi et al., 2024).

The World Health Organization (WHO) defines HRQOL as the individual's perception of his/her position in life, in the context of the culture and value systems in which she/he lives, and concerning his/her goals, expectations, and standards. Patients with CKD undergoing HD often face multiple health challenges, including the physical limitations imposed by the disease, the demanding and time-consuming nature of HD, dietary restrictions, and frequent hospital visits. These factors significantly lower their HRQOL compared to the general population and patients with other chronic conditions (Leung et al., 2005).

The kidney disease quality of life (KDQOL-36™) questionnaire is a widely used tool for assessing HRQOL specifically in CKD patients (Ware & Sherbourne, 1992). This instrument measures both generic and kidney disease-specific subscales of HRQOL, including physical and mental health, symptoms related to kidney disease, burden of kidney disease, and effects of kidney disease on daily life. Studies conducted in different countries have shown that patients on HD report lower HRQOL scores, particularly in physical and mental health subscales (Piyasena et al., 2024; van Oevelen et al., 2024).

Numerous studies have shown a strong correlation between decreased HRQOL and increased morbidity and mortality in individuals with CKD. The global emphasis on incorporating HRQOL indicators into the clinical management of CKD patients has been widely recognized (Mujais et al., 2009; Rebollo-Rubio et al., 2015; Tsai et al., 2010).

Health-related QOL in patients with CKD undergoing HD is influenced by various factors, including demographic characteristics and clinical symptoms. Age, gender, socioeconomic status, and marital status significantly impact the HRQOL in CKD patients undergoing HD (Al Salmi et al., 2021). Older patients often experience lower HRQOL due to increased comorbidities and reduced physical adaptability (Tsai et al., 2010), while younger patients may face psychological challenges related to work and social disruptions. Female patients generally report poorer HRQOL, particularly in mental health (AL-Jumaih et al., 2011) due to caregiving roles and higher levels of anxiety and depression. Lower socio-economic status further diminishes HRQOL (AL-Jumaih et al., 2011), especially in developing countries like Sri Lanka, where access to care is limited. Married patients tend to report better HRQOL, benefiting from emotional and practical spousal support (Krishnan et al., 2020). Especially in Sri Lankan context, lower educational levels, reduced income, and increased frequency of dialysis sessions were significantly associated with diminished HRQOL (Weerasooriya & Karunathilake, 2024). Moreover, advanced stages of CKD, presence of depression, psychological distress, and higher symptom burden were significantly associated with poorer HRQOL (Senanayake et al., 2020).

Multimorbidity in CKD is linked to decreased HRQOL (Alhaji et al., 2018; Porter et al., 2012), with conditions such as diabetes mellitus, vascular diseases, heart failure, and obesity contributing to this decline (Mousa et al., 2028; Porter et al., 2012). These comorbidities can negatively impact HRQOL either directly through their pathological effects or indirectly by causing frailty

and disability (Hussien et al., 2021).

In Sri Lanka, the healthcare infrastructure supporting CKD patients is still developing, and the availability of HD centres is often limited to urban areas. Rural populations, especially those affected by CKD face additional barriers to accessing care, which may further exacerbate their HRQOL (Weerakoon et al., 2024). Previous studies have highlighted the need for targeted interventions to improve HRQOL in CKD patients, focusing on both medical and psychosocial aspects of care (Piyasena et al., 2024; Senanayake et al., 2020; Weerasooriya & Karunathilake, 2024). Given the unique socio-cultural and healthcare context of Sri Lanka, it is essential to understand the specific determinants of HRQOL among Sri Lankan HD patients undergoing HD to develop effective interventions.

Considering the high prevalence of CKD in Sri Lanka and its impact on affected individuals, the present study aims to assess the HRQOL of HD patients and identify key determinants influencing their well-being. The findings will guide to inform targeted interventions and improve patient care outcomes in the context of CKD management. Understanding these determinants will help healthcare providers and policymakers design patient-centered care strategies to enhance the well-being of CKD patients and improve the overall quality of HD care in the country.

Methodology

Research Design and Participants

This study employed a descriptive cross-sectional design conducted at two dialysis units (DUs) in the National Hospital of Sri Lanka (NHSL) among patients with CKD undergoing HD therapy from May to August 2022. The sample size was calculated according to the below mentioned equation (Lwanga et al., 1991). Where n = the required sample size, SD = the standard deviation of the difference between paired observations, $Z1-\alpha$ = the Z-value corresponding to the desired confidence level (1.96 for 95%), $Z\ 1-\beta$ = the Z-value corresponding to the power of the test (80%) and d =

expected mean difference (effect size) between the paired measurements

$$n = \frac{2SD^2\,(z_{1-\propto}) + (Z_{1-\beta})^2}{d^2}$$

Based on sample size calculations, a total of 110 CKD patients were invited to participate voluntarily. Participants were recruited using a simple random sampling technique. A list of patients registered for HD at the selected tertiary care hospital was obtained from the patient registry. Each patient on the list was assigned a unique number, and using a simple random sampling table, the participants were randomly selected from this numbered list. Eligible participants included both male and female patients with CKD aged between 18 and 85 years who had been receiving regular HD for over three months and had undergone treatment at least once a week. Patients with altered levels of consciousness, cognitive impairments, or disabilities were excluded from the study.

Study Instruments and Data Collection

Data were collected using an interviewer-administered questionnaire which has two sections. The first section was specifically designed to gather information on participants' socio-demographic characteristics, comorbidities, signs and symptoms of fluid overload, and fluid management status. Data for these aspects were collected through interviews with the patients and by referring to their clinical records maintained by the medical staff during their HD sessions.

The second section utilized in this study was the KDQOL-36™ tool, which has been validated for assessing HRQOL among patients with CKD in the Sri Lankan healthcare context (Senanayake et al., 2017). As reported, KDQOL-SF™ was shown a satisfactory construct validity and acceptable reliability. Reliability determined through Cronbach's alpha of all domains of the tool except for

cognitive function and social function, exceeded 0.7. Also, the tool was shown good test re-test reliability by indicating intra class correlation coefficients more than 0.8 for all the domains.

The KDQOL-36 instrument comprises 36 items divided into five subscales. The first two subscales serve as generic measures of HRQOL, including 12 items categorized into Physical Component Summary (PCS) and Mental Component Summary (MCS). The remaining three subscales are disease-specific and include: Burden of Kidney Disease (BKD): 4 items; Symptoms and Problems of Kidney Disease (SPKD): 12 items and Effects of Kidney Disease (EKD): 8 items. Responses for the BKD, SPKD, and EKD subscales are measured using a 6-point Likert scale (1 = all of the time, 2 = most of the time, 3 = a good bit of the time, 4 = some of the time, 5 = a little of the time, 6 = none of the time) (Ware et al., 1996). The scores for these items are transformed on a scale from 0 to 100, with higher scores indicating better HRQOL.

Before the data collection, the instruments were pre-tested among ten patients with CKD undergoing HD in the same setting, and those patients were excluded from the original study. Minor modifications were made to the first section of the questionnaire based on the pre-test. A "widow" option was added under social status to better reflect participants' marital situations. The employment status item was simplified and re-categorized as "employed" and "non-employed" for participant convenience and ease of analysis. Additionally, the urine output measurement cutoff was adjusted to 500ml to align with clinical relevance. A new item on peripheral edema was incorporated into the questionnaire to capture a more comprehensive assessment of the patient's fluid status. Patients who met the inclusion and exclusion criteria were recruited for the study. The Sinhala versions of the instruments were administered to participants upon their admission for HD sessions, ensuring that their treatment was not disrupted.

Ethical Considerations

Ethical clearance for this study was obtained from the Ethics Review Committee of the National Hospital of Sri Lanka (AAJ/ETH/COM/2022/APRIL), and permission for data collection was secured from the relevant hospital authorities. All participants volunteered for the study and provided written informed consent after receiving complete information about the study's purpose and procedures. They were informed of their right to withdraw from the study at any time. The privacy, anonymity, and confidentiality of all participants were ensured throughout the research process.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Frequencies, percentages, means, and standard deviations were calculated for demographic variables and to describe the scores of the study variables. Since the data sets were skewed, non-parametric tests, including the Mann-Whitney U test and the Kruskal-Wallis test, were performed to determine associations between KDQOL-36™ scores and various demographic characteristics, disease, and therapy-related variables. A significance level of $p< 0.05$ was established for all statistical tests.

Results

Socio-Demographic Characteristics of Participants

All invited participants (n=110) took part in the study, resulting in a response rate of 100%. The socio-demographic characteristics of the participants are summarized in Table 1. The sample was predominantly male (76.40%), with most participants aged between 51 and 70 years. Additionally, a significant proportion were married (81%), and 44.50% had completed education up to the General Certificate of Education (G.C.E) Ordinary Level (O/L).

HRQOL of Patients with CKD Undergoing HD

The findings from the KDQOL-36™ questionnaire revealed an average HRQOL score of 41.91±12.25, with a range from 14.86 to 77.93. The mean scores ± SD and their ranges across the five subscales SPKD, EKD, BKD, PCS, and MCS were 75.15±14.33 (range: 25.00–100); 46.73±20.57 (range: 3.13–93.75); 22.10±19.42 (range: 0.00–87.50); 34.00±8.79 (range: 19.25–56.58); 31.56±9.74 (range: 15.76–60.95) respectively. Additionally, the mean Kidney Disease Symptom Component (KDSC), derived from the total scores of SPKD, EKD, and BKD, was 47.99±15.75 (range: 10.42-93.75).

Table 1. *Socio-Demographic Characteristics of Participants (N=110)*

Characteristics	Category	n	%
Sex	Male	84	76.40
	Female	26	23.60
Age (years)	18 – 30	12	10.90
	31 – 50	43	39.10
	51 – 70	51	46.40
	71 – 85	04	3.60
Civil status	Single	16	14.50
	Married	89	81.00
	Widowed/ separated	05	4.50
Educational level	Not attended to school	01	0.90
	Grade 1 – 5	10	9.10
	Grade 6 – 8	17	15.50
	G.C.E.O/L	49	44.50
	G.C.E.A/L	24	21.80
	Diploma/degree	9	8.20
Employment	Employed	55	50.00
	Unemployed	55	50.00
Monthly income (LKR)	<25000.00	33	30.00
	25000.00 – 49999.00	44	40.00
	50000.00 – 75000.00	14	12.70
	>75000.00	19	17.30

G.C.E.O/L; General Certificate of Education Ordinary Level
G.C.E.A/L; General Certificate of Education Advanced Level
LKR; Sri Lankan Rupees

Correlations Between Subscales of KDQOL-36™

Table 2 presents the correlations between the subscales of SPKD, EKD, BKD, PCS, and MCS. Since the subscales were shown skewed, Spearman's rho tests were performed to obtain correlations between subscales. As revealed, there were moderate (r=0.40–0.59) to strong (r=0.60–0.79) correlations between all the subscales.

Table 2. *Correlations Between Subscales of KDQOL™*

		SPKD	EKD	BKD	PCS	MCS
SPKD	r	1.000	.611**	.590**	.534**	.471**
	p		.000	.000	.000	.000
EKD	r	.611**	1.000	.582**	.654**	.599**
	p	.000		.000	.000	.000
BKD	r	.590**	.582**	1.000	.499**	.582**
	p	.000	.000		.000	.000
PCS	r	.534**	.654**	.499**	1.000	.466**
	p	.000	.000	.000		.000
MCS	r	.471**	.599**	.582**	.466**	1.000
	p	.000	.000	.000	.000	

** Correlation is significant at the 0.01 level (2-tailed)

Association Between KDQOL-36™ Scores and Socio-Demographic Characteristics

Tables 3 and 4 present the findings regarding the associations between participants' characteristics and KDQOL-36™ subscale scores. Notably, a significantly higher BKD score was observed in males compared to females (p=0.009). Additionally, patients who had completed A/L or higher education levels exhibited significantly higher HRQOL scores in the SPKD (p=0.004), BKD (p=0.008), and PCS (p=0.000) compared to those who only studied up to O/L. Furthermore, significantly higher HRQOL scores were found in the SPKD (p=0.000), EKD (p=0.039), BKD (p=0.007), and PCS (p=0.006) subscales among participants with monthly income greater than LKR 50,000.00 compared to those with lower

incomes. However, no significant relationships were found between participants' age and the subscale scores ($p>0.05$).

Association Between KDQOL-36™ Subscale Scores and Comorbidities, Disease, and Therapy-Related Factors

The findings of the present study revealed significant associations between KDQOL-36™ subscale scores and various comorbidities, diseases, and therapy-related factors among patients with CKD undergoing HD (Tables 5 and 6). Notably, more than 55% (n=61) of the patients in this study had been undergoing HD for one year or less, while 44.5% had received treatment for more than one year. However, no significant association was found between the duration of HD and the subscale scores ($p>0.05$).

Approximately, 82% (n=90) of the patients received two HD sessions per week, while the remaining 18.2% (n=20) underwent only one session per week. The present findings did not show any significant associations between the number of HD sessions per week and the KDQOL-36™ subscale scores ($p>0.05$). Regarding comorbidities, patients with heart failure reported significantly lower scores for the SPKD subscale compared to those without the disease ($p=0.035$). However, no significant differences were observed in the subscale scores between CKD patients with and without hypertension, diabetes, or asthma ($p>0.05$).

The findings of this study indicated that the urine output levels also influenced HRQOL among CKD patients undergoing HD. Patients with urine output ≥500ml had significantly higher scores in SPKD ($p=0.018$) and PCS ($p=0.003$) compared to those with urine output less than 500ml.

Table 3. *Associations Between Socio-Demographic Characteristics and Subscales of SPKD, EKD, and BKD*

Variable	Category	SPKD			EKD			BKD		
		Median	IQR	*p*	Median	IQR	*p*	Median	IQR	*p*
Age	≤50 years	79.17	18.75	0.287	43.75	25.00	0.561	25.00	18.75	0.925
	>50 years	77.08	20.84		46.88	28.12		18.75	`12.50	
Sex	Male	79.17	18.23	0.291	46.88	33.60	0.137	25.00	17.19	0.009
	Female	73.96	18.23		37.50	16.40		12.50	12.50	
Civil status	Married	77.08	18.75	0.367	43.75	31.25	0.044	18.75	12.50	0.495
	Single	78.12	27.08		51.56	17.97		25.00	15.63	
	Widowed/ separated	91.67	30.21		78.13	37.50		25.00	84.38	
Educational level	Up to G.C.E.O/L	72.92	20.84	0.015	43.75	25.00	0.079	18.75	18.75	0.008
	Up to G.C.E. A/L	80.21	11.26		46.88	35.16		21.87	12.50	
	Diploma/ degree	87.50	19.79		59.38	32.82		25.00	46.88	
Employment	Employed	72.92	20.83	0.001	37.50	18.75	0.039	12.50	18.75	0.007
	Not employed	83.33	14.58		50.00	37.50		25.00	18.75	
Monthly income	≤50000LKR	77.08	20.84	0.099	43.75	23.44	0.019	18.75	18.75	0.012
	>50000LKR	81.25	16.67		53.13	40.62		25.00	37.50	

G.C.E.O/L; General Certificate of Education Ordinary Level
G.C.E.A/L; General Certificate of Education Advanced Level Significance $p<0.05$

Table 4. *Associations Between Socio-Demographic Characteristics and Subscales of PCS and MCS*

Variable	PCS			MCS		
	Median	IQR	*p*	Median	IQR	*p*
Age						
≤50 years	34.90	13.16	0.083	28.94	12.83	0.205
>50 years	31.92	12.83		31.01	11.81	
Sex						
Male	32.56	11.31	0.927	30.34	12.30	0.133
Female	33.03	11.90		27.81	10.35	
Civil status						
Married	32.08	11.29	0.495	29.41	10.08	0.327
Single	35.49	11.12		33.32	12.49	
Widow/separated	47.47	25.59		40.76	39.63	
Educational level						
Up to G.C.E. O/L	30.09	10.67	0.000	28.94	10.53	0.002
Up to G.C.E. A/L	36.55	14.56		34.22	13.47	
Diploma/degree	37.65	24.27		38.19	20.34	
Employment						
Employed	30.72	11.95	0.006	29.31	10.50	0.226
Not employed	35.61	14.30		30.74	12.71	
Monthly income						
≤50000 LKR	31.92	11.17	0.298	29.10	9.31	0.148
>50000 LKR	33.92	11.27		32.63	18.25	

G.C.E.O/L; General Certificate of Education Ordinary Level
G.C.E.A/L; General Certificate of Education Advanced Level
LKR; Sri Lankan Rupees
Significance $p<0.05$

Additionally, patients who actively monitored their daily intake exhibited markedly better scores across the SPKD (p=0.005), EKD (p=0.022), BKD (p=0.024), and PCS (p=0.003) subscales. Other variables, such as the duration of CKD and frequency of dialysis sessions, did not show statistically significant differences in HRQOL subscale scores (p>0.05).

Table 5. *Associations Between Disease Condition and Therapy-Related Factors and Subscales of SPKD, EKD, and BKD*

	SPKD			EKD			BKD		
Variable	Median	IQR	*p*	Median	IQR	*p*	Median	IQR	*p*
Duration of CKD (years)									
≤3	77.08	19.80	0.993	46.88	26.69	0.865	25.00	15.63	0.043
>3	77.08	20.84		43.75	31.25		12.50	18.75	
Urine output (ml)									
<500	75.00	20.84	0.018	43.75	27.35	0.085	18.75	12.50	0.295
≥500	83.33	13.02		54.69	41.41		25.00	34.38	
Measure daily intake									
Yes	76.04	18.23	0.005	43.75	24.22	0.022	15.62	17.49	0.024
No	79.17	18.75		46.88	31.25		18.75	12.50	

Association between KDQOL-36™ Subscale Scores and Signs and Symptoms

The association between HRQOL scores and various signs and symptoms of CKD patients receiving HD is presented in Tables 7 and 8. The findings indicate that shortness of breath, ascites, and peripheral edema are significantly associated with all five subscales of the KDQOL-36™, including SPKD, EKD, BKD, PCS, and MCS. Specifically, patients without these symptoms reported higher scores compared to those experiencing these symptoms (p<0.05). Similar associations were observed between patients with and without pulmonary edema across the SPKD, EKD, BKD, and

PCS subscales (p<0.05).

Table 6. *Associations Between Disease and Therapy-Related Factors and Subscales of PCS and MCS*

	PCS			MCS		
Variable	Median	IQR	*P*	Median	IQR	*p*
Duration of CKD (years)						
≤3	33.92	10.94	0.285	30.52	12.00	0.711
>3	30.72	13.19		29.31	12.23	
Urine output (ml)						
>500	31.51	10.42	0.003	30.36	12.32	0.346
≥500	39.84	15.58		34.81	20.74	
Measure daily intake						
Yes	30.85	09.63	0.006	29.75	17.13	0.439
No	33.93	12.17		30.28	11.07	

Discussion

Chronic kidney disease has been a growing public health concern in Sri Lanka for several decades. Yet, there remains a notable lack of evidence specifically addressing the HRQOL of patients undergoing HD. This study highlights the key findings that are crucial for healthcare providers to consider in their efforts to enhance the QoL for these patients.

Consistent with previous studies from Sri Lanka, Ethiopia, The current findings are in line with recent reports that Estrogen in females may have a protective effect on kidney function, whereas testosterone in males has been associated with faster progression of kidney disease (Lima-Posada & Bobadilla, 2021). Further, a recent study suggested that men are more prone to glomerular damage and proteinuria, accelerating CKD progression (Swartling et al., 2021).

Table 7. *Associations Between Signs and Symptoms and Subscales of SPKD, EKD & BKD*

Variable	SPKD			EKD			BKD		
	Median	IQR	*P*	Median	IQR	*P*	Median	IQR	*P*
Shortness of breath									
No	82.33	10.94	*0.000*	50.00	28.91	*0.001*	25.00	14.06	*0.010*
Yes	70.83	16.66		37.50	24.22		12.50	25.00	
Pulmonary edema									
No	79.17	16.67	*0.001*	50.00	31.25	*0.013*	21.87	12.50	*0.031*
Yes	68.75	19.27		37.50	18.75		12.50	20.31	
Ascites									
No	79.17	16.67	*0.000*	50.00	31.25	*0.008*	25.00	12.50	*0.005*
Yes	68.75	19.79		37.50	21.88		12.50	21.88	
Peripheral edema									
No	85.42	14.59	*0.000*	62.50	39.06	*0.001*	25.00	31.25	*0.008*
Yes	72.92	17.71		40.63	21.88		18.75	*18.75*	

The present study confirms global findings that highlight the diminished HRQOL in patients with CKD undergoing HD therapy. The overall HRQOL, as measured by the KDQOL-36™ scale, was found to be below average compared to the previous studies (Kim et al., 2021; Shumbusho et al., 2022), emphasizing the substantial impact CKD has on patients' lives. Except for the score for SPKD, all other subscale scores were considerably low, including EKD, BKD, PCS, and MCS. Comparatively, the markedly low BKD score reflects the profound burden experienced by CKD patients in the current study, consistent with previous studies on the subject (Senanayeka et al., 2020; Shumbusho et al., 2022). Present findings indicate moderate to strong correlations between all

KDQOL-36™ subscales, suggesting interrelatedness across the different QoL dimensions. These results suggest that improvements or declines in one aspect of quality of life are likely to impact other areas, highlighting the interconnectedness of physical, mental, and kidney disease-specific factors in CKD patients.

Table 8. *Associations Between Signs and Symptoms and Subscales of PCS & MCS*

Variable	PCS			MCS		
	Median	IQR	*P*	Median	IQR	*P*
Shortness of breath						
No	36.55	10.33	*0.000*	33.56	11.54	*0.001*
Yes	27.83	10.37		27.90	12.31	
Pulmonary edema						
No	35.40	11.53	*0.000*	30.89	11.27	*0.077*
Yes	27.21	05.39		29.12	10.57	
Ascites						
No	34.73	12.67	*0.008*	30.77	11.05	*0.001*
Yes	28.77	07.33		25.60	12.20	
Peripheral edema						
No	37.40	17.97	*0.000*	33.18	14.13	*0.017*
Yes	30.46	10.45		28.94	10.74	

The KDSC mean score of 47.99 (SD ±15.75) in the present study is significantly lower compared to findings from other studies, indicating a higher symptom burden among CKD patients in this cohort. For instance, the KDSC score reported in the rural community of Anuradhapura was 58.7 (SD±7.7), suggesting better symptom management in that population (Senanayake et al., 2020). In comparison, Mujais et al. (2009) reported a much higher KDSC score of 74.6 (SD±13.6) in North America, demonstrating superior symptom control, likely supported by more advanced healthcare systems and better access to treatment resources. These findings highlight the need for improved interventions to address the symptom burden in this patient group, as the low KDSC score reflects poorer QoL and greater challenges in

managing CKD symptoms effectively.

The PCS score in the present study is relatively like the study done in a rural community in Anuradhapura in Sri Lanka (Senanayeka et al., 2020). This similarity suggests that the physical well-being of CKD patients undergoing HD is similarly impacted, regardless of geographic or socio-economic differences. However, MCS scores show a notable difference, with the present study reporting 31.56±9.74, which is significantly lower than 39.6 (SD±12.3) in the study done in Anuradhapura (Senanayeka et al., 2020). This suggests that the mental health of CKD patients in the present study is more severely affected, potentially reflecting differences in mental health support or patient resilience. According to Mujais et al. (2009), The PCS (39.5±10.6) and MCS scores (49.8±10.4) were notably higher, suggesting better HRQOL in North America compared to the present study, where PCS and MCS scores are significantly lower despite both populations facing similar physical and mental health challenges.

The analysis of associations between participants' characteristics and KDQOL-36™ subscale scores reveals several important factors influencing HRQOL in HD patients. Notably, male participants showed significantly higher scores in the BKD subscale compared to females, suggesting that males may perceive less burden from their disease. Present finding contrasts with some studies (Mujais et al., 2009; Mousa et al., 2018; Tommel et al., 2020), which did not find significant gender differences in HRQOL scores, though some research indicates that women with CKD often report lower HRQOL (Gebrie et al., 2023; Sharma et al., 2018; Shumbusho et al., 2022), possibly due to differences in emotional and social impacts. This gender disparity underscores the importance of gender-sensitive approaches to managing CKD, especially for female patients, who may require additional psychosocial support to improve their perceived burden of illness.

Education level also plays a critical role in HRQOL. Patients who studied up to A/L or above had significantly higher scores in PCS and MCS sub scales. This indicates that higher education may

contribute to better HRQOL by improving the patients' understanding of their condition and treatment, leading to better coping strategies. Previous studies have similarly reported that better-educated patients tend to have higher HRQOL scores (Yusop et al., 2013; Mousa et al., 2018., Sharma et al., 2019), likely due to improved health literacy and self-management capabilities. This finding highlights the potential benefit of educational interventions to enhance patient outcomes, especially for those with lower levels of education.

Income also emerged as a significant factor. Patients with a monthly income exceeding LKR 50,000.00 had higher HRQOL scores in the EKD, and BKD subscales compared to those with lower incomes. This result aligns with global research, which consistently demonstrates that socioeconomic status is a key determinant of HRQOL in patients with chronic disease. Higher-income likely provides better access to healthcare, medications, and resources for symptom management, contributing to improved physical and mental well-being. Studies such as Mujais et al. (2009), Mousa et al. (2018), and Senanayake et al. (2020) have also noted similar associations between income and HRQOL in CKD patients, emphasizing that economic stability plays a pivotal role in managing the disease burden.

Interestingly, there were no significant associations found between the participants' age and the KDQOL-36™ subscale scores suggesting that age might not be a primary determinant of HRQOL in this cohort. This is in contrast to existing studies, where older age has been linked with lower HRQOL (Mousa et al., 2018; Sharma et al., 2019; Kim et al., 2021) due to physical decline and comorbidities. Ethiopian and Egyptian studies have found significantly lower scores for BKD for elderly patients than younger patients (Bayoumi et al., 2013; Kim et al., 2021). The lack of age-related differences in the present study could indicate that, in this population, factors such as education, income, and gender have a more profound impact on HRQOL than age.

The present study's findings highlight the important associations between KDQOL-36™ subscale scores and various health and treatment-related factors among CKD patients undergoing HD. As shown in previous studies, the number of dialysis has a negative impact on the overall QoL of dialysis patients (Sharma et al., 2018; Kim et al., 2021; Gebrie et al., 2024). Interestingly, the present study found no significant associations between the duration of dialysis or the number of HD sessions per week and the KDQOL-36™ subscale scores ($p > 0.05$). Similarly, a study from Palestine also found that neither the frequency nor the duration of dialysis sessions significantly influenced QoL among HD patients (Mousa et al., 2018).

In terms of comorbidities, the present study observed that patients with heart failure had significantly lower scores in the SPKD of the KDQOL-36™. However, no significant differences were noted for CKD patients with comorbidities such as hypertension, diabetes mellitus, or asthma. This finding aligns with research from several contexts (Moua et al., 2018; Senanayake et al., 2020; Pretto et al., 2020), which reported that the presence of comorbidities negatively affected HRQOL in CKD patients, though the impact varied depending on the specific condition. Similarly, the Palestinian study found that a higher number of comorbid diseases was associated with lower QoL among HD patients (Mousa et al., 2018). These findings suggest that while certain comorbidities, like heart failure, may significantly influence HRQOL, the impact of others, such as hypertension and diabetes, may be less pronounced. Having multiple comorbidities seems to increase the burden of physical and psycho-emotional symptoms, along with the need for more intensive care. This leads to greater limitations in daily functioning, ultimately worsening the QoL and accelerating the progression of the disease.

A notable finding from the present study is the significant association between the urine output and HRQOL. Patients with a urine output of 500ml or more had significantly higher SPKD and PCS scores compared to those with lower urine output. This

relationship is well-supported in the literature, with previous studies indicating that preserved urine output; a marker of residual kidney function—correlates with better HRQOL outcomes (Senanayeka et al., 2020). Additionally, the study found that patients who actively monitored their daily intake had markedly better scores across several KDQOL-36™ subscales, underscoring the importance of self-management behaviours in enhancing HRQOL. Research from Palestine similarly highlights that self-management activities, such as fluid and dietary monitoring, are associated with improved QoL in HD patients (Mousa et al., 2018).

The present study highlights the importance of symptom management in improving overall QoL for HD patients. As found. symptoms such as shortness of breath, ascites, and peripheral edema significantly impact the HRQOL in CKD patients undergoing HD, as measured across all five KDQOL-36™ subscales (SPKD, EKD, BKD, PCS, and MCS). Patients without these symptoms reported higher HRQOL scores compared to those with these symptoms. Similarly, pulmonary edema was associated with lower HRQOL scores across four subscales (SPKD, EKD, BKD, and PCS), indicating that fluid-related symptoms and respiratory complications substantially reduce both physical and mental well-being in this patient group. Research from the United Kingdom has shown that chronic edema is associated with reduced QoL, particularly in physical and emotional capacities, as well as overall HRQOL (Moffatt et al., 2017).

These findings suggest that while certain clinical factors like the duration or frequency of HD may not significantly affect HRQOL, other factors such as comorbidities, residual kidney function, and self-management behaviours play crucial roles. Interventions aimed at improving these aspects managing comorbid conditions, preserving urine output, and fostering effective self-management strategies could potentially enhance HRQOL in CKD patients undergoing HD.

Limitations

The limitations of this study include being conducted in a single setting in Sri Lanka, limiting its ability to reflect the experiences of CKD patients in other regions. Furthermore, data collection relied on interviews, which may introduce bias due to self-reporting and potential inaccuracies in patient responses.

Conclusions

This study highlights the considerable impact of CKD and HD therapy on the patient's HRQOL. Findings show that overall HRQOL scores as well as in the areas of BKD, EKD, PCS, and MCS, were lower than average. The study underscores the interconnectedness of physical, mental, and kidney-specific dimensions of QoL, suggesting that any improvement or decline in one area is likely to influence other aspects. The study identifies key factors affecting HRQOL, such as gender, level of education, and income. Male patients reported a lower perceived burden of kidney disease compared to females, indicating that gender plays a role in how patients experience CKD. Additionally, patients with higher levels of education and income demonstrated better HRQOL scores, likely due to a better understanding of their condition and improved access to resources. These findings emphasize the importance of addressing socioeconomic disparities to enhance patient outcomes and QoL. Comorbidities were also shown to influence HRQOL, particularly for patients with heart failure, who had significantly lower scores in certain areas. This highlights the additional burden that certain health conditions place on CKD patients. The study also found that patients with higher urine output, an indicator of residual kidney function, reported better HRQOL. This underscores the importance of preserving kidney function to improve overall QoL.

In conclusion, the study demonstrates the need for a comprehensive approach to managing CKD that addresses both the physical and psychosocial aspects of the disease. By focusing on symptom management, supporting self-care behaviours, and

considering factors such as gender, level of education, and income, healthcare providers could improve the QoL for CKD patients undergoing HD. Tailored interventions that address these specific needs are essential in enhancing the overall well-being of these patients.

Conflict of interest

The authors declare that they have no conflicts of interest

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