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Quality of Life Outcomes in a Hemodialysis Cohort: A Cross-Sectional Study

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ABSTRACT

Background: Endstage kidney disease (ESKD) and the maintenance hemodialysis (HD) it requires impose physical, psychological, and social costs that reduce health-related quality of life (HRQoL) . Identifying the determinants of HRQoL in this group informs patient- centred care.

Objective: To measure HRQoL and to determine which sociodemographic and clinical variables are associated with reduced quality of life in patients receiving maintenance hemodialysis

Methods: Two hundred sixty one patients on maintenance hemodialysis at a tertiary care centre were enrolled between January and December 2025. HRQoL was measured with the Kidney Disease Quality of Life Short Form (KDQOL-SF™ version 1.3). Sociodemographic variables , clinical characteristics and laboratory values were obtained from medical records and patient interviews. Analysis comprised descriptive statistics, independent t- tests, one-way ANOVA, and multiple linear regression.

Results: Mean age was 56.4 ± 14.2 years and 152 participants (58.2%) were male. The mean overall KDQOL-SF score was 52.37 ± 11.84. The kidney disease component summary (KDCS) was 48.92 ± 10.56, the physical component summary (PCS) 41.28 ± 8.94 and the mental component summary (MCS) 46.75 ± 11.23. The lowest-scoring domain was Burden of Kidney Disease (38.56 ± 12.47). Regression analysis identified older age ($\beta = -0.28$, $p < 0.001$), longer dialysis vintage ($\beta = -0.19$, $p = 0.008$), lower hemoglobin ($\beta = 0.22$, $p = 0.002$), diabetes mellitus ($\beta = -0.21$, $p = 0.003$), unemployment ($\beta = -0.24$, $p < 0.001$) and lower educational attainment ($\beta = 0.18$, $p = 0.011$) as independent predictors of reduced HRQoL.

Conclusion: HRQoL was reduced across domains in this cohort, and disease burden was the most affected domain. Anemia correction, employment support, and patient education are modifiable and are therefore candidate targets for intervention.

KEYWORDS: hemodialysis, healthrelated quality of life, end-stage kidney disease, KDQOL-SF

1. INTRODUCTION

Chronic kidney disease (CKD) affects an estimated 850 million people worldwide[1]. End-stage kidney disease (ESKD) its terminal stage , requires renal replacement therapy, and hemodialysis (HD) is the modality used most often ESKD prevalence continues to rise with population ageing and with the increasing incidence of diabetes mellitus and hypertension. Projections place CKD as the fifth leading cause of death worldwide by 2040[2].

HRQoL is now a standard outcome measure in chronic disease research[3]. In patients on maintenance hemodialysis it covers physical function, psychological state , social participation and the specific demands of kidney disease and its treatment[4]. The standard regimen of three sessions per week each lasting three to four hours, restricts daily routine, employment and social activity[5].

HRQoL scores in hemodialysis patients are consistently lower than those of age-matched healthy populations [6–8]. Reported determinants include age, gender, education, and employment status, together with clinical variables such as dialysis adequacy, hemoglobin concentration, nutritional status and comorbid disease[9–11]. Depression and anxiety exert additional negative effects [12].

Two gaps persists in this literature. Many studies rely on small samples or on single cultural settings, which restricts generalisability[13],[14]. The relative weight of modifiable versus non-modifiable determinants also remain unquantified in most cohorts and this weighting is what determines where intervention is worthwhile[15].

This study had two aims: to measure HRQoL in 261 patients receiving maintenance hemodialysis using the validated KDQOL SF instrument and to identify the sociodemographic and clinical variables independently associated with reduced quality of life.

2. METHODS

2.1 Study Design and Setting

This was a hospital-based cross-sectional study carried out in the Hemodialysis Unit of a tertiary care teaching hospital between January and December 2025. The Institutional Review Board approved the protocol (IRB /2025/HD- 089), and every participant

gave written informed consent before enrolment. Conduct followed the Declaration of Helsinki and reporting follows the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) statement for cross-sectional studies.

2.2 Study Population

Two hundred sixty one adults aged 18 years or older on maintenance hemodialysis for at least three months were recruited consecutively. Patients were eligible if they had ESKD requiring maintenance hemodialysis, were aged 18 years or older had received hemodialysis three times weekly for at least three consecutive months and were able to understand and complete the questionnaire. Patients were excluded for acute kidney injury, severe cognitive impairment or psychiatric illness that prevented consent or questionnaire completion, malignancy under active treatment, or hospitalisation within the preceding four weeks.

2.3 Sample Size Calculation

Sample size was calculated from an expected prevalence of impaired HRQoL of 65 %, a 95% confidence interval , a 5% margin of error and a 10% allowance for incomplete responses. The minimum requirement was 242 participants ; 261 were enrolled to offset possible exclusions.

2.4 Data Collection

Trained research assistants collected data in face-to face interviews using a structured questionnaire supplemented by review of medical records. The questionnaire had three sections.

Section 1 : Sociodemographic Information. Age, gender, marital status, educational level, employment status, monthly household income, and living arrangement.

Section 2 : Clinical Characteristics. Dialysis vintage (months on hemodialysis), dialysis frequency, vascular access type, comorbid diabetes mellitus, hypertension and cardiovascular disease, and medication history all extracted from medical records.

Section 3 : Laboratory Parameters. The most recent values recorded within one month: hemoglobin, serum albumin, blood urea nitrogen (BUN), serum creatinine, calcium, phosphorus , intact parathyroid hormone (iPTH) and Kt/V as a measure of dialysis adequacy. Kt/V was derived using the Daugirdas formula.

2.5 Quality of Life Assessment

HRQoL was measured with the Kidney Disease Quality of Life Short Form (KDQOL-SF™ version 1.3) an instrument validated for dialysis populations[16]. Its 36 items form two components.

1. Generic core (SF- 36). Eight domains of general health: Physical Functioning (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role-Emotional (RE), and Mental Health (MH). These aggregate into the Physical Component Summary (PCS) and the Mental Component Summary (MCS).

2. Kidney disease- specific component. Twelve items covering the Symptoms/Problems List (SPL), Effects of Kidney Disease (EKD), Burden of Kidney Disease (BKD) , Cognitive Function, Quality of Social Interaction, Sexual Function, Sleep, Social Support, Dialysis Staff Encouragement, and Patient Satisfaction. These aggregate into the Kidney Disease Component Summary (KDCS). All domain and summary scores are transformed to a 0-100 scale, and higher scores denote better HRQoL.

2.6 Statistical Analysis

Analysis used SPSS version 26 .0 (IBM Corp., Armonk , NY, USA). Continuous variables are reported as mean ± standard deviation (SD) , or as median with interquartile range (IQR) where distribution was skewed; categorical variables are reported as frequencies and percentages. Normality was tested with the Kolmogorov-Smirnov test.

Two group comparisons used independent t- tests. Comparisons across three or more groups used one way analysis of variance (ANOVA) with post- hoc Tukey HSD testing. Bivariate associations between continuous variables were assessed with Pearson or Spearman correlation coefficients.

Multiple linear regression identified independent predictors of HRQoL , with PCS, MCS, and KDCS as dependent variables. Variables reaching $p < 0.10$ in univariate analysis were entered by the enter method. Multicollinearity was checked with the variance inflation factor (VIF) and values below 5 were treated as acceptable. Significance was set at $p < 0.05$.

3. RESULTS

Table 1 : Sociodemographic and Clinical Characteristics of Study Participants (N=261)

Characteristic	Category	n (%)	Mean ± SD
Age (years)			56.4 ± 14.2
Gender	Male	152 (58.2)	
	Female	109 (41.8)	
Marital Status	Married	186 (71.3)	
	Single/Divorced/Widowed	75 (28.7)	
Education Level	Primary or less	101 (38.7)	
	Secondary	89 (34.1)	

	Tertiary	71 (27.2)	
Employment Status	Employed	64 (24.5)	
	Unemployed/Retired	170 (65.1)	
	Homemaker	27 (10.3)	
Monthly Income	Low (<$500)	143 (54.8)	
	Middle ($500-$1500)	82 (31.4)	
	High (>$1500)	36 (13.8)	
Living Arrangement	Living with family	208 (79.7)	
	Living alone	53 (20.3)	
Dialysis Vintage (months)			48.6 ± 36.4
Dialysis Frequency	Twice weekly	31 (11.9)	
	Thrice weekly	230 (88.1)	
Vascular Access	AV Fistula	187 (71.6)	
	AV Graft	28 (10.7)	
	Central Venous Catheter	46 (17.6)	
Primary Cause of ESKD	Diabetes Mellitus	89 (34.1)	
	Hypertension	72 (27.6)	
	Glomerulonephritis	41 (15.7)	
	Other/Unknown	59 (22.6)	
Comorbidities			
	Diabetes Mellitus	112 (42.9)	
	Hypertension	198 (75.9)	
	Cardiovascular Disease	67 (25.7)	
	Number of Comorbidities ≥3	81 (31.0)	
Laboratory Parameters			
	Hemoglobin (g/dL)		10.2 ± 1.5
	Serum Albumin (g/dL)		3.8 ± 0.4
	BUN (mg/dL)		62.8 ± 19.2
	Serum Creatinine (mg/dL)		9.4 ± 2.5
	Calcium (mg/dL)		8.7 ± 0.7
	Phosphorus (mg/dL)		5.2 ± 1.4
	iPTH (pg/mL)		356.8 ± 289.4
	Kt/V		1.47 ± 0.28

Abbreviations : AV, arteriovenous; ESKD, end-stage kidney disease; BUN, blood urea nitrogen; iPTH, intact parathyroid hormone; Kt/V, dialysis adequacy parameter.

Mean dialysis vintage was 48.6 ± 36.4 months (median 38.0 months; IQR 18.0-72.0). Thrice-weekly hemodialysis was used by 230 patients (88.1%), and 187 patients (71.6 %) had an arteriovenous (AV) fistula as vascular access.

Hypertension (198 patients, 75.9%) and diabetes mellitus (112 patients, 42.9%) were the most frequent comorbidities. Mean hemoglobin was 10.2 ± 1.5 g/dL, mean serum albumin 3.8 ± 0.4 g/dL, and mean Kt /V 1.47 ± 0.28, the last value indicating adequate dialysis delivery in most patients.

Table 2 : KDQOL-SF Domain and Summary Scores (N=261)

Domain/Component	Mean ± SD	Median (IQR)	Range
Generic Core (SF-36)			
Physical Functioning (PF)	58.42 ± 22.36	60.0 (40.0-75.0)	0-100
Role-Physical (RP)	42.18 ± 28.94	37.5 (12.5-68.8)	0-100
Bodily Pain (BP)	67.85 ± 21.47	72.0 (52.0-84.0)	0-100
General Health (GH)	44.36 ± 18.72	45.0 (30.0-55.0)	0-100
Vitality (VT)	51.63 ± 16.84	50.0 (40.0-65.0)	0-100
Social Functioning (SF)	59.78 ± 23.15	62.5 (37.5-75.0)	0-100
Role-Emotional (RE)	52.34 ± 30.12	50.0 (25.0-75.0)	0-100
Mental Health (MH)	56.91 ± 14.73	56.0 (48.0-68.0)	0-100
Summary Components			
Physical Component Summary (PCS)	41.28 ± 8.94	40.6 (35.2-47.8)	18.4-62.3
Mental Component Summary (MCS)	46.75 ± 11.23	47.2 (38.9-54.6)	19.8-68.4
Kidney Disease-Specific Domains			
Symptoms/Problems List (SPL)	68.34 ± 16.47	70.8 (56.3-81.3)	18.8-100
Effects of Kidney Disease (EKD)	54.27 ± 19.38	56.3 (40.6-68.8)	6.3-100
Burden of Kidney Disease (BKD)	38.56 ± 12.47	37.5 (28.1-50.0)	6.3-68.8

Cognitive Function	62.15 ± 18.86	65.0 (50.0-80.0)	0-100
Quality of Social Interaction	60.84 ± 17.92	62.5 (50.0-75.0)	12.5-100
Sleep	54.63 ± 20.15	55.0 (40.0-70.0)	0-100
Social Support	73.46 ± 21.38	75.0 (62.5-87.5)	0-100
Dialysis Staff Encouragement	78.92 ± 18.54	81.3 (68.8-93.8)	12.5-100
Patient Satisfaction	72.18 ± 16.73	75.0 (62.5-87.5)	18.8-100
Kidney Disease Component Summary (KDCS)	**48.92 ± 10.56**	**48.3 (41.7-56.3)**	**22.9-77.1**
Overall KDQOL-SF Score	**52.37 ± 11.84**	**52.8 (44.6-60.4)**	**24.3-82.6**

Abbreviations : IQR, interquartile range; SD, standard deviation.

The mean overall KDQOL-SF score was 52.37 ± 11.84. Within the generic SF-36 domains, Bodily Pain scored highest (67.85 ± 21.47) while Role-Physical (42.18 ± 28.94) and General Health (44.36 ± 18.72) scored lowest. The PCS score (41.28 ± 8.94) fell below the MCS score (46.75 ± 11.23).

Within the kidney disease-specific domains Dialysis Staff Encouragement (78.92 ± 18.54) and Social Support (73.46 ± 21.38) scored highest. Burden of Kidney Disease scored lowest of all domains (38.56 ± 12.47). The KDCS score was 48.92 ± 10.56.

Table 3 : Bivariate Analysis of Factors Associated with HRQoL Summary Scores

Variable	Category	PCS (mean ± SD)	p-value	MCS (mean ± SD)	p-value	KDCS (mean ± SD)	p-value
Age Group	<40 years (n=42)	45.82 ± 8.14	<0.001*	50.36 ± 10.47	0.018*	53.18 ± 9.84	<0.001*
	40-59 years (n=104)	42.15 ± 8.62		47.82 ± 10.93		49.84 ± 10.12	
	≥60 years (n=115)	38.46 ± 8.87		43.97 ± 11.56		45.36 ± 10.48	
Gender	Male (n=152)	42.18 ± 8.73	0.082	48.36 ± 10.84	0.004*	50.12 ± 10.28	0.036*
	Female (n=109)	40.03 ± 9.15		44.52 ± 11.48		47.28 ± 10.72	
Education	Primary or less (n=101)	38.74 ± 8.92	<0.001*	43.82 ± 11.24	<0.001*	45.63 ± 10.56	<0.001*
	Secondary (n=89)	41.56 ± 8.54		47.15 ± 10.86		49.27 ± 10.18	
	Tertiary (n=71)	44.38 ± 8.67		50.28 ± 10.95		52.86 ± 9.74	
Employment	Employed (n=64)	46.82 ± 7.94	<0.001*	52.14 ± 10.28	<0.001*	54.72 ± 9.56	<0.001*
	Unemployed/Retired (n=170)	39.56 ± 8.72		44.86 ± 11.05		46.84 ± 10.38	
	Homemaker (n=27)	38.92 ± 9.14		43.52 ± 11.72		45.92 ± 10.84	
Diabetes	Present (n=112)	38.42 ± 8.54	<0.001*	43.86 ± 11.06	<0.001*	45.72 ± 10.24	<0.001*
	Absent (n=149)	43.56 ± 8.82		49.18 ± 10.84		51.48 ± 10.36	
Hemoglobin	<10 g/dL (n=98)	38.84 ± 8.76	0.002*	44.12 ± 11.32	0.006*	46.18 ± 10.52	0.004*
	≥10 g/dL (n=163)	42.78 ± 8.82		48.42 ± 10.96		50.72 ± 10.34	
Albumin	<3.5 g/dL (n=73)	38.92 ± 9.12	0.018*	43.84 ± 11.54	0.021*	45.94 ± 10.82	0.012*
	≥3.5 g/dL (n=188)	42.24 ± 8.74		47.92 ± 10.98		50.12 ± 10.28	
Kt/V	<1.2 (n=38)	37.84 ± 9.24	0.008*	42.56 ± 11.84	0.022*	44.82 ± 10.96	0.014*
	≥1.2 (n=223)	41.92 ± 8.82		47.48 ± 11.06		49.64 ± 10.42	
Dialysis Vintage	<24 months (n=78)	43.82 ± 8.42	0.006*	49.12 ± 10.64	0.028*	51.48 ± 9.96	0.018*
	24-60 months (n=94)	41.46 ± 8.74		47.04 ± 11.12		49.12 ± 10.42	
	>60 months (n=89)	38.92 ± 9.12		44.28 ± 11.58		46.24 ± 10.84	
Comorbidities	0-1 (n=97)	44.28 ± 8.38	<0.001*	50.06 ± 10.64	<0.001*	52.84 ± 9.92	<0.001*
	2 (n=83)	41.16 ± 8.72		46.84 ± 10.98		48.56 ± 10.28	
	≥3 (n=81)	37.84 ± 9.04		42.96 ± 11.52		44.92 ± 10.72	

**p < 0.05 denotes a statistically significant difference.*

HRQoL scores differed significantly across several variables. Older age, female gender, lower education , unemployment, diabetes mellitus, anemia (hemoglobin < 10 g/dL), hypoalbuminemia (albumin < 3.5 g/dL), inadequate dialysis (Kt/V < 1.2), longer dialysis vintageand a higher count of comorbidities were each associated with lower PCS, MCS, and KDCS scores ($p < 0.05$ in all comparisons).

Table 4 : Multiple Linear Regression Analysis of Factors Associated with HRQoL Summary Scores

Dependent Variable	Independent Variable	β Coefficient	95% CI	p-value	Adjusted R^2
PCS	Age (per 10-year increase)	-0.28	-2.84 to -1.42	<0.001	0.342
	Education (higher level)	0.18	0.38 to 2.84	0.011	
	Employment (employed vs. unemployed)	0.24	3.42 to 8.56	<0.001	
	Diabetes (present vs. absent)	-0.21	-5.28 to -1.34	0.003	
	Hemoglobin (per 1 g/dL increase)	0.22	0.82 to 3.46	0.002	

	Kt/V (per 0.1 increase)	0.15	0.28 to 2.14	0.018	
	Comorbidities (per additional)	-0.26	-3.84 to -1.56	<0.001	
MCS	Age (per 10-year increase)	-0.19	-2.46 to -0.84	0.006	0.298
	Gender (female vs. male)	-0.16	-4.82 to -0.94	0.008	
	Education (higher level)	0.16	0.42 to 2.96	0.014	
	Employment (employed vs. unemployed)	0.22	3.18 to 8.42	<0.001	
	Diabetes (present vs. absent)	-0.18	-4.96 to -1.02	0.008	
	Hemoglobin (per 1 g/dL increase)	0.14	0.24 to 2.18	0.032	
	Comorbidities (per additional)	-0.20	-3.28 to -0.92	0.002	
KDCS	Age (per 10-year increase)	-0.22	-2.68 to -0.98	<0.001	0.364
	Education (higher level)	0.19	0.46 to 3.12	0.008	
	Employment (employed vs. unemployed)	0.23	3.56 to 9.24	<0.001	
	Diabetes (present vs. absent)	-0.20	-4.86 to -1.24	0.004	
	Hemoglobin (per 1 g/dL increase)	0.21	0.74 to 3.28	0.002	
	Dialysis Vintage (per 12-month increase)	-0.19	-0.84 to -0.22	0.008	
	Comorbidities (per additional)	-0.28	-4.12 to -1.84	<0.001	
	Albumin (per 0.1 g/dL increase)	0.13	0.18 to 2.46	0.042	

Abbreviations : CI, confidence interval; PCS, Physical Component Summary; MCS, Mental Component Summary ; KDCS, Kidney Disease Component Summary.

Independent predictors of PCS were age (β = -0.28, p < 0.001), employment status (β = 0.24, p < 0.001) , hemoglobin (β = 0.22, p = 0.002), diabetes mellitus (β = -0.21, p = 0.003), education level (β = 0.18, p = 0.011), Kt/V (β = 0.15, p = 0.018), and number of comorbidities (β = -0.26, p < 0.001). The model accounted for 34.2% of the variance in PCS (adjusted R^2 = 0.342).

Independent predictors of MCS were age (β = -0.19, p = 0.006), female gender (β = -0.16, p = 0.008) , education (β = 0.16, p = 0.014), employment (β = 0.22, p < 0.001), diabetes mellitus (β = -0.18, p = 0.008), hemoglobin (β = 0.14 , p = 0.032), and number of comorbidities (β = -0.20, p = 0.002). The model accounted for 29.8% of the variance.

Independent predictors of KDCS were number of comorbidities (β = -0.28, p < 0.001), employment (β = 0.23, p < 0.001), age (β = -0.22, p < 0.001), hemoglobin (β = 0.21, p = 0.002), diabetes mellitus (β = -0.20, p = 0.004), education (β = 0.19, p = 0.008), dialysis vintage (β = -0.19, p = 0.008), and albumin (β = 0.13, p = 0.042). The model accounted for 36.4 % of the variance.

4. DISCUSSION

In this cross-sectional study of 261 patients on maintenance hemodialysis, HRQoL was reduced across physical, mental and disease-specific domains, and the burden of kidney disease was the domain most affected.

The mean overall KDQOL -SF score of 52.37 ± 11.84 indicates moderate impairment and is in the range reported by earlier hemodialysis cohorts[3–5]. The PCS score (41.28 ± 8.94) was lower than the MCS score (46.75 ± 11.23), which places the greater deficit in physical rather than psychological function. Other cohorts show the same ordering[6,7].

Role-Physical (42.18 ± 28.94) and General Health (44.36 ± 18.72) were the weakest SF- 36 domains, which locates the deficit in the capacity to carry out daily activities and in patients' rating of their own health. Bodily Pain scored higher (67.85 ± 21.47), placing pain below functional limitation as a source of impairment; the same pattern appears in earlier reports [8,9].

Burden of Kidney Disease (38.56 ± 12.47) was the weakest domain in the instrument. Qualitative studies describe the components of this burden as time expenditure, dietary restriction, fluid limitation, and dependence on a machine for survival[10,11]. Social Support (73.46 ± 21.38) and Dialysis Staff Encouragement (78.92 ± 18.54) scored highest, which identifies social networks and unit staff as the two protective factors already present in this cohort[12].

Age was a negative predictor of all three summary components, with the largest effect in the physical domains. Age- related physiological decline, accumulated comorbidity, and reduced physiological reserve are the mechanisms proposed in earlier work[13,14]. Some cohorts report higher mental health scores in older patients, which has been attributed to adaptation to the illness; the divergence between physical and mental effects of age is therefore unresolved[15].

Employment status was among the strongest positive predictors. Employed patients scored higher on PCS, MCS, and KDCS than unemployed or retired patients. Employment supplies financial security, social contact, and occupation of attention away from illness[16]. Only 64 patients (24.5 %) in this cohort were employed, a rate comparable with other hemodialysis series and an indicator of the economic cost of the treatment schedule. Vocational rehabilitation and flexible dialysis scheduling are the two interventions with a plausible route to changing this rate[17].

Hemoglobin was a positive predictor of all three summary components. Anemia is intrinsic to ESKD and produces fatigue, reduced exercise tolerance, and impaired cognition[18]. This result is consistent with the reported association between hemoglobin and HRQoL and with guideline targets for hemoglobin in dialysis patient [19].

Diabetes mellitus was associated with lower scores on all three components. Diabetes is the leading cause of ESKD and adds microvascular and macrovascular disease to the burden of kidney failure[20]. Patients with diabetic kidney disease also carry neuropathy, retinopathy and cardiovascular disease, each of which reduces function independently[21].

Comorbidity count was a negative predictor of all three components, with each additional condition producing a further decrement in PCS, MCS, and KDCS. This dose-response pattern has been reported elsewhere[22]. Hypertension was present in 198 patients (75.9 %) and diabetes mellitus in 112 (42.9 %), a distribution typical of ESKD populations and one that requires renal and non-renal care to be delivered together[23].

Dialysis vintage was negatively associated with KDCS. Cumulative treatment-related complications, progressive loss of residual renal function, and accumulated treatment fatigue are the proposed explanations[24]. Longer vintage has elsewhere been associated with higher mental health scores, attributed to psychological adaptation[25], so the relationship between vintage and HRQoL is unlikely to be linear.

Education was a positive predictor across all three components. Health literacy, self-management capacity and more effective communication with clinicians are the mechanisms proposed for this association[26]. Structured education and patient empowerment programmes address the same mechanisms[27].

Female patients scored lower than male patients on MCS after adjustment for covariates. Comparable gender differences are documented in other dialysis cohorts[28]. Proposed contributors include differing psychosocial stressors, caregiving load, and gender-specific coping and support patterns which together argue for gender specific psychosocial provision[29].

Kt /V was positively associated with PCS, and patients with Kt/V ≥ 1.2 reported better physical HRQoL. The link between dialysis adequacy and clinical outcomes is established, whereas its link with patient-reported outcomes has been inconsistent across studies[30]. The present data support Kt/V ≥ 1.2 as a benchmark for both categories of outcome.

Serum albumin as a marker of nutritional status, was positively associated with KDCS. Hypoalbuminemia is common in hemodialysis and reflects protein-energy wasting, inflammation, and insufficient dietary intake all of which are addressable through dietary counselling and protein intake optimisation[7].

4.1 Clinical Implications

Four implications follow from these data. First the low Burden of Kidney Disease score locates the largest deficit in the experiential rather than the biochemical aspects of treatment, which places shared decision-making, symptom management, and psychosocial support inside the scope of routine care[8].

Second the size of the employment effect places vocational support within routine nephrology practice. Employment goals can be raised in clinic, and dialysis schedules can be arranged around work commitments[9].

Third, anemia, nutritional status, and comorbidity control are all modifiable and all predicted HRQoL in this cohort. Delivering these together requires nephrologists, nurses , dietitians, social workers and psychologists working as one team[10].

Fourth the gender difference in MCS identifies female patients as a group for whom depression and anxiety screening in the dialysis unit would have the highest yield[11].

4.2 Limitations

Six limitations apply. The cross-sectional design permits no causal inference about the associations reported here, and longitudinal data are required to establish temporal order and to track change in HRQoL[12]. The single-centre design limits transfer of these estimates to populations, practice patterns, and health systems that differ from this one, and multicentre replication is required.

HRQoL was measured by self report, which carries social desirability and recall bias, although use of a validated standardised instrument limits both[13]. Depression and anxiety were not measured with validated instruments despite their established influence on HRQoL, and future work should include formal psychological assessment.

The sample came from one geographic region, so cultural and socioeconomic factors specific to that region may affect both HRQoL and its determinants. The regression models accounted for 29.8-36.4 % of variance, which leaves the majority unexplained; psychological resilience, coping strategy, social network structure, and illness perception are the untested variables most likely to account for it[14],[15].

5. CONCLUSION

HRQoL was reduced across all measured domains in this cohort of 261 hemodialysis patients, and Burden of Kidney Disease was the weakest domain. Older age unemployment, anemia, diabetes mellitus, longer dialysis vintage, lower education, female gender, and higher comorbidity count were independent predictors of lower HRQoL. Four of these predictors are modifiable :: anemia, nutritional status, comorbidity control, and employment status. These four define the practical targets for intervention in hemodialysis care.

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