Non comunicable diseases

Health-related quality of life of patients with chronic kidney disease: Does it improve after initiation of haemodialysis? A single-centre study from South India

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Keywords

Haemodialysis • Health-related quality of life • Chronic Kidney Disease • End-stage renal disease

Summary

Background. *In recent years, research on quality of life has emerged as a valuable tool in assessing the effectiveness of therapeutic interventions in chronic kidney disease. This study aims to assess the health-related quality of life among patients with chronic kidney disease, and draw comparisons between haemodialysis and non-dialysis patients.*
Methods. *This is a prospective questionnaire-based observational study involving 148 patients (81 haemodialysis and 67 non-dialysis patients) with chronic kidney disease (Stage 3-5D) conducted in a tertiary care hospital in South India over six months (July 2023-December 2023). The instrument used was the Kidney Disease Quality of Life Short Form-36.*
Results. *The overall mean health-related quality of life score was better among non-dialysis patients compared to haemodialysis patients. A reduction in various domains, including physical functioning ($p < 0.014$), role limitations due to physical health ($p < 0.001$), role limitations due to emotional problems ($p < 0.001$) and social functioning ($p < 0.007$) were observed in the haemodialysis group. In our population, age, gender, employment status and socioeconomic classes were found to be independent predictors of health-related quality of life.*
Conclusion. *This study highlights the deleterious impact of chronic kidney disease on health-related quality of life, with more significant deterioration among patients undergoing haemodialysis compared to non-dialysis patients. Further, this study advocates potential areas of target for therapeutic intervention.*

Introduction

Chronic Kidney Disease (CKD) and End-Stage Renal Disease (ESRD) have become major global health challenges due to their rapidly growing prevalence characterised by high morbidity and mortality, diminished quality of life, and substantial economic strain on healthcare systems. The global burden of ESRD is growing at around 7% annually and is one of the leading causes of mortality [1]. In India, the reported annual incidence of ESRD is around 232 per million population [2].
Chronic kidney disease is characterised by a progressive decline in renal function, with diabetes and hypertension serving as the primary contributing factors. With the increasing prevalence of these two key risk factors owing to economic growth and urbanisation, CKD has become a global health burden. End-stage renal disease represents the terminal stage of CKD characterised by a glomerular filtration rate (GFR) of less than 15 mL/min/1.73 m², signifying severe irreversible renal damage often requiring kidney replacement therapy (KRT) such as dialysis or renal transplantation [2].
In recent years, there has been growing attention on exploring the physical and psychosocial influence of an illness on the overall quality of life of a patient. The shift of focus towards psychological and social aspects in addition to biomedical measures has been shown to play a vital role in ensuring positive patient outcome from both the patient's and clinician's perspective, and has become a crucial component of outcome measure when evaluating treatment. Quality of life (QOL) is a broad multifaceted concept encompassing physical, psychological, social and environmental domains that are shaped by a person's experience, expectations, beliefs and perceptions. Health-related quality of life (HRQOL) is a subset of QOL, concentrating specifically on the aspects of life that are directly or indirectly influenced by health, disease or therapeutic interventions [3].
The chronic nature of CKD has a profound impact on the HRQOL of patients as well as their caregivers. Although successful kidney transplantation with a well-matched kidney is the most preferred form of KRT, it is not easily attainable making long-term maintenance dialysis the most feasible alternative with a bias towards haemodialysis worldwide. Despite being designed to improve the patient's HRQOL, haemodialysis is time-consuming, resource-intensive, expensive, requires dietary modifications, and often results in loss of independence, reliance on caregivers, reduced physical, emotional and financial stability leading to disruption in marital, family and social life [4]. Hence,

a multidisciplinary approach with timely interventions to improve HRQOL can significantly benefit a patient's health. It is critical to educate healthcare professionals on the methods of using HRQOL tools in assessing patients under their care and the importance of implementing necessary interventions to improve the HRQOL of patients with CKD.

Despite the escalating global burden of CKD, there are very few studies dealing with the HRQOL of CKD patients, with most of these being from developed countries. The main objective of this study is to assess the HRQOL among patients with CKD based on physical, emotional and social domains with an attempt to compare between patients undergoing haemodialysis and non-dialysis patients. We also aim to determine the key socio-demographic factors affecting the HRQOL among patients with CKD. This information is key in helping health professionals deliver patient-centred rehabilitation and care to cater the personal needs of each patient thus improving their overall health outcomes.

Materials and methods

Study design

A prospective questionnaire-based observational study was conducted in an urban tertiary care hospital in South India. Following approval from the institutional ethics committee (CSP/20/FEB/84/89), the study was carried out over six months, from July 2023 to December 2023. A simple random sampling was used to select the participants. Using the single population proportion formula, considering the prevalence of CKD (stage 3 to 5D) as 6% with 95% confidence interval and 10% attrition, the sample size was calculated as 148 patients.

Inclusion and exclusion criteria

Patients with CKD stage 3 to 5D attending the nephrology outpatient department or patients undergoing haemodialysis for at least three months or admitted at this centre were the study participants. Patients with a history of renal transplantation, undergoing peritoneal dialysis, malignancy, psychiatric illness and significant impairment of speech, hearing, or cognitive disturbances were excluded from the study population.

Data collection

Data were collected using pre-structured and pre-tested questionnaires containing socio-demographic characteristics, disease parameters and health-related quality of life questions. The HRQOL was assessed using Kidney Disease Quality of Life Short Form 36-Item (KDQOL SF-36) health survey from RAND Corporation [5]. SF-36 is a 36-item short-form questionnaire not specific to any disease or treatment group. SF-36 assesses the disease burden in an 8-dimensional profile on a 100-point scale; a higher score indicates a better perceived HRQOL. The eight dimensions include physical functioning (PF), role limitations due to physical health (RP), role limitations due to emotional problems (RE), energy/fatigue (E/F), emotional well-being (EW), social functioning (SF), bodily pain (BP) and general health (GH).

The English version of SF-36 has been validated in the Indian population. The questionnaire was translated into the regional language according to instructions given by RAND Corporation. A Nephrologist reviewed and back-translated the translated questionnaire to verify the accuracy of the translated terms. A pilot study with 15 patients assessed the cultural appropriateness and the inputs were used for framing the final version. Even though SF-36 is a self-reported questionnaire, considering the response bias, the authors administered the questionnaire by interviewing all the study participants. Written informed consent was obtained from patients after explaining the objectives of this study in their language.

Data analysis

Data were coded, entered into Microsoft Excel and analysed using SPSS version 26.0. Normality and outliers were assessed using histograms, the Shapiro–Wilk normality test, skewness, and kurtosis indices. The data were found to be normally distributed. Descriptive statistics were conducted for the whole sample population followed by separately for non-dialysis and haemodialysis group. Categorical variables were represented as frequencies and percentages, and all continuous variables were expressed as means and standard deviations (SD). Two summary scores were calculated using these eight domains: Physical Component Summary (PCS) and Mental Component Summary (MCS). PF, RP, BP and GH were included in PCS; and E/F, EW, RE and SF were included in MCS. The mean and SD of PCS and MCS were determined and used to categorise patients into three groups according to the level of HRQOL: one SD above the mean is "good", +/- one SD from the mean is "fair" and one SD below the mean is "poor". Differences between non-dialysis and haemodialysis groups were examined using the Student's unpaired t-test. Associations between socio-demographic variables and SF-36 domains among non-dialysis and haemodialysis patients were assessed using student's unpaired t-test to compare variables containing two groups, and one-way analysis of variance (ANOVA) to compare variables containing more than two groups. Two-tailed p-value < 0.05 was considered statistically significant.

Results

Of the 148 participants, 67 (46.5%) patients were non-dialysis (stages 3 to 5) and 81 (54.7%) were on haemodialysis (stage 5D).

Socio-demographic parameters

The age of patients ranged between 26 and 84 years, with the mean age being 54.57 ± 11.91 years. The majority of the study participants were in the age group 40 to 60 years, which accounted for 46.6%. Among our study

population, 60% were males. More than half were urban dwellers (68.2%). Only a small proportion (25.7%) of patients were currently employed. More than half of the study population belonged to upper-middle (31.8%) and upper-lower (39.2%) socioeconomic classes. The general patient characteristics according to CKD stages are shown in Table I. Based on body mass index, 58% of our study population was within the normal weight range. Nearly one-fifth of the patients were chronic smokers and alcoholics.

Clinical parameters

Overall, patients had been diagnosed with CKD for an average of 3.8 years, ranging from less than two years (47, 31.7%), to 2-5 years (66, 44.6%) and over five years (35, 23.7%). In addition to CKD, it was found that 122 (82.4%) had hypertension, 58 (39.2%) had diabetes, 31 (20.9%) had coronary artery disease and 4 (2.7%) had cerebrovascular accident concomitantly.

The most frequently reported inter-dialytic symptoms were tiredness (77.78%), oedema (56.50%), shortness of breath (46.91%) and muscle cramps (44.44%). Other inter-dialytic symptoms are summarised in Figure 1. In the haemodialysis group, 58 (71.6%) patients had anaemia. In general, haemodialysis patients had slightly more hospital admissions (38.3%) than non-dialysis patients (32.8%).

Health-related quality of life scores and correlations among various domains of SF-36

Haemodialysis group displayed significantly lower scores in 5 out of 8 HRQOL domains compared to non-dialysis group. Although PF, RP, RE, E/F and SF domain scores were better among non-dialysis patients, EW, BP and GH domains were better among haemodialysis patients. The difference in PF, RP, RE and SF scores between haemodialysis and non-dialysis was statistically significant ($p < 0.05$). Analysis of individual scores of SF-36 showed that the highest mean scores among non-dialysis patients were RE (mean = 73) and PF (mean = 67) domains, and among haemodialysis patients were BP (mean = 65) and EW (mean = 65) domains. RP had the lowest mean score among non-dialysis (mean =48) and haemodialysis (mean = 18) patients. Comparison of mean HRQOL scores among haemodialysis and non-dialysis patients is shown in Figure 2. Measurements of HRQOL across

Tab. I. General characteristics of the study population.

Parameter		All (n = 148)	Non-dialysis (n = 67)	Haemodialysis (n = 81)
Age	< 40 years	16 (10.8%)	6 (9%)	10 (12.3%)
	40 - 60 years	69 (46.6%)	29 (43.3%)	40 (49.4%)
	> 60 years	63 (42.6%)	32 (47.8%)	31 (38.3%)
Gender	Female	59 (39.9%)	26 (38.8%)	33 (40.7%)
	Male	89 (60.1%)	41 (61.2%)	48 (59.3%)
Residence	Urban	101 (68.2%)	43 (64.2%)	58 (71.6%)
	Rural	47 (31.8%)	24 (35.8%)	23 (28.4%)
Employment status	Currently working	38 (25.7%)	19 (28.4%)	19 (23.5%)
	Not currently working	110 (74.3%)	48 (71.6%)	62 (76.5%)
Socioeconomic status	Upper	5 (3.4%)	3 (4.5%)	2 (2.5%)
	Upper-middle	47 (31.8%)	16 (23.9%)	31 (38.3%)
	Lower-middle	34 (23%)	13 (19.4%)	21 (25.9%)
	Upper-lower	58 (39.2%)	31 (46.3%)	27 (33.3%)
	Lower-lower	4 (2.7%)	4 (6%)	0 (0%)
Type of family	Nuclear	104 (70.3%)	42 (62.7%)	62 (76.5%)
	Joint	44 (29.7%)	25 (37.3%)	19 (23.5%)
Marital status	Married	140 (94.6%)	64 (95.5%)	76 (93.8%)
	Single	8 (5.4%)	3 (4.5%)	5 (6.2%)
Body mass index (BMI)	Underweight	16 (10.8%)	8 (11.9%)	8 (9.9%)
	Normal	86 (58.1%)	36 (53.7%)	50 (61.7%)
	Overweight	34 (23%)	16 (23.9%)	18 (22.2%)
	Obese	12 (8.11%)	7 (10.45%)	45 (6.17%)
Smoking	Yes	27 (18.2%)	13 (19.4%)	14 (17.3%)
	No	121 (81.8%)	54 (80.6%)	67 (82.7%)
Alcohol consumption	Yes	29 (19.6%)	18 (26.9%)	11 (13.6%)
	No	119 (80.4%)	49 (73.1%)	70 (86.4%)
Co-morbidities	Diabetes	58 (39.1%)	28 (41.8%)	30 (37%)
	Hypertension	122 (82.4%)	48 (71.6%)	74 (91.4%)
	Heart disease	31 (20.9%)	8 (11.9%)	23 (28.4%)
	Stroke	4 (2.7%)	2 (3%)	2 (2.5%)

Fig. 1. Inter-dialytic symptoms experienced by haemodialysis patients (n = 81).

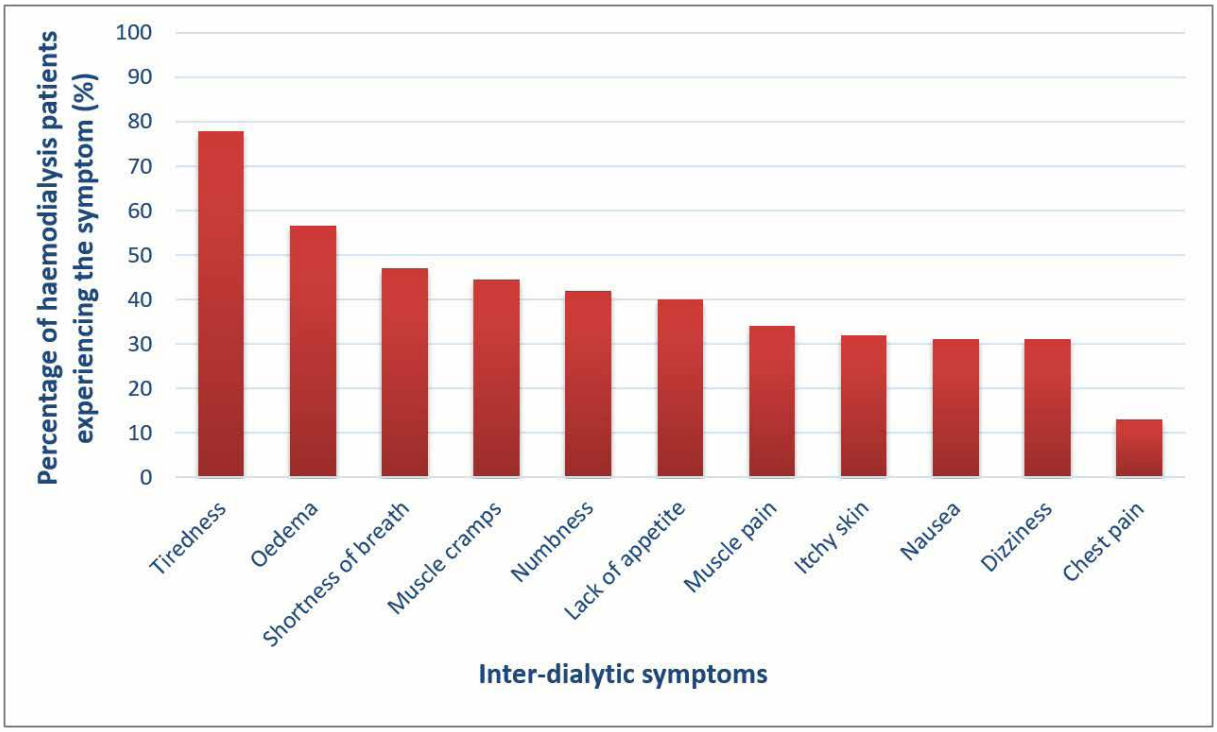
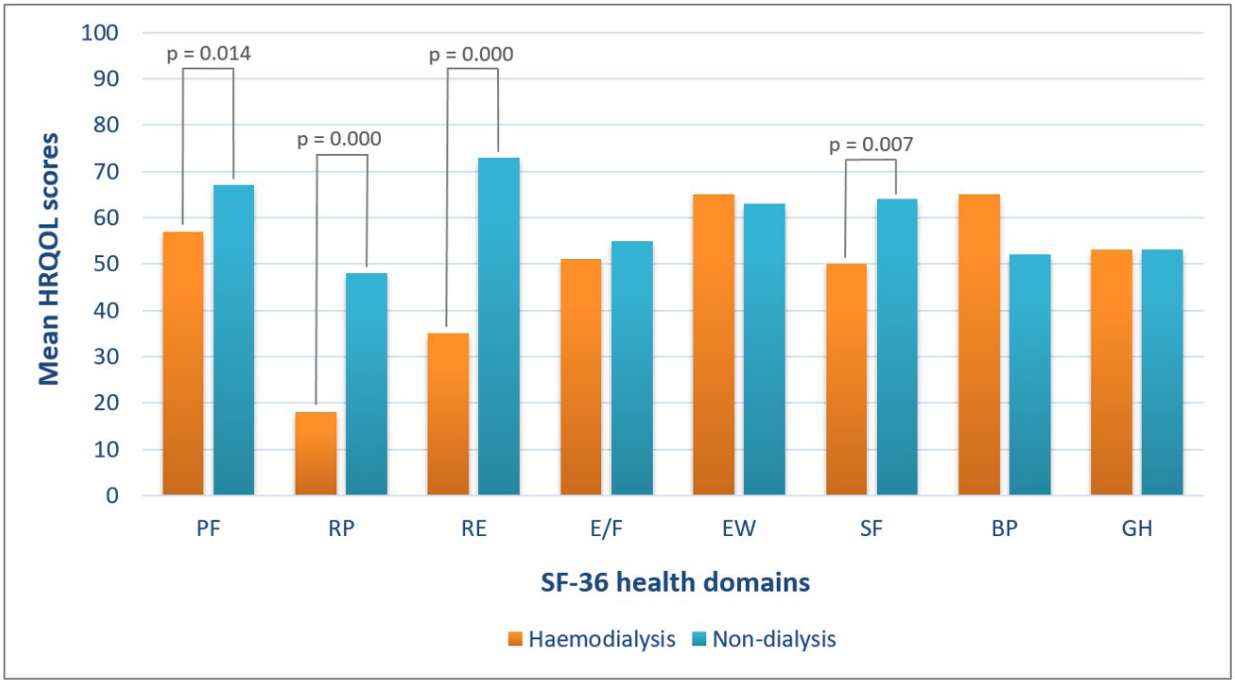


Fig. 2. Comparison of mean HRQOL scores across various domains of SF-36 between non-dialysis and haemodialysis patients.



PF = physical functioning; RP = role limitations due to physical health; RE = role limitations due to emotional problems; E/F = energy/fatigue; EW = emotional well-being; SF = social functioning; BP = bodily pain; GH = general health

*the graph is based on the mean scores of the population under study. #differences did not meet the level of statistical significance unless otherwise specified

Fig. 3. Comparison of mean HRQOL scores among the study population.

PF = physical functioning; RP = role limitations due to physical health; RE = role limitations due to emotional problems; E/F = energy/fatigue; EW = emotional well-being; SF = social functioning; BP = bodily pain; GH = general health

various domains of SF-36 for the entire study population (Fig. 3), and for haemodialysis and non-dialysis groups separately (Fig. 4) are shown in Table II.

In our study population, the PCS and MCS were fair for more than half (62.84% and 60.14%, respectively) of the patients. A higher proportion of non-dialysis patients had better PCS and MCS scores than haemodialysis patients. However, there was a lower proportion of haemodialysis patients with poor PCS and MCS scores than their counterparts (Tab. III). Figure 5 shows the linear relationship between PCS and MCS, represented by a linear equation with R squared 65%, y = 0.8351x + 17.649 (where x is PCS and y is MCS).

Effect of socio-demographic parameters on SF-36 domains

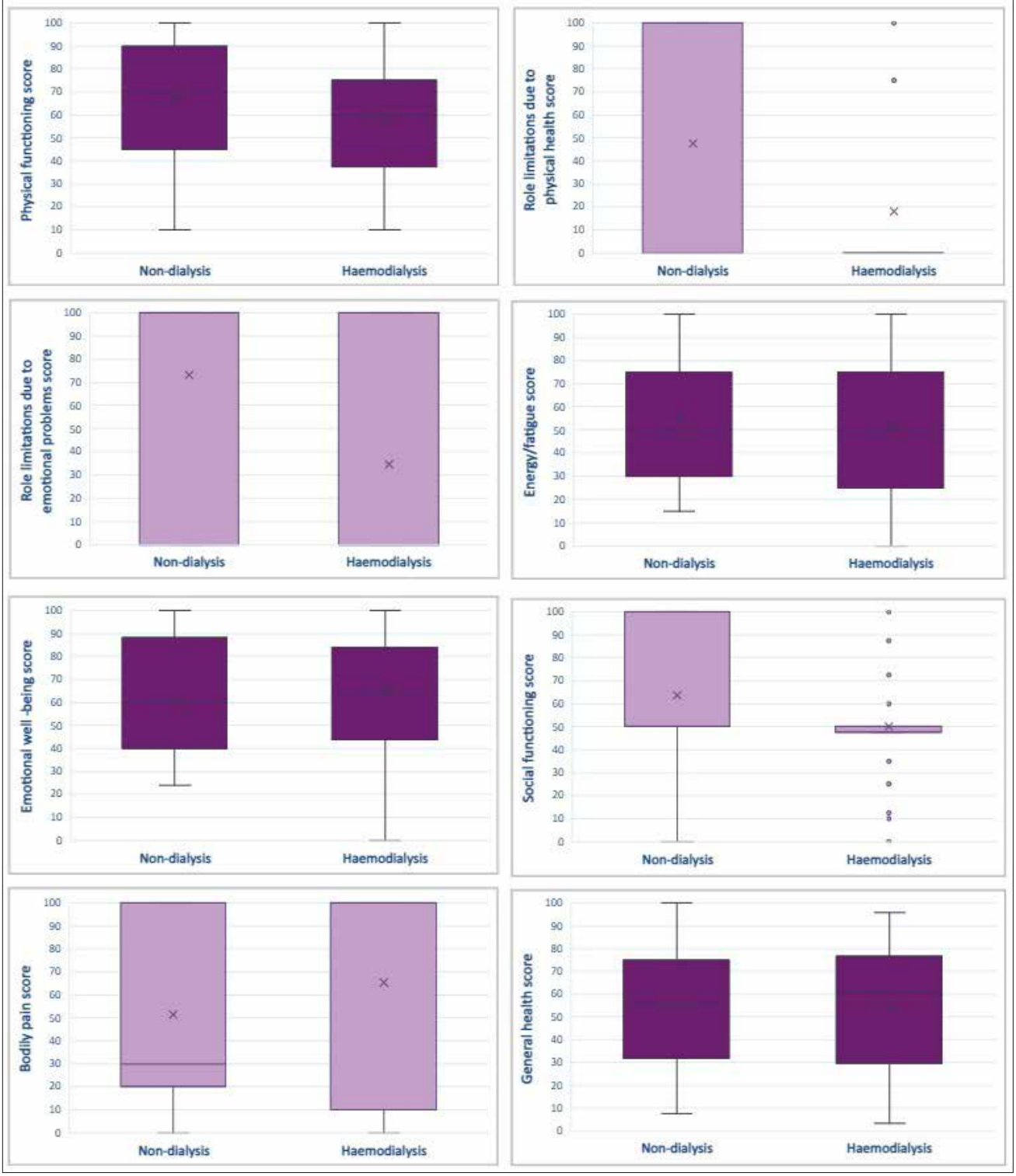
Among the various domains of SF-36, PF significantly declined with advancing age among haemodialysis patients ($p < 0.05$), while age did not affect the PF among non-dialysis patients. In the present study, male patients undergoing haemodialysis had better HRQOL with respect to PF, E/F, EW, SF, BP and GH compared to female patients. In addition, gender was statistically associated with PF ($p = 0.001$), RE ($p = 0.024$), E/F ($p = 0.024$) and BP ($p = 0.044$) among non-dialysis patients. Among both non-dialysis and haemodialysis groups, the working population had better mean HRQOL scores than their counterparts across all domains. Univariate analysis revealed that employment status statistically correlated with PF, RE, E/F, EW, SF and GH among haemodialysis patients ($p < 0.05$) and, RP and RE among non-dialysis patients ($p < 0.05$). Higher socioeconomic groups had higher HRQOL scores in all SF-36 domains in non-dialysis patients,

Tab. II. Mean health-related quality of life scores across various domains of SF-36 among patients with Chronic Kidney Disease.

Health-related quality of life domain	Non-dialysis	Haemodialysis	*p* value
Physical functioning	67 ± 26.8	57.3 ± 23.1	0.014*
Role limitations due to physical health	47.8 ± 50.3	17.9 ± 38	0.000*
Role limitations due to emotional problems	73.1 ± 44.7	34.6 ± 47.3	0.000*
Energy/ fatigue	54.8 ± 26.9	51.2 ± 32.5	0.491
Emotional well-being	62.8 ± 25.8	65.4 ± 24.8	0.459
Social functioning	63.8 ± 37	50.3 ± 28.7	0.007*
Bodily pain	51.6 ± 41.4	65.4 ± 43.2	0.104
General health	52.7 ± 25.3	53.1 ± 25.8	0.730

* Statistically significant at $p < 0.05$

Fig. 4. Box & whisker plot summarising the HRQOL scores across various domains of SF-36.

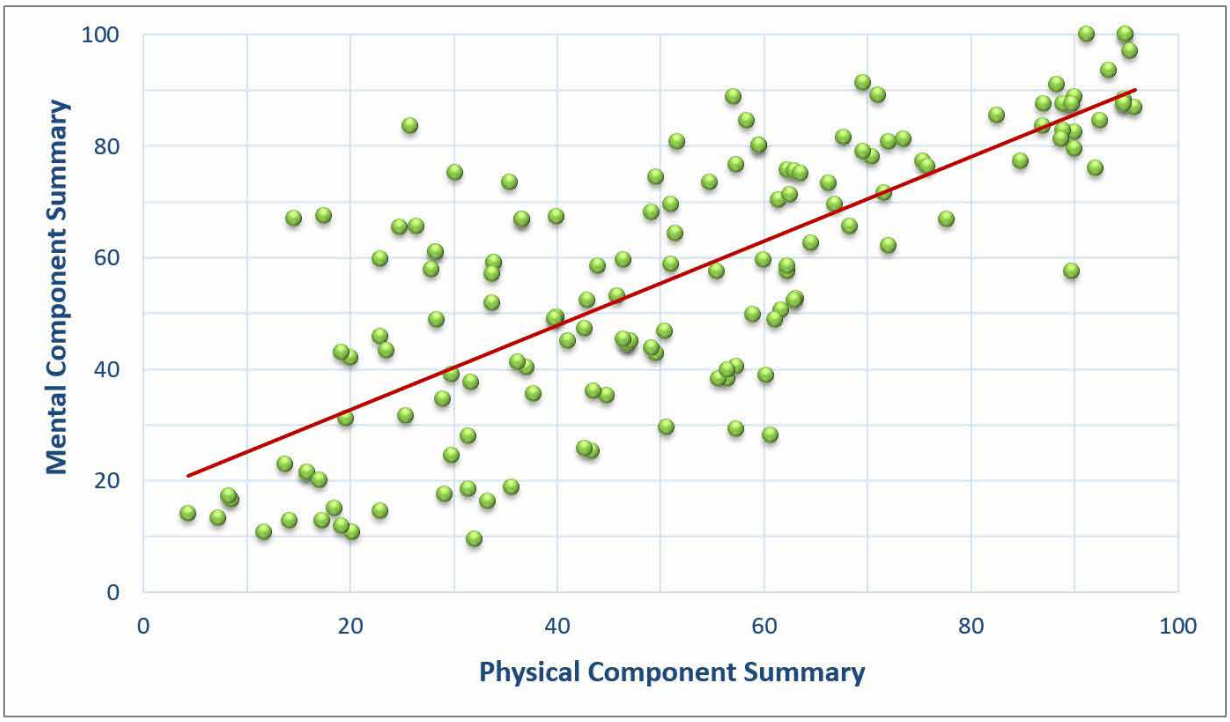


Tab. III. Physical and mental component summary of patients with Chronic Kidney Disease.

	All		Non-dialysis		Haemodialysis	
	PCS	MCS	PCS	MCS	PCS	MCS
Good	18.92%	20.27%	22.39%	25.37%	16.05%	16.05%
Fair	62.84%	60.14%	58.21%	55.23%	66.67%	66.67%
Poor	18.24%	19.59%	19.40%	19.40%	17.28%	17.28%

PCS: physical component summary, MCS: mental component summary.

Fig. 5. Correlation between physical and mental component summary.



while this trend was not noted among haemodialysis patients. The findings of the comparative statistical analysis between SF-36 domains and categorical socio-demographic variables among non-dialysis and haemodialysis patients are summarised in Table IV and Table V, respectively.

Tab. IV. Comparative statistical analysis of mean scores of SF-36 domains among non-dialysis patients, based on socio-demographic variables.

Parameters		PF	RP	RE	E/F	EW	SF	BP	GH
Age	< 40 years	75 ± 31.5	33.3 ± 51.6	83.3 ± 40.8	48.3 ± 29.9	54 ± 35.8	83.3±25.8	30 ± 35.2	32.4 ± 21.5
	40-60 years	55.5 ± 27.4	44.8 ± 50.6	60.5 ± 48.4	57.1 ± 25.9	55.7 ± 23.1	52.3±41.9	59.1 ± 52.9	47.1± 27.7
	> 60 years	66.9 ± 26	53.1 ± 50.7	78.1 ± 42	53.9 ± 27.9	70.9 ± 24.5	70.5±31.1	48.8 ± 40.4	57.8 ± 23.3
	p value	0.644	0.620	0.459	0.656	0.049*	0.077	0.325	0.242
Gender	Female	53.2 ± 25.8	38.5 ± 49.6	57.7 ± 50.4	46.4 ± 28.5	55.9 ± 27.5	62.7±41.3	40.4 ± 42.2	45.6 ± 26.9
	Male	75.7 ± 23.8	53.7 ± 50.5	83 ± 38.1	60.1 ± 24.8	67.2 ± 24	64.5±34.4	58.7 ± 39.8	57.1 ± 23.5
	p value	0.001*	0.228	0.024*	0.024*	0.054	0.929	0.044*	0.060
Residence	Urban	62 ± 28.9	44.2 ± 50.2	67.4 ± 47.4	54.4 ± 27.5	65.4 ± 25.8	57.6 ± 37.7	53.8 ± 42.9	49.8 ± 24.8
	Rural	76 ± 20	54.1 ± 50.9	83.3 ± 38.1	55.4 ± 26.5	58.2 ± 25.8	75 ± 33.6	47.5 ± 39.1	57.7 ± 26.1
	p value	0.559	0.770	0.412	0.474	0.382	0.074	0.083	0.646
Employment status	Currently working	75 ± 25.6	68.4 ± 47.8	94.7 ± 23	63.7 ± 23.6	63 ± 21.8	65.7 ± 37.3	70 ± 38.8	56.8 ± 24.6
	Not currently working	63.9 ± 26.8	39.6 ± 49.4	64.6 ± 48.3	51.3 ± 27.6	62.8 ± 27.5	59.1 ± 36.7	47 ± 41.9	51 ± 25.7
	p value	0.101	0.035*	0.013*	0.062	0.905	0.483	0.111	0.432
Socio-economic status	Upper	83.3 ± 5.8	100±0	100±0	91.7 ± 14.4	85.3 ± 25.4	83.3 ± 28.9	66.7 ± 57.7	85.3 ± 25.5
	Upper-middle	65.9 ± 27	62.5 ± 50	75 ± 44.7	60 ± 24.5	69.3 ± 25.1	47.5 ± 27.5	58.4 ± 45.5	54.6 ± 23.2
	Lower-middle	82.3 ± 23	53.9 ± 51.9	84.7 ± 37.6	63.1 ± 27.6	65 ± 23	67.1 ± 40.3	53.1 ± 42.5	63.1 ± 31
	Upper-lower	60.8 ± 28.3	38.7 ± 49.5	67.7 ± 47.5	46.9 ± 26.3	60.1 ± 26.3	69.1 ± 39	44.8 ± 38.4	46.6 ± 21.6
	Lower-lower	57.5 ± 12.6	0 ± 0	50 ± 57.7	40 ± 11.5	34 ± 12	62.5 ± 43.3	60 ± 46.2	33 ± 8.2
	p value	0.080	0.052	0.478	0.032*	0.048*	0.206	0.911	0.036*

* Statistically significant at $p < 0.05$.

PF: physical functioning, RP: role limitations due to physical health, RE: role limitations due to emotional problems, E/F: energy/fatigue, EW: emotional well-being, SF: social functioning, BP: bodily pain, GH: general health.

Tab. V. Comparative statistical analysis of mean scores of SF-36 domains among haemodialysis patients, based on socio-demographic variables.

Parameters		PF	RP	RE	E/F	EW	SF	BP	GH
Age	< 40 years	66 ± 19.3	30 ± 48.3	40 ± 51.6	48.5 ± 29.7	59.2 ± 28.2	60.3 ± 28.5	56.5 ± 44.1	55.8 ± 24.7
	40-60 years	64.9 ± 22.4	21.3 ± 40.3	44.2 ± 49.7	57.3 ± 34.5	70.5 ± 23.1	54.8 ± 24.9	66 ± 44.1	58.4 ± 23.3
	> 60 years	44.8 ± 19.9	9.7 ± 30.1	20.4 ± 40.1	44.4 ± 30	60.9 ± 25.3	41.4 ± 31.6	54.2 ± 43.2	45.6 ± 28
	p value	0.000*	0.246	0.125	0.277	0.220	0.043*	0.965	0.123
Gender	Female	51.8 ± 24.7	20.5 ± 40.2	37.4 ± 48.4	40.6 ± 30.6	60.2 ± 25.9	46.3 ± 31.1	58.5 ± 44.3	49.4 ± 28.6
	Male	61.1 ± 21.3	16.2 ± 36.6	32.7 ± 46.9	58.5 ± 32	69 ± 23.7	53.1 ± 26.9	70.1 ± 42.3	55.7 ± 23.6
	p value	0.092	0.613	0.597	0.012*	0.119	0.089	0.188	0.351
Residence	Urban	58.6 ± 23.1	18.1 ± 37.9	34.5 ± 47.1	54.2 ± 33.2	68.2 ± 23.5	48.9 ± 29.7	65.3 ± 42.9	55.5 ± 26.7
	Rural	54.1 ± 23.1	17.4 ± 38.8	34.8 ± 48.7	43.7 ± 29.9	58.4 ± 27.1	54 ± 26.1	65.4 ± 44.9	47.3 ± 22.7
	p value	0.466	0.920	0.985	0.245	0.130	0.898	0.963	0.109
Employment status	Currently working	69.5 ± 21.9	31.6 ± 47.7	52.6 ± 51.3	65 ± 33.4	75.4 ± 21.8	62.4 ± 28.5	80 ± 40	64.3 ± 16.7
	Not currently working	53.6 ± 22.3	13.7 ± 33.8	29.1 ± 45	47 ± 31.2	62.4 ± 25	46.7 ± 27.9	60.9 ± 43.5	49.7 ± 27.2
	p value	0.008*	0.078	0.043*	0.027*	0.045*	0.015*	0.097	0.045*
Socio-economic status	Upper	45 ± 35.4	0 ± 0	50 ± 70.7	25 ± 35.4	70 ± 14	43.8 ± 61.9	50 ± 70.7	38.3 ± 14.1
	Upper-middle	53.1 ± 22.9	12.1 ± 32.2	25.8 ± 44.5	44.8 ± 33.8	64.8 ± 26.1	54 ± 26.3	62.4 ± 44.1	53.1 ± 23.7
	Lower-middle	62.1 ± 18.5	13.1 ± 33.2	38.2 ± 47.5	53.1 ± 30.4	61 ± 23.9	41.2 ± 22.5	32.1 ± 41	52.3 ± 27.2
	Upper-lower	59.4 ± 25.8	29.6 46.5	40.7 ± 50.1	59.1 ± 31.7	69.3 ± 25	53.8 ± 33.1	64.6 ± 44.2	55 ± 28.2
	Lower-lower	-	-	-	-	-	-	-	-
	p value	0.507	0.270	0.582	0.217	0.679	0.326	0.873	0.736

* Statistically significant at $p < 0.05$

PF: physical functioning, RP: role limitations due to physical health, RE: role limitations due to emotional problems, E/F: energy/fatigue, EW: emotional well-being, SF: social functioning, BP: bodily pain, GH: general health

Discussion

Over the last few decades, health systems have begun to pay increasing attention towards HRQOL due to the emergence of a holistic approach to health and disease. In this study, there was a decline in the HRQOL across all stages of CKD and more significant HRQOL deterioration was noted among patients undergoing haemodialysis compared to non-dialysis patients. Socioeconomic characteristics were found to have a significant impact on the HRQOL of patients.

The mean age in our cohort was slightly higher compared to patients reported in the Indian CKD registry and a slight male predominance was seen similar to other studies [6-8]. Sex hormones are assumed to be significant in the pathogenic mechanisms associated with gender-specific disease outcomes. In vitro studies with animal models have established oestrogen's protective influence and testosterone's negative influence on several mechanisms involved in kidney injury [8]. Even in the modern Indian context, due to the prevailing male breadwinner tradition, the increased incidence of CKD in men can lead to severe financial distress in the family.

In our study population, diabetes mellitus and hypertension were the common co-morbidities associated with CKD. This finding was in conjunction with the Indian CKD registry. Studies reveal that patients with concomitant CKD and diabetes have markedly lower HRQOL [9, 10]. Prospective health screening is necessary to identify these predisposing factors and to promote an active healthy lifestyle among these individuals.

In our study, haemodialysis patients displayed lower HRQOL scores than non-dialysis patients in most SF-36 domains. Patients experienced significant role limitations due to both physical health (47.8 ± 50.3 in non-dialysis and 17.9 ± 38 in haemodialysis) and emotional health problems (73.1 ± 44.7 in non-dialysis and 34.6 ± 47.3 in haemodialysis). These were the lowest-scoring items in the haemodialysis group and statistically correlated with the stage of kidney disease. These scores were significantly higher than the study performed by Kefale B et al. in the non-dialysis group [11]. At the same time, it was much lower compared to the study by Cruz MC et al. in the haemodialysis group [9]. The SF score among non-dialysis patients was better than haemodialysis patients. This finding was in accordance with Bagasha et al. [12]. This may be attributed to the extensive time spent at haemodialysis centres in conjunction with dependency on machines and healthcare professionals, which entail a significant burden for patients characterised by lifestyle disruption, and feelings of guilt and inadequacy. The mean score of PF among non-dialysis patients was higher than among haemodialysis patients. This finding was coherent with the results of Cruz MC et al. [9]. Impaired PF due to fatigue, muscle weakness and exercise intolerance reduce the ability to perform day-to-day activities among patients undergoing haemodialysis, attributing to the decreased PF scores. Reduced physical functioning limits the ability of a person to work in a paying job in addition to increased treatment expenses leading to financial instability, which in turn affects the emotional and social functioning of the patient. These are interrelated and thus continue as a vicious

cycle affecting the patient's overall HRQOL. A well-founded social and family support network and a stable ambience are crucial in providing holistic care to these patients. There is adequate evidence to suggest a positive relationship between a reliable social support system and lower depression rates resulting in higher compliance to treatment and overall better HRQOL [13, 14].

In general, we observed the PCS and MCS scores to be better in non-dialysis patients compared to haemodialysis patients. In our population, the mean PCS score was 51.3 ± 24.7, which was similar to other studies from developing countries [15, 16]. Varied PCS scores were observed in studies from different countries [11, 17, 18], with higher scores noted in developed countries [19, 20]. Our study determined the mean MCS score as 56.4 ± 24.4, similar to previous studies [15, 21]. Higher MCS score was noted in studies from Western countries [19, 22]. This variation may be attributed to the differences in educational standards, economic status and treatment protocols between countries. Overall, MCS was higher than PCS, reflecting the patients' psychological adaptation to chronic illness. An analysis of nearly 14,000 in-centre haemodialysis patients found that HRQOL scores were critical predictors of hospitalisation and mortality. Their results revealed that each 5-point increase in PCS score was associated with a 10% reduction in the relative risk of hospitalisation and death, and each 5-point increase in MCS was associated with a 5% and 10% reduction in the relative risk of hospitalisation and death, respectively [23].

The presence of two or more concurrent co-morbidities had a negative impact on the domains of PCS, particularly PF and RP. Earlier reports have suggested that the coexistence of multiple co-morbidities is a significant determinant of deterioration in HRQOL [9, 24]. Apart from physical, functional and clinical parameters, factors such as socio-demographic characteristics, employment status and accessibility to medical care play a pivotal role in an individual's perception of life [25, 26]. Among our population, older age was found to be a negative predictor of PF in haemodialysis patients; on the contrary, younger age was a negative predictor of SF among haemodialysis patients and EW among non-dialysis patients. Though older adults may have reduced motivation and energy to perform physical activity, they scored better in emotional domains due to better adaptability and maturity to deal with the disease than younger adults in the face of CKD. In our analysis, female gender emerged as a strong predictor of lower scores in SF-36 domains, particularly in E/F among haemodialysis patients, and PF, RE, E/F and BP among non-dialysis patients. This reflects the vulnerability of women with chronic disease ascribed to their different psychosocial perspectives on life, such as social stigmatisation, higher prevalence of psychological distress and family commitments, compared to men. Through our study, we observed that unemployment adversely affected the HRQOL across most domains. Similar results have also been reported by previous studies conducted in Ethiopia [26], the United States of America [27] and India [28]. The findings of this association may imply that financial constraints to manage the treatment expenses could have resulted in lower HRQOL. To reduce the incidence of unemployment among patients undergoing haemodialysis, flexible haemodialysis shifts to adapt to individuals' lifestyles are essential to ameliorate the employment rate. On careful evaluation, we found that higher socioeconomic status positively predicted E/F, EW and GH among non-dialysis patients. Patients of higher socioeconomic status can afford better treatment to satisfy their needs. In addition, financial security may lead to a better state of mind resulting in higher HRQOL compared to those in lower socioeconomic classes. A similar pattern of HRQOL and its relation with socioeconomic status was found in other studies [25, 29, 30].

In our study population, more than half of the CKD patients across all stages had difficulty falling asleep during the night. Biological, psychological and behavioural factors might contribute to the increasing prevalence of sleep disturbances among patients with CKD. End-stage renal disease is characterised by considerable changes in sleep architecture, circadian rhythm and endogenous melatonin release [31]. Poor quality of sleep in CKD patients has an adverse effect on their HRQOL. Therefore, counselling and advocacy programs should be established to improve the patient's sleep quality and HRQOL.

With rise in prevalence of CKD, it becomes even more essential to evaluate effectiveness of therapeutic approaches in order to enhance the treatment quality, improve operational efficiency, optimise resource allocation and devise individualised care plans. This is elucidated in the study by Guarducci et al., which used EuroQol 5-Dimension 5-Level questionnaire and Cumulative Illness Rating Scale to perform patient-reported and clinical assessments, respectively, in order to evaluate health gains in the form of quality-adjusted life years (QALYs) and related treatment costs in an Italian private healthcare centre [32]. Chronic kidney disease involves a complex interaction between physiological deterioration and HRQOL. This association has been investigated by D'Arrigo et al. in an Italian study cohort, which highlighted that the progressive decline in kidney function (GFR) was significantly associated with reductions in both physical and mental components of HRQOL over a 3-year follow-up period [33]. More such longitudinal studies are required to evaluate the progression of HRQOL across all CKD stages and to assess the precise impact of socioeconomic factors in order to plan context-specific and sustainable interventions.

This was a single-centre study with a relatively small sample size; hence, multi-centre studies involving various geographical locations may be needed. The study's observational nature permitted only to determine associations between various independent and dependent variables and not causal relationships. There may be residual confounding factors affecting the results, such as compliance with therapy, capacity to handle stress, and cultural and religious practices.

Conclusion

The increasing life expectancy, along with the rising prevalence of risk factors, is significantly increasing the burden of chronic diseases like CKD, particularly among resource-poor and medically underserved populations, representing one of the most complex challenges that the future healthcare system must face. Thus, the need to assess and improve the HRQOL of these patients becomes increasingly fundamental. In the present study, we observed a significant decline in the HRQOL of patients with CKD. Socioeconomic characteristics were found to considerably impact the HRQOL of patients in our population. Though haemodialysis is initiated to improve a patient's overall well-being, evidence from several studies including the present study report greater HRQOL deterioration among patients undergoing haemodialysis compared to non-dialysis patients. Therefore, routine utilisation of HRQOL assessments in the care of patients with CKD would allow an improved understanding of HRQOL and its predictors, and help in formulating tailored treatment strategies for each patient with the potential to improve their long-term health outcomes. Future initiatives should prioritise a bench-to-bedside approach which transforms these findings into real-world interventions such as enhanced pharmacological therapies, nutritional counselling, vocational training, standardised HRQOL evaluation criteria, and psychosocial support for patients and caregivers.

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Conflict of interest

There were no potential conflicts of interest among the authors.

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Authors' contribution

SG and JJ formulated the study design, collected data, carried out data analysis and prepared the draft. EI approved the final draft and guided through publication process.

Ethical approval

IRB approval number CSP/20/FEB/84/89.

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