

Health-Related Quality of Life Among Adults Receiving Maintenance Haemodialysis in Punjab, India: A Cross-Sectional Study Using the SF-36

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Abstract

Background: Adults receiving maintenance haemodialysis experience substantial physical, psychological and social burdens, but domain-specific health-related quality-of-life data from northern India remain limited. **Material and Methods:** A hospital-based analytical cross-sectional study included 75 adults receiving maintenance haemodialysis at a tertiary-care institution in Bathinda, Punjab, between April and September 2023. Health-related quality of life was measured using the eight standard domains of the 36-Item Short Form Health Survey (SF-36), each scored from 0 to 100, with higher scores indicating better health status. Domain distributions, floor and ceiling effects, internal consistency, bivariate associations and separate multivariable linear-regression models were examined. HC3 heteroscedasticity-robust standard errors and Benjamini-Hochberg false-discovery-rate adjustment were used for sensitivity analyses. **Results:** The mean age was 57.04 years (SD 13.29), 56 participants (74.7%) were male, 71 (94.7%) had hypertension and 32 (42.7%) had diabetes mellitus. Mean SF-36 scores were lowest for role limitations due to physical health (40.33), role limitations due to emotional problems (40.44), physical functioning (42.20) and energy/fatigue (42.60); bodily pain had the highest mean score (58.17). Substantial floor and ceiling effects occurred in both role-limitation domains, and bodily pain showed a substantial ceiling effect. No bivariate association met the nominal two-sided threshold of $p < 0.05$. In adjusted analysis, higher body weight was associated with lower energy/fatigue scores ($B = -0.549$ points per kg, 95% CI -0.958 to -0.141 ; $p = 0.009$), but this association did not remain significant after false-discovery-rate adjustment (adjusted $p = 0.515$). **Conclusion:** Adults receiving maintenance haemodialysis had broad impairment in health-related quality of life, particularly in physical and emotional role performance, physical functioning and vitality. The exploratory predictor analyses were inconclusive after correction for multiple testing. Larger multicentre studies incorporating biochemical, nutritional, psychological and socioeconomic factors are required.

Keywords: chronic kidney disease; haemodialysis; health-related quality of life; SF-36; patient-reported outcomes; India.

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INTRODUCTION

Chronic kidney disease (CKD), defined by abnormalities of kidney structure or function persisting for at least three months with implications for health, is an increasingly important cause of morbidity and mortality worldwide.^[1] The Global Burden of Disease Study 2023 estimated that approximately 788 million adults were living with CKD in 2023 and that CKD ranked among the leading global causes of death.^[2] India contributes substantially to this burden. A systematic review of community-based Indian studies published between 2011 and 2023 estimated a pooled CKD prevalence of 13.24%, with marked geographical heterogeneity and higher estimates in rural than urban populations.^[3] For people who progress to kidney failure, haemodialysis is life sustaining but does not fully restore health or everyday functioning. Treatment is accompanied by uraemic symptoms, comorbid disease, dietary and fluid restrictions, vascular-access procedures, repeated travel and prolonged treatment sessions. A global systematic review of 449 studies involving more than 199,000 participants found considerable symptom and health-related quality-of-life burden across CKD populations, with fatigue reported by approximately

70% of patients receiving dialysis.^[4]

Health-related quality of life (HRQoL) captures physical, emotional and social consequences that are not adequately represented by laboratory measures or dialysis adequacy alone. The 36-Item Short Form Health Survey (SF-36) assesses eight domains: physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, bodily pain and general health.^[5] Lower HRQoL has also been associated with subsequent hospitalization and mortality among haemodialysis populations, supporting the clinical relevance of patient-reported outcomes.^[6]

HRQoL is influenced by comorbidity, socioeconomic resources,

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family support, healthcare access and dialysis-delivery practices; consequently, results from high-income settings may not be directly transferable to Indian populations. Prior studies have consistently described substantial impairment in physical and role-function domains among haemodialysis recipients,^[7,8] but contemporary domain-specific evidence from Punjab is limited. This study therefore assessed the eight SF-36 domains and explored sociodemographic and clinical correlates of HRQoL among adults receiving maintenance haemodialysis at a tertiary-care institution in Bathinda, Punjab.

Objective

To assess health-related quality of life across the eight SF-36 domains and explore its sociodemographic and clinical correlates among adults receiving maintenance haemodialysis at a tertiary-care institution in Punjab, India.

MATERIALS AND METHODS

Study design and setting: A hospital-based analytical cross-sectional study was conducted among adults with chronic kidney disease receiving maintenance haemodialysis at the General Medicine and Nephrology services of Adesh Institute of Medical Sciences and Research, Bathinda, Punjab, India. Data collection was undertaken over six months, from 1 April to 30 September 2023.

Study population: The study population comprised adult patients with chronic kidney disease who were receiving maintenance haemodialysis and attended the study institution during the data-collection period.

Inclusion criteria

Patients were included when they:

1. Were aged more than 18 years.
2. Had chronic kidney disease and had been receiving maintenance haemodialysis for at least three months.
3. Were able to understand and respond to the study questionnaire.
4. Provided written informed consent to participate.

Exclusion criteria

Patients were excluded when they:

1. Had physical, cognitive or communication limitations that prevented them from completing the questionnaire.
2. Were unwilling to participate.
3. Had been receiving haemodialysis for less than three months.

Sample-size calculation

The sample size was calculated using Daniel's formula for estimating a population proportion:

$$[n = \frac{Z^2 p(1-p)}{d^2}]$$

where (Z) was 1.96 for a 95% confidence level, (p) was the expected proportion and (d) was the absolute precision of 5%. The study protocol reported a calculated sample size of 72, which was rounded to a minimum target of 75 participants. Eligible patients attending the study services during the study period were approached for participation. Only those satisfying the eligibility criteria and providing informed consent were enrolled.

Data-collection procedure: Data were collected using a structured study proforma and the 36-Item Short Form

Health Survey. Participants were interviewed during their visit for haemodialysis. Available clinical information was supplemented from patient records where required. The following sociodemographic and clinical variables were recorded: Age in completed years, Sex, Marital status, Body weight, Presence of comorbidities, Duration of haemodialysis in months, Frequency of haemodialysis sessions per week, Presence or absence of an arteriovenous fistula. Comorbidities were recorded from the patients' clinical histories and included hypertension, diabetes mellitus, coronary artery disease, chronic obstructive airway disease, obesity, renal stone disease and other documented conditions.

Assessment of health-related quality of life: Health-related quality of life was assessed using the 36-Item Short Form Health Survey, commonly referred to as the SF-36. It is a generic health-status instrument designed to measure the physical, psychological and social dimensions of perceived health (Ware & Sherbourne, 1992).

The SF-36 evaluates eight health domains:

1. Physical functioning: limitations in physical activities such as walking, climbing stairs, lifting and self-care.
2. Role limitations due to physical health: interference of physical health with work and other usual activities.
3. Role limitations due to emotional problems: interference of emotional problems with work and usual activities.
4. Energy/fatigue or vitality: perceived energy, tiredness and fatigue.
5. Emotional well-being: nervousness, sadness, peacefulness and happiness.
6. Social functioning: interference of physical or emotional health with social activities.
7. Bodily pain: intensity of pain and its interference with usual work.
8. General health: participants' overall perception of their current and expected health.

The questionnaire also contained a health-transition item that assessed perceived change in health compared with one year earlier. This item was reported separately and was not included in the eight-domain quality-of-life profile.

SF-36 scoring: Responses to individual SF-36 items were coded and transformed to a scale ranging from 0 to 100 according to the direction of the item. Negatively worded items were reverse-coded so that higher values consistently represented a more favourable health state.

The items belonging to each domain were averaged to calculate the corresponding domain score. Thus:

- A score of 0 represented the poorest possible health status.
- A score of 100 represented the best possible health status.

The eight domain scores were analysed and reported separately. The arithmetic mean of all 36 items shown in the original spreadsheet was not treated as a validated overall SF-36 score. Physical Component Summary and Mental Component Summary scores were also not calculated because norm-based scoring coefficients were not available in the dataset.

Data quality and management: The dataset was reviewed for completeness, internal consistency, duplicate observations and values outside the permissible scoring range before statistical analysis. Five SF-36 item entries were outside the permissible recorded range. These values were treated as missing rather than

being replaced with assumed values. The relevant domain score was calculated from the remaining valid constituent items where sufficient information was available. No participant was excluded from the final analysis solely because of these isolated item-level inconsistencies. Participant names and other direct personal identifiers were excluded from the analytical dataset.

Statistical analysis: Data were analysed using IBM SPSS Statistics for Windows, version 25.0. Categorical variables were summarised using frequencies and percentages. Continuous variables were described using the mean and standard deviation when approximately normally distributed and the median and interquartile range when the distribution was skewed. Mean, standard deviation, median, interquartile range, minimum and maximum were calculated for each SF-36 domain. The proportion of participants with the minimum and maximum possible scores was examined to identify floor and ceiling effects, particularly in the physical-role and emotional-role domains. An exploratory multiple linear-regression model was used to assess the independent relationship between arteriovenous-fistula use and the general-health score. The model was adjusted for age, sex, diabetes mellitus, duration of haemodialysis and weekly

haemodialysis frequency. Regression coefficients were presented with their corresponding 95% confidence intervals. All tests were two-sided, and a p-value below 0.05 was considered statistically significant. Because several domain-level comparisons were exploratory, statistically significant findings were interpreted cautiously.

Ethical considerations: The study was conducted after approval from the Institutional Ethics Committee for Biomedical & Health Research, Adesh University, Bathinda, Punjab. The protocol carried reference number AU/EC_BHR/2K23/342 Date-10/03/2023. Written informed consent was obtained from every participant before enrolment.

RESULTS

Participant characteristics: All 75 participants were included. The mean age was 57.04 years (SD 13.29), and 56 (74.7%) were male. Mean body weight was 69.36 kg (SD 15.59). Median haemodialysis duration was 12 months (IQR 8-18; range 3-38). Most participants received haemodialysis twice weekly (58/75, 77.3%), and 55 (73.3%) had an arteriovenous fistula. Hypertension was documented in 71 (94.7%), diabetes mellitus in 32 (42.7%) and coronary artery disease in 5 (6.7%) participants [Table 1].

Table 1: Sociodemographic and clinical characteristics of adults receiving maintenance haemodialysis (n=75)

Characteristic	Mean $\pm$ SD or n (%)	Median (IQR)	Range
Age, years	57.04 $\pm$ 13.29	60.00 (48.00-65.50)	19-78
Weight, kg	69.36 $\pm$ 15.59	68.00 (57.50-80.00)	43-115
Haemodialysis duration, months	13.72 $\pm$ 8.16	12.00 (8.00-18.00)	3-38
Age group: 19-40 years	7 (9.3%)		
Age group: 41-50 years	15 (20.0%)		
Age group: 51-60 years	18 (24.0%)		
Age group: 61-70 years	24 (32.0%)		
Age group: >70 years	11 (14.7%)		
Female sex	19 (25.3%)		
Male sex	56 (74.7%)		
Married	67 (89.3%)		
Unmarried	8 (10.7%)		
Diabetes mellitus	32 (42.7%)		
Hypertension	71 (94.7%)		
Coronary artery disease	5 (6.7%)		
Other documented condition	8 (10.7%)		
Haemodialysis frequency: 1/week	2 (2.7%)		
Haemodialysis frequency: 2/week	58 (77.3%)		
Haemodialysis frequency: 3/week	15 (20.0%)		
Arteriovenous fistula present	55 (73.3%)		
Arteriovenous fistula absent	20 (26.7%)		

Values are mean $\pm$ standard deviation, median (interquartile range), range, or n (%), as appropriate.

SF-36 domain scores, floor and ceiling effects

All eight SF-36 domains had complete data. Mean scores were lowest for role limitations due to physical health (40.33, SD 44.25) and role limitations due to emotional problems (40.44, SD 43.25), followed by physical functioning (42.20, SD 29.42) and energy/fatigue (42.60, SD 28.10). Bodily pain had the highest mean score (58.17, SD 31.29) [Table 2;

Figures 1 and 2].

Substantial floor and ceiling effects were present for role limitations due to physical health (floor 50.7%; ceiling 26.7%) and role limitations due to emotional problems (floor 46.7%; ceiling 28.0%). Bodily pain showed a substantial ceiling effect (22.7%). No other domain exceeded the 15% threshold.

Table 2: Distribution of SF-36 domain scores (n=75)

Domain	Mean $\pm$ SD	Median (IQR)	Range	95% CI	Floor, n (%)	Ceiling, n (%)
Role limitations due to physical health	40.33 $\pm$ 44.25	0.00 (0.00-100.00)	0.00-100.00	30.15-50.51	38 (50.7%)	20 (26.7%)
Role limitations due to	40.44 $\pm$ 43.25	33.33 (0.00-100.00)	0.00-100.00	30.49-50.40	35 (46.7%)	21 (28.0%)

emotional problems						
Physical functioning	42.20 ± 29.42	40.00 (20.00-65.00)	0.00-100.00	35.43-48.97	7 (9.3%)	4 (5.3%)
Energy/fatigue	42.60 ± 28.10	50.00 (20.00-60.00)	0.00-100.00	36.14-49.06	4 (5.3%)	2 (2.7%)
Social functioning	45.33 ± 24.21	50.00 (25.00-62.50)	0.00-100.00	39.76-50.90	4 (5.3%)	1 (1.3%)
General health	46.20 ± 17.76	45.00 (30.00-55.00)	15.00-90.00	42.11-50.29	0 (0.0%)	0 (0.0%)
Emotional well-being	51.20 ± 23.18	48.00 (36.00-68.00)	0.00-100.00	45.87-56.53	1 (1.3%)	3 (4.0%)
Bodily pain	58.17 ± 31.29	55.00 (43.75-77.50)	0.00-100.00	50.97-65.37	7 (9.3%)	17 (22.7%)

Higher scores indicate better health-related quality of life. A floor or ceiling effect was considered substantial when >15% of participants scored 0 or 100, respectively.

Internal consistency: Internal consistency was high for physical functioning (Cronbach's $\alpha=0.940$), role limitations due to physical health (0.921), role limitations due to emotional problems (0.863), energy/fatigue (0.862) and bodily pain (0.956), and acceptable for emotional well-being (0.787). Lower estimates were observed for social functioning (0.455) and general health (0.525). The two-item social-functioning and bodily-pain estimates were interpreted cautiously.

Bivariate analyses: None of the 80 bivariate associations met the nominal two-sided threshold of $p<0.05$. The smallest p-values were observed for general health by arteriovenous-fistula status ($p=0.057$), weight with energy/fatigue ($p=0.066$), weight with emotional well-being ($p=0.072$) and role limitations due to physical health by arteriovenous-fistula status ($p=0.074$). All selected associations had Benjamini-Hochberg-adjusted $p=0.858$ [Table 3].

Table 3: Selected bivariate associations with SF-36 domain scores

Domain	Characteristic	Effect estimate	95% CI	p-value	BH-adjusted p
General health	Arteriovenous fistula	Median difference: 10.00	0.00 to 15.00	0.057	0.858
Energy/fatigue	Weight, kg	Spearman $\rho=-0.213$	-0.429 to 0.015	0.066	0.858
Emotional well-being	Weight, kg	Pearson $r=-0.209$	-0.416 to 0.019	0.072	0.858
Role limitations due to physical health	Arteriovenous fistula	Median difference: 50.00	0.00 to 50.00	0.074	0.858
Emotional well-being	Female sex	Mean difference: -7.67; Hedges $g=-0.329$	-16.943 to 1.604	0.103	0.858
Energy/fatigue	Age, years	Spearman $\rho=-0.183$	-0.421 to 0.050	0.116	0.858

BH, Benjamini-Hochberg. Arteriovenous-fistula differences compare participants with versus without a fistula; female-sex differences compare women with men. The complete analysis comprised 80 exploratory tests.

Multivariable analyses: Separate models were fitted for each SF-36 domain. Variance inflation factors were low (maximum 1.19), and Breusch-Pagan tests did not indicate heteroscedasticity. Residual normality was not supported for role limitations due to physical health, role limitations due to emotional problems or bodily pain; the emotional-well-being model also showed possible functional-form misspecification by Ramsey RESET ($p=0.021$). HC3 robust standard errors were therefore retained throughout. No valid participant record was removed from the primary analysis.

The only coefficient with an unadjusted $p<0.05$ was body weight in the energy/fatigue model: each 1-kg higher weight was associated with a 0.549-point lower score ($B=-0.549$, 95% CI -0.958 to -0.141; $p=0.009$; standardized beta=-0.305). The overall model did not meet the conventional significance threshold (robust $F(7,67)=1.945$; $p=0.076$; adjusted $R^2=0.073$), and the coefficient was not significant after Benjamini-Hochberg adjustment across 56 regression coefficients (adjusted $p=0.515$). No other predictor-domain coefficient had an unadjusted $p<0.05$ [Table 4, Figure 4].

Table 4: Multivariable predictors of SF-36 domain scores

SF-36 domain	Age	Female sex	Diabetes mellitus	Dialysis duration, months	HD sessions/week	AV fistula	Weight, kg
Physical functioning	-0.001 [-0.617 to 0.615] (0.997)	-8.849 [-26.374 to 8.676] (0.317)	8.524 [-7.955 to 25.002] (0.306)	-0.404 [-1.574 to 0.766] (0.493)	2.226 [-14.765 to 19.218] (0.795)	0.397 [-18.893 to 19.686] (0.967)	-0.191 [-0.626 to 0.243] (0.383)
Role limitations due to physical health	-0.439 [-1.283 to 0.404] (0.302)	-13.055 [-37.708 to 11.598] (0.294)	-5.183 [-27.297 to 16.931] (0.641)	0.261 [-1.247 to 1.768] (0.731)	7.948 [-17.958 to 33.854] (0.542)	16.437 [-9.969 to 42.843] (0.218)	-0.561 [-1.305 to 0.182] (0.137)
Role limitations due to emotional problems	-0.040 [-0.847 to 0.768] (0.922)	-6.879 [-32.159 to 18.400] (0.589)	-8.090 [-30.290 to 14.110] (0.470)	0.427 [-0.966 to 1.820] (0.543)	-4.385 [-28.329 to 19.558] (0.716)	6.852 [-18.253 to 31.957] (0.588)	-0.263 [-1.022 to 0.497] (0.492)
Energy/fatigue	-0.447 [-1.056 to 0.163] (0.148)	-10.604 [-29.051 to 7.842] (0.255)	3.046 [-10.398 to 16.489] (0.653)	0.302 [-0.778 to 1.382] (0.579)	6.192 [-9.463 to 21.847] (0.433)	2.127 [-13.132 to 17.385] (0.782)	-0.549 [-0.958 to -0.141] (0.009)
Emotional well-being	-0.194 [-0.704 to 0.316] (0.492)	-8.814 [-21.875 to 4.247] (0.294)	1.664 [-9.933 to 13.261] (0.782)	-0.047 [-0.953 to 0.858] (0.917)	2.721 [-11.780 to 17.223] (0.709)	3.902 [-10.368 to 28.172] (0.605)	-0.375 [-0.794 to 0.044] (0.100)

	0.316] (0.450)	4.247] (0.183)	(0.775)			18.172] (0.587)	(0.079)
Social functioning	-0.240 [-0.746 to 0.266] (0.347)	-10.364 [-25.683 to 4.954] (0.181)	3.000 [-9.362 to 15.361] (0.630)	0.109 [-0.798 to 1.016] (0.811)	7.903 [-9.536 to 25.342] (0.369)	6.963 [-8.799 to 22.726] (0.381)	-0.319 [-0.668 to 0.030] (0.073)
Bodily pain	-0.160 [-0.828 to 0.507] (0.633)	-1.985 [-22.843 to 18.872] (0.850)	5.573 [-11.029 to 22.174] (0.505)	0.358 [-0.728 to 1.444] (0.513)	1.166 [-20.071 to 22.403] (0.913)	-0.387 [-21.546 to 20.772] (0.971)	-0.175 [-0.673 to 0.324] (0.487)
General health	-0.141 [-0.486 to 0.203] (0.416)	-5.056 [-15.500 to 5.388] (0.337)	1.774 [-7.012 to 10.561] (0.688)	-0.254 [-0.880 to 0.373] (0.422)	0.308 [-10.410 to 11.026] (0.954)	7.619 [-1.095 to 16.333] (0.086)	-0.222 [-0.577 to 0.133] (0.216)

Values are unstandardized regression coefficients, B [95% confidence interval] (p-value), estimated using HC3 heteroscedasticity-robust standard errors. Reference categories were male sex, no diabetes mellitus and no arteriovenous fistula. All models included n=75 participants.

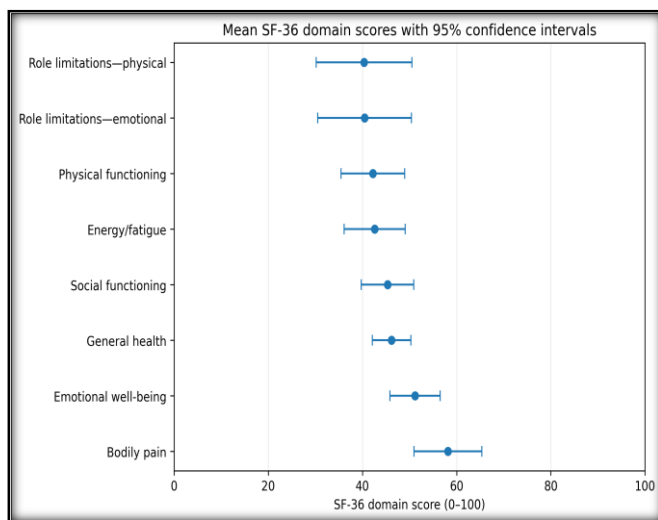


Figure 1: Mean SF-36 domain scores with 95% confidence intervals. Domains are ordered from the lowest to the highest mean score. Higher scores indicate better health-related quality of life.

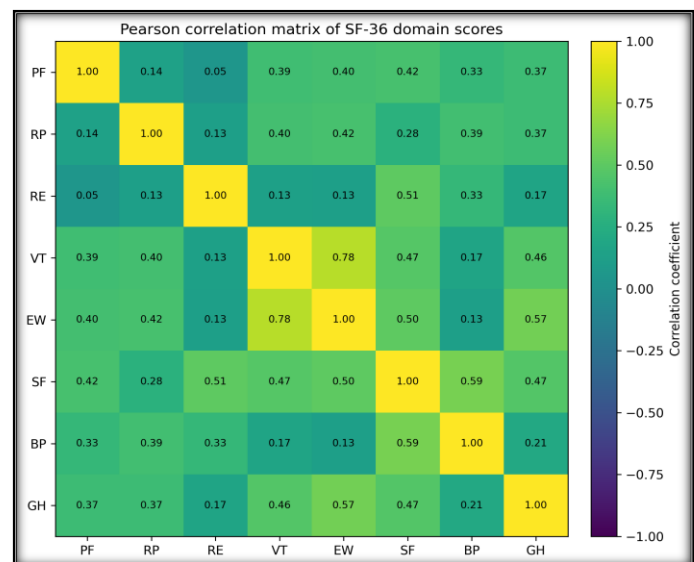


Figure 3: Pearson correlation matrix for the eight SF-36 domains. PF, physical functioning; RP, role limitations due to physical health; RE, role limitations due to emotional problems; VT, energy/fatigue (vitality); EW, emotional well-being; SF, social functioning; BP, bodily pain; GH, general health.

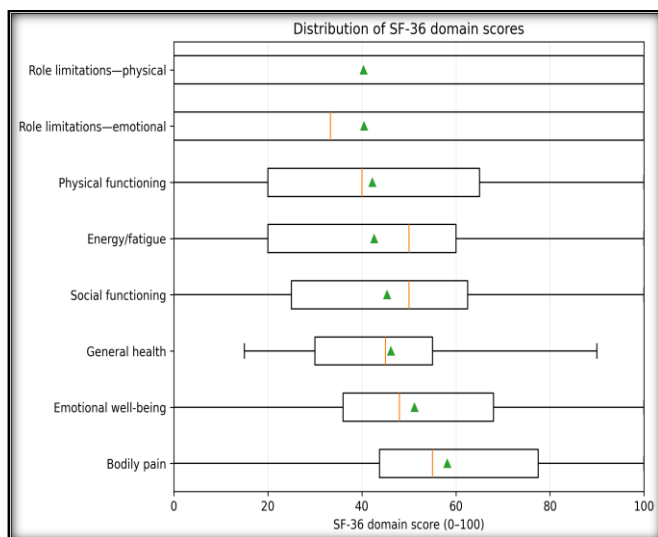


Figure 2: Distribution of the eight SF-36 domain scores. Boxes show the interquartile range, central lines show medians, whiskers show the distribution outside the box and markers show means.

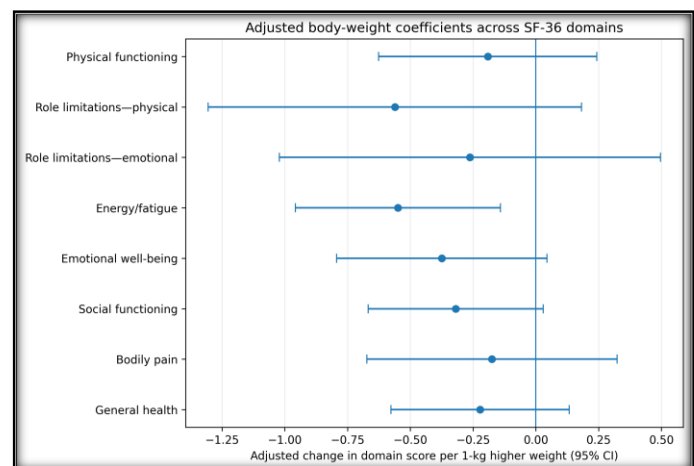


Figure 4: Adjusted regression coefficients for body weight across SF-36 domains. Points indicate the estimated change in domain score per 1-kg higher body weight; horizontal lines indicate HC3 robust 95% confidence intervals.

DISCUSSION

This study identified broad impairment across the SF-36 profile among adults receiving maintenance haemodialysis in Punjab. The lowest mean scores occurred in role limitations due to physical health, role limitations due to emotional problems, physical functioning and energy/fatigue. Bodily pain had the highest mean score, although the average remained well below the best possible health state. The two role-limitation domains also displayed pronounced floor and ceiling effects. Neither the bivariate analyses nor the prespecified multivariable models identified a robust sociodemographic or clinical correlate after false-discovery-rate adjustment.

The predominance of physical and role-related impairment is consistent with the broader haemodialysis literature. A synthesis of SF-36 studies found that haemodialysis populations experienced their greatest relative burden in physical functioning, general health and role limitations due to physical health.^[7] In a 2024 Peruvian study, physical-role functioning, physical functioning and emotional-role functioning were also the lowest-scoring SF-36 domains.^[8] More recently, a systematic review and meta-analysis from low- and lower-middle-income countries demonstrated substantial deterioration in HRQoL at advanced CKD stages and among patients receiving dialysis.^[9] Although absolute scores should not be compared uncritically across studies because of differences in language, culture, case mix and treatment delivery, the recurring pattern strengthens the plausibility of the present domain profile.

The very high proportions of participants at the minimum and maximum values in the two role-limitation domains require careful interpretation. The original role items use dichotomous response options and therefore generate relatively coarse scores, which can produce clustering at 0 and 100. Consequently, the low mean role scores likely reflect genuine limitations in work and usual activities, but these domains may be less sensitive to small between-person differences or change than more continuously distributed scales such as physical functioning, energy/fatigue and emotional well-being. The absence of arbitrary categories such as 'poor' or 'good' HRQoL is therefore important; the results are best interpreted as a domain profile rather than as a diagnostic classification.

The low energy/fatigue score is clinically relevant. Fatigue affects approximately 70% of people receiving dialysis worldwide and may reflect anaemia, inflammation, sleep disturbance, depressive symptoms, comorbidity, fluid shifts and physical deconditioning.^[4] In the present study, physical functioning and social functioning were also reduced, suggesting that low vitality may coexist with restricted mobility, dependence in daily activities and reduced social participation. Routine assessment of fatigue should therefore prompt evaluation of potentially modifiable contributors rather than being accepted as an inevitable consequence of haemodialysis.

Higher body weight was associated with a lower energy/fatigue score in the adjusted model, but this finding should be considered exploratory. The coefficient was no

longer statistically significant after correction for multiple testing, the overall model did not reach the conventional significance threshold and body weight alone cannot distinguish adiposity, lean mass or extracellular volume. Residual confounding by nutritional status, interdialytic fluid gain, inflammation, physical activity or comorbidity is therefore plausible. The direction and magnitude of this association should be reassessed using body mass index, waist measures, objective volume assessment and nutritional markers in a larger cohort rather than interpreted as evidence that greater weight causes fatigue.

Most examined characteristics, including age, sex, diabetes mellitus, dialysis duration, weekly haemodialysis frequency and arteriovenous-fistula status, were not independently associated with the SF-36 domains. This should not be interpreted as proof of no clinically important relationship. The sample was modest, several exposure categories were imbalanced, hypertension was nearly universal and the available variables did not capture haemoglobin, albumin, dialysis adequacy, residual kidney function, depressive symptoms, frailty, employment, income, transport burden or family support. These limitations reduce statistical power and leave substantial scope for residual confounding. Wide confidence intervals for several coefficients also show that clinically meaningful positive or negative associations remain compatible with the data.

The internal-consistency findings provide additional context. Reliability was high for most multi-item domains, but lower for social functioning and general health. The social-functioning scale contains only two items, making alpha especially sensitive to the inter-item correlation. The lower general-health alpha, including a weak corrected item-total correlation for one item, may also reflect cultural interpretation, translation or heterogeneity in the construct. These domains should therefore be interpreted cautiously, and future studies should document the exact language version, cultural adaptation and measurement properties of the instrument in the target population.

The findings support a more patient-centred approach to haemodialysis care. Biochemical and treatment-delivery indicators remain essential, but they do not fully describe whether patients can walk, work, maintain social roles or sustain energy. Brief repeated patient-reported outcome assessment could identify people requiring evaluation for anaemia, malnutrition, sleep disturbance, depression, pain, functional decline or social difficulties. Higher HRQoL has been associated with lower subsequent hospitalization and mortality in dialysis cohorts,^[6,10] although the present cross-sectional study cannot determine whether interventions that improve SF-36 scores would improve clinical outcomes.

This study has several strengths, including analysis of all 75 enrolled participants, complete data for all study variables, automated verification of SF-36 scoring, reporting of all eight domains rather than an unvalidated total score, assessment of floor and ceiling effects, and use of robust regression and multiplicity sensitivity analyses. Its limitations include the cross-sectional single-centre design, small sample size, non-probability recruitment, absence of a non-dialysis or population comparison group, use of body weight rather than body mass index or body-composition measures, and limited clinical, biochemical, psychological and socioeconomic covariates. The results may

therefore not be generalizable to other dialysis centres or regions. Future multicentre longitudinal studies should incorporate dialysis adequacy, laboratory and nutritional measures, residual kidney function, frailty, depression, employment and financial burden, and should evaluate changes in HRQoL over time.

CONCLUSION

Adults receiving maintenance haemodialysis at this tertiary-care institution experienced substantial impairment across multiple dimensions of health-related quality of life, particularly physical and emotional role performance, physical functioning and energy/fatigue. The apparent inverse association between body weight and energy/fatigue did not withstand correction for multiple testing and should be treated as hypothesis generating. Incorporating structured patient-reported outcome assessment into haemodialysis care may help identify functional, psychological and social needs that are not captured by conventional clinical indicators.

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Conflicts of interest

There are no conflicts of interest.

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