Nefrologia xx (2026) 501593

Revista de la Sociedad Española de Nefrología
journal homepage: www.revistanefrologia.com

Original article

# Comparative analysis of patient-reported outcome and experience measures in different stages of chronic kidney disease

## *Análisis comparativo de los parámetros de resultados y experiencia comunicados por los pacientes en las diferentes fases de la enfermedad renal crónica*

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ARTICLE INFO

*Keywords:*
CKD
Quality of life
Renal replacement therapies
PROMs
PREMs

ABSTRACT

*Background:* Patients with advanced chronic kidney disease (CKD) in different stages have lower quality of life relative to the general population. No study has yet compared all available renal replacement options and included patient self-assessment of the quality of healthcare received.
*Methods:* Descriptive observational, cross-sectional, multicenter study conducted by applying Patient-Reported Outcome Measures (PROMs) [VAS, SF36, FACIT, PFS, HADS] and Patient-Reported Experience Measures (PREMs) questionnaires (PACIC), in patients with stage 4–5 CKD, kidney transplant (KT), in-center hemodialysis (HD), home hemodialysis (HHD), peritoneal dialysis (PD), and CKD stages 1–2 as controls.
*Results:* A total of 319 patients were included, comprising 84 (26%) on HD, 48 (15%) on PD, 50 (16%) with KT, 50 (16%) with advanced CKD, 38 (12%) on HHD, and 49 (15%) individuals with stages 1 and 2 CKD (control group).

Among PROMS, significant differences were found in the SF-36 physical functioning and fatigue scales (PFS and FACIT), with HHD patients showing the best results.

In PREMS, the highest rating of quality of care received (using the PACIC scale) was also from HHD patients, followed by transplant recipients and patients on peritoneal dialysis.
*Conclusions:* Patients on HHD reported the best physical functioning, resembling controls and transplant patients in fatigue symptoms, and this group also gave the best rating on healthcare received. Home hemodialysis is a renal replacement therapy option with high indices of quality of life and patient-reported experience, similar to those achieved in kidney transplant patients. This should be considered when informing patients and selecting the optimal renal replacement therapy option.

*Palabras clave:*
Enfermedad renal crónica
Calidad de vida

RESUMEN

*Antecedentes:* Los pacientes con enfermedad renal crónica (ERC) avanzada en diferentes etapas presentan una menor calidad de vida en comparación con la población general. Ningún estudio ha comparado hasta ahora

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https://doi.org/10.1016/j.nefro.2026.501593
Received 14 January 2026; Accepted 1 June 2026
Available online xxx
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Please cite this article in press as: C. Daza, A. Herranz, P. Molina, et al., Comparative analysis of patient-reported outcome and experience measures in different stages of chronic kidney disease, Nefrologia, https://doi.org/10.1016/j.nefro.2026.501593

Terapias de sustitución renal
PROM
PREM

todas las opciones disponibles de reemplazo renal incluyendo además la autoevaluación del paciente sobre la calidad de la atención recibida.

*Métodos:* Estudio observacional, descriptivo, transversal y multicéntrico realizado mediante la aplicación de cuestionarios de Medidas de Resultados Reportados por los Pacientes (PROMs) [VAS, SF36, FACIT, PFS, HADS] y Medidas de Experiencia Reportadas por los Pacientes (PREMs) (PACIC), en pacientes con ERC en estadio 4–5, trasplante renal (TR), hemodiálisis en centro (HD), hemodiálisis domiciliaria (HHD), diálisis peritoneal (PD) y ERC en estadios 1–2 como controles.

*Resultados:* Se incluyeron 319 pacientes: 84 (26%) en HD, 48 (15%) en PD, 50 (16%) con TR, 50 (16%) con ERC avanzada, 38 (12%) en HHD y 49 (15%) con ERC en estadios 1 y 2 (grupo control).

Entre los PROMs se encontraron diferencias significativas en las escalas de funcionamiento físico del SF-36 y en las de fatiga (PFS y FACIT), siendo los pacientes en HHD quienes mostraron los mejores resultados.

En los PREMs, la puntuación más alta en calidad de la atención recibida (según la escala PACIC) también correspondió a los pacientes en HHD, seguidos por los receptores de trasplante y los pacientes en diálisis peritoneal.

*Conclusiones:* Los pacientes en HHD reportaron el mejor funcionamiento físico, similar al de los controles y los pacientes trasplantados en cuanto a síntomas de fatiga, y este grupo también otorgó la mejor valoración a la atención sanitaria recibida. La hemodiálisis domiciliaria es una opción de terapia de tratamiento renal sustitutivo con altos índices de calidad de vida y experiencia reportada por los pacientes, comparable a los logrados en los pacientes trasplantados. Esto debe considerarse al informar a los pacientes y en el proceso de toma de decisiones compartidas.

## Introduction

Chronic kidney disease (CKD) is a significant global health challenge, with an estimated 850 million individuals affected worldwide[1] and a rising incidence.[2] CKD progression is gradual, leading patients to advanced chronic kidney disease (ACKD), and prompting consideration of renal replacement therapy (RRT), typically indicated when the filtration rate falls below 10 ml/min/1.73 $m^2$. Current RRT options consist of kidney transplantation and extracorporeal clearance techniques, including in-center hemodialysis (HD), home hemodialysis (HHD), and peritoneal dialysis (PD).

Use of home hemodialysis is experiencing a growing incidence worldwide, as it provides patients with the comfort of being at home and enables them to maintain a more normal lifestyle with fewer diet and fluid intake restrictions. However, data on quality of life studies in these patients are lacking.

The physical effects of CKD[3] coupled with the emotional impact of transitioning to RRT can substantially impact patient quality of life.[4,5]

Health-related quality of life (HRQoL) gauges the extent to which an individual's routine or expected physical, emotional, and social well-being is affected by their medical condition or its treatment. Despite its limited integration into routine clinical practice, HRQoL assessment is critical, as its decline correlates with heightened hospitalization and mortality risks. Patient-Reported Outcome Measures (PROMs) are validated scales quantifying patients' health status perceptions, considering symptomatic burden, functional status, and mental and physical states.[6]

Although less explored, Patient-Reported Experience Measures (PREMs) are also closely tied to HRQoL, offering validated insights into patient perception of the quality of healthcare received.

Numerous studies have highlighted the reduced HRQoL among CKD patients in various stages and RRT modalities compared with general population.[7–9] Many authors have studied the influence of the type of chosen treatment in HRQoL[10–12] but to our knowledge, none have made a comprehensive comparison including all available options and a control group in early stages of CKD, encompassing not only PROMs but also PREMs.

## Objectives

To analyze the differences in the results of HRQoL assessed through validated scales (PROMs and PREMs) in patients across different scenarios of advanced chronic kidney disease and a control group.

## Methods and materials

### *Study design*

We conducted an observational, cross-sectional, multicenter descriptive study by administrating PROMs and PREMs questionnaires and collecting demographic and analytical variables.

### *Participants*

This project was conducted at the Hospital Clínico Universitario de Valencia, Hospital Universitario Dr. Peset, Hospital General Universitario de Castellón, and the BBRAUN Avitum Valnefrón and Massamagrell satellite hemodialysis centers. Patients aged 18 and older in follow-up at these centers, with various stages of CKD and modalities of RRT and who provided informed consent were randomly included. Participants were categorized into six study groups: advanced chronic kidney disease (CKD stages 4 and 5) not on dialysis, home hemodialysis (HHD), peritoneal dialysis (PD), in center hemodialysis (HD), kidney transplant recipients (KT), and finally, patients with CKD stages 1 and 2 (control group). Patients with severe psychiatric disorders, advanced dementia, severe active disease, hospitalized patients, and those with a life expectancy of less than one year were excluded.

### *Data collection*

The required information was collected between January 2023 and February 2024. Whenever feasible, patients independently completed PROM and PREM questionnaires and provided sociodemographic variables. This process lasted approximately 25 min and was preceded by a standardized brief explanation by a trained psychologist across all centers to mitigate biases stemming from survey interpretation variability (same psychologist in all centers).

Whenever feasible, patients completed the PROM and PREM questionnaires independently after receiving a standardized explanation from a trained psychologist present in all centers. When patients had reading difficulties or visual impairment, the questionnaires were interviewer-administered, with healthcare professionals reading the questions aloud and recording the responses indicated by the patient, without interpretation or modification.

Overall, questionnaires were self-administered in approximately 70% of participants, while assisted administration was required in the remaining patients, mainly due to age-related limitations or visual impairment.

Clinical variables were extracted from medical records using the health system's clinical management application (Orion Clinic).

### *Demographic and clinical variables*

The demographic variables collected included age, sex, employment status, education level, and marital status. Clinical and biochemical profiles included number and type of comorbidities, estimated glomerular filtration rated by CKD-EPI, and blood values of C-reactive protein, hemoglobin, albumin, phosphorus, and creatinine. Comorbidities were assessed using the Charlson Comorbidity Index,[13] and overall functional status was evaluated using the Karnofsky Performance Status Scale.

### *PROMs*

The following validated scales were administered in their Spanish version: the *Visual Analog Scale* (VAS)[14] for pain assessment; the *Short-form-36* (SF-36)[15] (comprising subscales for physical functioning, social functioning, role limitations due to physical or emotional problems, mental health, vitality, and general health perception); the *Functional Assessment of Chronic Illness Therapy – Fatigue* (FACIT-F)[16]; the *Piper Fatigue Scale* (PFS),[17] and the *Hospital Anxiety and Depression Scale* (HADS).[18]

The Piper Fatigue Scale (PFS) ranges from 0 to 10, with higher scores indicating greater fatigue severity. Scores above 4 are generally considered to represent clinically relevant fatigue.

The Functional Assessment of Chronic Illness Therapy – Fatigue (FACIT-F) scale ranges from 0 to 52, with higher scores indicating lower fatigue levels and better functional status.

These scales allow complementary assessment of fatigue burden in patients with CKD.

### *PREMs*

To evaluate PREMs we administered the Spanish version of the validated *Patient Assessment of Chronic Illness Care* (PACIC) scale,[19] with a score ranging between 1 and 5, higher values indicating a better perception of the quality of care received.

The study was approved by the Institutional Review Board of the Hospital Clínico Universitario de València (protocol number 2022/322).

### *Statistical analysis*

Descriptive analysis of quantitative variables was expressed using the median and the interquartile range (IQR) in variables with non-parametric distribution, and using the mean and standard deviation for those with normal distribution. Qualitative variables were presented with frequency distributions and percentages.

Hypothesis testing with Pearson's Chi-squared test ($X^2$) was used to compare qualitative variables in independent groups (multiple groups). Quantitative variables were compared between groups (HD, DP, advanced CKD, HHD, TR, Control), using the ANOVA test when data followed a normal distribution, and otherwise, the Kruskal–Wallis test. Analyses were conducted both including and excluding the control group to obtain a comprehensive view of the results.

When global differences were observed between groups, exploratory pairwise comparisons were performed to identify the main group differences.

A $p$-value $< 0.05$ was considered statistically significant for all measurements.

IBM SPSS Statistics version 25 was utilized for all analyses.

## Results

### *Patient characteristics*

A total of 319 patients were included in the study, of whom 84 (26%) were on HD, 48 (15%) on PD, 50 (16%) had undergone kidney transplantation (KT), 50 (16%) had advanced CKD not yet on RRT, 38 (12%) were on HHD, and 49 (15%) were individuals with CKD stages 1 and 2 (control group).

The main characteristics of the groups are summarized in Tables 1 and 2. A lower comorbidity burden was observed in the KT, HHD, and control groups, as compared to the PD, HD, and advanced CKD groups, which were older and had more prevalence of

**Table 1**
Patients' characteristics according to study group.

| | PD ($n$ = 48) | HD ($n$ = 84) | ACKD ($n$ = 50) | KT ($n$ = 50) | CONTROLS ($n$ = 49) | HHD ($n$ = 38) | TOTAL ($n$ = 319) | $p$ | $p$ without control group |
|---|---|---|---|---|---|---|---|---|---|
| *Age* | 70.1 ± 13.55 | 73.9 ± 10.81 | 74.8 ± 11.91 | 60.9 ± 14.60 | 58.0 ± 15.97 | 58.4 ± 10.24 | 67.13 ± 14.62 | **0.000** | <0.000 |
| *Sex* | | | | | | | | | |
| Male | 36 (75.0) | 62 (73.8) | 27 (54.0) | 33 (66.0) | 27 (55.1) | 24 (63.2) | 209 (65.8) | **0.079** | 0.122 |
| Female | 12 (25.0) | 22 (26.2) | 23 (46.0) | 17 (34.0) | 22 (44.9) | 14(36.8) | 110 (34.2) | | |
| *Educative level* | | | | | | | | | |
| None | 6 | 18 | 14 | 4 | 3 | 2 | 47 (16.8%) | 0.125 | 0.233 |
| Basic | 22 | 36 | 20 | 26 | 22 | 18 | 144 (51.6%) | | |
| Secondary school | 13 | 21 | 10 | 12 | 13 | 9 | 78 (28.0%) | | |
| University | 7 | 9 | 5 | 7 | 11 | 8 | 47 (16.8%) | | |
| *Civil status* | | | | | | | | | |
| Married | 37 (77.1) | 58 (69.0) | 24 (50.0) | 26 (53.1) | 31 (64.6) | 24 (64.9) | 176 (63.5) | <**0.001** | <**0.001** |
| Single | 0 | 3 (3.6) | 5 (10.4) | 5 (10.2) | 9 (18.8) | 2 (5.4) | 27 (9.7) | | |
| Domestic couple | 5 (10.4) | 0 | 0 | 4 (8.2) | 0 | 1 (2.7) | 24 (8.7) | | |
| Separated/Divorced | 2 (4.2) | 5 (6) | 3 (6.3) | 12 (24.5) | 2 (4.2) | 7 (18.9) | 50 (18.1) | | |
| Widower | 4 (8.3) | 18 (21.4) | 16 (33.3) | 6 (12.2) | 6 (12.5) | 3(8.1) | | | |
| *Work status* | | | | | | | | | |
| Active | 6 (12.5) | 4 (4.8) | 4 (8.0) | 5 (10.2) | 20 (40.8) | 9 (24.3) | 48 (15.1) | | |
| Non active | 42 (87.5) | 80 (95.2) | 46 (92) | 44 (89.8) | 29 (59.2) | 28 (75.7) | 269(84.9) | <**0.001** | **0.026** |
| *Charlson comobility Index* | 6.0 ± 2.46 | 6.5 ± 2.85 | 6.0 ± 1.74 | 3.3 ± 2.34 | 2.2 ± 1.86 | 4.18 ± 2.36 | 4.94 ± 2.87 | <**0.001** | <**0.001** |
| *Karnofsky Index* | 72.92 ± 14.29 | 69.94 ± 15.09 | 72.65 ± 14.83 | 81.60 ± 11.67 | 79.39 ± 12.65 | 82.63 ± 12.01 | 75.53 ± 14.52 | <**0.001** | <**0.001** |

*N* (%); mean ± SD. PD: peritoneal dialysis; HD: hemodialysis; ACKD: advanced chronic kidney disease; KT: kidney transplant; Control: CKD stages 1–2. Test ANOVA/Kruskal–Wallis.

**Table 2**
Main comorbidities and lab data across different groups.

| | PD | HD | ACKD | KT | CONTROLS | HDD | TOTAL | *p* | *p* without control group |
|---|---|---|---|---|---|---|---|---|---|
| Diabetes | 22 (45.8) | 21 (25.3) | 15 (30.0) | 16 (32.0) | 11 (22.4) | 7(18.4) | 92 (28.6) | 0.062 | 0.059 |
| Congestive heart failure | 9 (18.8) | 15 (18.1) | 5 (10.0) | 1 (2.0) | 0 (0.0) | 5(13.2) | 35 (11) | **0.003** | **0.060** |
| Coronary heart disease | 4 (8.3) | 14 (16.9) | 2 (4.0) | 1 (2.0) | 1 (2.0) | 4(10.5) | 26 (8.2) | **0.011** | **0.032** |
| COPD | 2 (4.2) | 8 (9.6) | 3 (6.0) | 2 (4.0) | 0 (0.0) | 1 (2.6) | 16 (5) | 0.219 | 0.5496 |
| eGFR CKD-EPI (ml/min * 1.73 $m^2$) | 10.95 [6.97–17.32] | – | 15.80 [13.65–19.95] | 53 [36–76] | 89.70 [69.10–90] | 9 [6–9] | 13.05 [5–44] | **<0.001** | **< 0.001** |
| Serum creatinine (mg/dl) | 4.93 [3.5–7.37] | 7.51 [5.48–8.54] | 3.13 [2.72–3.6] | 1.33 [1.02–1.65] | 0.83 [0.71–1.03] | 7.47 [5.96–9.13] | 3.84 [1.43–7.20] | **<0.001** | **< 0.001** |
| Hemoglobin (g/dl) | 12 [10.7–13.05] | 11.15 [10.47–12.03] | 12 [11.35–12.75] | 13.50 [12.10–14.80] | 14.7 [13.5–15.9] | 11.3 [10.7–12.22] | 12.1 [11.05–13.5] | **<0.001** | **< 0.001** |
| Serum albumin (g/dl) | 3.75 [3.4–4] | 3.80 [3.6–4] | 4.10 [3.8–4] | 4.40 [4.1–4.7] | 4.20 [4.05–4.6] | 3.95 [3.77–4.30] | 4 [3.7–4.3] | **<0.001** | **< 0.001** |
| CRP (mg/dl) | 3.05 [1.77–11] | 5 [2.37–12.87] | 3 [1.35–13] | 2 [1–5] | 2 [0.95–3.55] | 5.4 [1.12–13.63] | 3.3 [1.22–10.55] | **0.001** | **0.085** |
| Phosphorus (mg/dl) | 4.50 [3.7–5] | 4.50 [3.57–5.3] | 4 [3.5–4.35] | 3.20 [2.8–3.5] | 3.50 [3.1–4.05] | 4.70 [3.80–5.42] | 3.9 [3.3–4.7] | **<0.001** | **0.000** |
| ESA treatment | 20 (42.6) | 69 (82.1) | 15 (30) | 6 (12) | | 31 (81.6) | 141 (52.4) | | **< 0.001** |

*N* (%); Median [IQR]; PD: peritoneal dyalisis; HD: hemodialysis; ACKD: advanced chronic kidney disease; KT: kidney transplant; Control: CKD stages 1–2; COPD: chronic obstructive pulmonary disease; eGFR: estimated glomerular filtration rate; CRP: C reactive protein; ESA: erythropoietin stimulating treatment.

cardiovascular disease. All groups achieved target hemoglobin levels or above. Anemia was present in the HD and HHD groups, with very similar hemoglobin levels (11.15 and 11.3 g/dl, respectively). Consequently, a higher percentage of patients in these groups were receiving erythropoietin treatment. There were differences in albumin levels, but all groups were within the normal range. Differences in C-reactive protein (CRP) levels lost statistical significance when excluding the control group. The highest CRP values were observed in the HHD group, followed by the HD group. Differences in phosphorus levels were observed, remaining within the normal range in all groups except for the HHD group, where they slightly exceeded it ($p < 0.001$).

### *PREMs*

Regarding PREMs assessed using the PACIC scale, the highest quality of care rating was from patients on HHD, followed by transplant recipients and patients on peritoneal dialysis (Fig. 1), while the lowest rating in this scale was from HD and advanced CKD (similar to controls). After adjustment for multiple comparisions differences we found significative differences between HD/DP, HD-KT and ACKD-KT.

### *PROMs*

Table 3 summarizes the results obtained from the validated scales. In the PROMS scales, differences were observed in fatigue scales (PFS and FACIT), consistent with the differences found in physical functioning and general health in the SF-36.

In the SF-36, patients on HHD had the best outcomes in physical functioning, comparable to those of controls. In the general health category, however, HD patients had the poorest results, followed by HHD. KT patients showed the most positive scores in SF-36 general health, similar to controls.

Higher scores on the PFS scale indicate greater symptomatic burden and worse functionality, whereas higher scores on FACIT and SF-36 indicate better outcomes.

The wide interquartile ranges observed in PFS results suggest the presence of a subgroup of patients with moderate-to-severe fatigue, particularly in the PD group.

Patients undergoing PD exhibited the worst results in both fatigue scales (FACIT and PFS).

In the PFS scale, KT and controls had the best results, followed by patients on HHD. In the FACIT scale, the highest scores were obtained by controls and patients on HHD, followed by patients on HD.

We found no differences in the results of the VAS scale or the specific anxiety and depression scales (HADS). No between-group differences were found in emotional, and mental health domains of the SF-36, nor in the vitality section.

Overall, the best results were observed in HHD and KT patients compared with HD and PD groups in this unadjusted analysis.

## Discussion

Although several treatments and modalities of renal replacement therapy are available for improving survival in patients with advanced CKD, the low quality of life observed in these populations remains a challenge, and additional strategies to enhance the physical and mental health of these patients are needed. We conducted this study to test the hypothesis that the CKD stage and the type of kidney replacement treatment may be related to both the quality of life and the self-reported quality of healthcare received. Results suggest that there are differences in HRQoL among the various stages of CKD in the scale used to measure PREMs (PACIC), and the different PROMs,

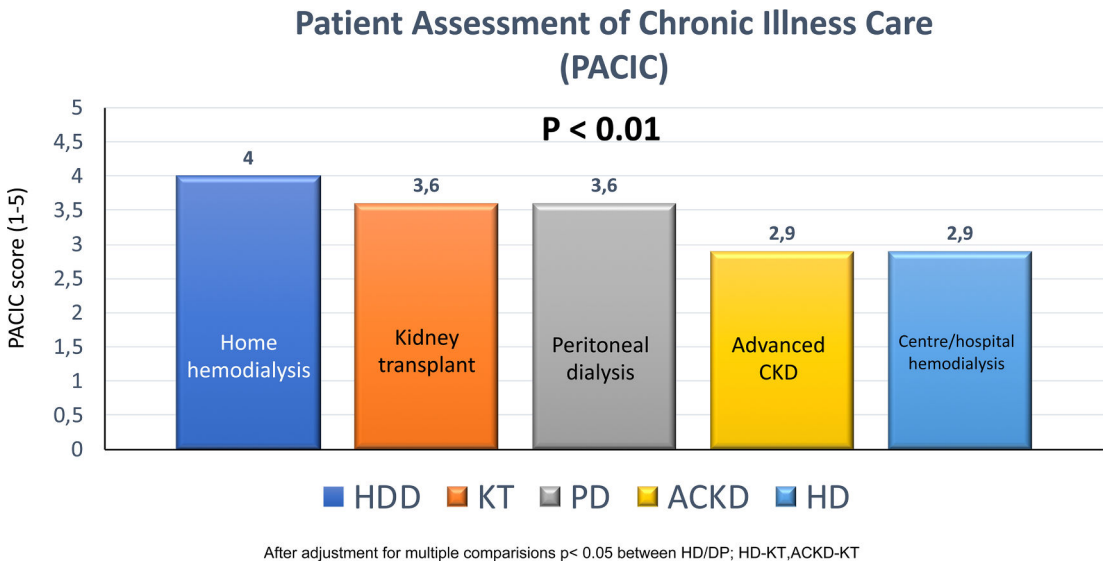


**Fig. 1.** Comparative results between groups according to the PACIC scale (ANOVA Test). After adjustment for multiple comparisons $p < 0.05$ between HD/DP; HD-KT, ACKD-KT.

specifically in those assessing physical functionality, but not in those evaluating psychological, emotional, or social aspects domains.

To our knowledge, this is the first study comparing PREMs on CKD patients with different stages and all available options for renal replacement therapy, showing that the patients most satisfied with the care received as measured by PACIC are those on HHD, closely followed by transplant recipients and patients on PD.

The PACIC scale has been assessed as a tool for implementing a patient-centered care model in chronic conditions such as diabetes,[20] chronic pain, heart failure, asthma, and coronary artery disease.[21] However, only two studies have employed it in renal populations. In a Canadian study, Evans et al. used this scale to evaluate perceived level of coordination of the multidisciplinary care required by patients on HD, HHD, and with ACD not yet on RRT. Similar to our study, the HHD group patients yielded the best results, while patients on HD had the poorest outcomes in the various items evaluated by the scale.[22]

In our study, patients in stages 1 and 2 of the disease scored the lowest in care received according to the PACIC scale, which can be explained by a lower need for monitoring than other groups, resulting in fewer visits to the center and thus a weaker bond with the healthcare professional. Additionally, many of the questions on this scale (e.g., "I was encouraged to attend a specific group or class that would help me cope with my illness") are aspects crucial in the care of ACD or RRT patients, but less relevant and thus unratable for patients in the early stages of CKD. Excluding this group, ACD and HD patients scored the lowest, with very similar values. These results are similar to those found by Evans et al.[22] from their specific comparison between the two abovementioned groups, of which ACD patients had significantly better scores only in items asking about the healthcare professional's interest in their visits to other specialists or encouragement to attend community support programs.

Patients on HHD and HD also showed contrasting results in the physical functioning domain of the SF-36, with the former presenting the highest scores, equivalent to those of controls, and the latter scoring the lowest, consistent with findings in the literature.[23] Between these extremes, renal transplant patients in our study exhibited better results, in line with Ogutmen et al.'s study, which found better outcomes for renal transplant patients than those on DP or HD in the role–physical domain of the SF-36.[24] These authors excluded patients with advanced CKD and those on HHD from their analysis. Interestingly, kidney transplant patients in our study did not possess a particularly high perception of quality of life. One possible explanation for this is that the selection criteria for this procedure is currently being extended to include older patients with more comorbidities in this RRT type.[25]

In contrast to the above, but in line with Ogutmen et al., renal transplant recipients scored the highest in the SF-36 general health subscale in our study, while HD patients scored the lowest, closely followed by HHD patients. In addition to the influence of group heterogeneity in terms of comorbidity burden, this may be attributed to the nature of the questions assessing this domain (Supplementary Material Questions 1 and 11, SF-36), which ask patients to rate their overall health on a scale from poor to excellent and subjectively assess their tendency to illness with a temporal perspective and compared to other people. Despite demonstrating good physical performance, as indicated by the results in this domain, HHD patients, like HD patients, experience almost daily confirmation of their renal disease, which has a greater impact on their daily lives than stable renal transplant patients, those with advanced CKD not yet requiring TRS, or even patients on DP.

Fatigue, defined as a continuous sensation of tiredness that prevents individuals from carrying out their usual activities,[26] stands out among the wide array of symptoms reported by renal patients.[27] We found that patients on DP reported higher levels of fatigue in both the PFS and FACIT scales. Lobbedez et al. found no differences in degree of fatigue between patients on DP and those on HD[28]; however, their study only included patients over 70 years old and employed a different assessment scale. Like our findings, they observed a higher burden of fatigue in patients undergoing RRT, whether on DP or HD, compared to controls. In the PFS scale, renal transplant patients even outperformed controls, and patients on HHD achieved the next best results. Conversely, in the FACIT scale, HHD patients ranked below controls, with renal transplant patients scoring lower even than those on HD.

The discrepancy observed in the results derived from the PFS and the FACIT-F questionnaires could be ascribed to the formulation of the questions. PFS questions are somewhat abstract, potentially confusing patients, leading them toward indicating a lack of fatigue. In contrast, the alternative questionnaire featured more intelligible inquiries, enabling patients to provide more coherent responses and consequently yielding a more precise depiction of their fatigue levels.

The data we collected from the HADS questionnaire contradicts the available literature. Various studies report high rates of depression and anxiety in chronic kidney disease patients,[29–31] while our study's

**Table 3**
Mean PROMs and scores according to study group.

| | PD | HD | ACKD | KT | CONTROL | HHD | *p* | *p* without control group |
|---|---|---|---|---|---|---|---|---|
| *Karnofsky Index* | 70 [60–80] | 70 [60–80] | 70 [60–85] | 80 [70–90] | 80 [70–90] | 80 [77.50–90] | **0.000** | **0.003** |
| **PROMs** | | | | | | | | |
| *Visual Analog Scale* | 12 [0–27.5] | 20 [1–50] | 18 [0–50.5] | 19 [0–50.5] | 17 [0–40.5] | 5 [0–30] | **0.235** | **0.157** |
| *Piper Fatigue Scale* | 3.86 [1.95–6] | 2.27 [0.61–5.25] | 1.95 [0.00-5.56] | 0 [0–3.95] | 1.02 [0–3.69] | 1.81 [0.85–5.30] | **0.006** | < **0.001** |
| *FACIT* | 20 [10–35] | 30.00 [19.00–39.75] | 23.00 [13.00–37.00] | 23.00 [12.5–40.00] | 41.00 [30.5–47.00] | 40.50 [31.75–45.00] | < **0.001** | < 0.001 |
| **HADS subscales** | | | | | | | | |
| *HADS-Depression* | 5 [3–9] | 5.00 [2.00–8.00] | 6 [1.00–9] | 3 [2–5.25] | 3.5 [1–8] | 4.5 [1.00–6.00] | 0.087 | 0.063 |
| Normal | 30 (62.5) | 59 (71.1) | 30 (60.0) | 41 (82.0) | 34 (70.8) | 30 (78.9) | 0.478 | 0.282 |
| Borderline | 9 (18.8) | 11 (13.3) | 11 (22.0) | 5 (10.0) | 8 (16.7) | 5 (13.2) | | |
| Depression | 9 (18.8) | 13 (15.7) | 9 (18.0) | 4 (8.0) | 6 (12.5) | 3 (7.9) | | |
| *HADS-Anxiety* | 5 [2–8] | 5.00 [2.00–8.2.5] | 4 [3.00–10.00] | 4 [2–8] | 5 [3–9] | 5.00 [3.00–7.00] | 0.780 | 0.947 |
| Normal | 34 (70.8) | 58 (70.7) | 32 (68.1) | 35 (70.0) | 33 (67.3) | 30 (78.9) | 0.922 | 0.851 |
| Borderline | 10 (20.8) | 12 (14.6) | 8 (17.0) | 8 (16.0)) | 8 (16.3) | 6 (15.8) | | |
| Depression | 4 (8.3) | 12 (14.6) | 7 (14.9) | 7 (14.0) | 8 (16.3) | 2 (5.3) | | |
| **SF-36-subscales** | | | | | | | | |
| *SF-36-Physical functioning* | 45 [20–70] | 37.50 [15.00–60.00] | 45.00 [20.00–70.00] | 70 [48.75–85] | 80 [57.5–95] | 80.00 [57.5–90] | < **0.001** | < **0.001** |
| *SF-36- Role-Physical* | 25 [0–75] | 0 [0–50] | 12.5 [0–100] | 37.50 [0–100] | 75 [25–100] | 75 [0–100] | < **0.001** | 0.064 |
| *SF-36-General health* | 44.66 ± 17.50 | 37.9 ± 17.19 | 42.0 ± 19.17 | 54.74 ± 20.71 | 54.5 ± 18.26 | 40 [31.5–63.25] | < **0.001** | < **0.001** |
| *SF-36-Vitality* | 45 [20–63.75] | 52.5 [30–70] | 50 [25–80] | 60 [40–80] | 65 [32.5–80] | 57.5 [35–80] | 0.075 | 0.089 |
| *SF-36-Social functioning* | 62.5 [50–96.87] | 62.5 [37.5–100] | 75 [34.37–90.62] | 75 [59.37–100] | 100 [62.5–100] | 75 [50–100] | **0.018** | 0.692 |
| *SF-36- Role-Emotional* | 100 [33.3–100] | 100 [0–100] | 100 [0–100] | 100 [33.3–100] | 100 [33.33–100] | 100 [58.33–100] | 0.471 | 0.543 |
| *SF-36-Mental health* | 64 [52–83] | 68 [52.00–91.00] | 74 [47–88] | 74 [52–85] | 68 [52–84] | 80 [63–88] | 0.312 | 0.932 |

*N* (%); Median [IQR]. PD: peritoneal dialysis; HD: hemodialysis; ACKD: advanced chronic kidney disease; KT: kidney transplant; Control: CKD stages 1–2. ANOVA test was used when data followed a normal distribution, and otherwise, the Kruskal–Wallis test.

results indicate a low prevalence of both conditions. Furthermore, disease stage and treatment modality did not influence the prevalence of these two disorders, as no significant differences were found in any case, diverging from other articles. These findings align with those obtained in the domains of SF-36 mental health and SF-36 role–emotional, with low values and no significant between-group differences found. These scores could be explained by the fact that in many cases healthcare personnel were responsible for reading out and marking responses, which given the ongoing stigma and discrimination regarding mental health may have made patients uncomfortable addressing such issues. Another possible explanation is that patients undergoing long-term renal replacement therapy may develop psychological adaptation mechanisms over time, which could attenuate differences in reported anxiety and depression across treatment modalities. Additionally, the relatively small sample size in each group may limit the ability to detect subtle differences in psychological outcomes.

The low scores on the VAS, consistent across groups, suggest that pain is not a central symptom in any of the patient groups included in our study. It is known that pain is among the symptoms with the greatest psychosocial impact of diseases, and that there is a bidirectional relationship between them[32]; therefore, the low scores obtained on the pain scale could explain the good results of our patients in this area.

The current study has several limitations. The primary drawback is the small sample size of the groups and the unavoidable influence of their inherent characteristics, making it difficult to separate these factors from the influence of the patient's clinical setting.

Another limitation relates to the mode of administration of the questionnaires. Although most PROMs and PREMs were self-administered, a proportion required interviewer-assisted administration due to age-related limitations. This could potentially influence responses, particularly in sensitive domains such as psychological symptoms.

Due to the cross-sectional design and the heterogeneity between groups, we did not perform multivariable analyses adjusting for potential confounders such as age, comorbidity burden, or functional status. Therefore, results should be interpreted cautiously.

Finally, the heterogeneity of patient comorbidities may make it difficult to obtain conclusions from the study, although this could be compensated by our inclusion of patients in all stages of RRT as well as an early-stage CKD control group. Nonetheless, performing multiple quality of life tests, and including patients on home hemodialysis (a notably understudied area), may be considered strengths of the study.

From a clinical perspective, incorporating PROMs and PREMs into routine nephrology practice could help identify unmet patient needs that are not captured through traditional clinical indicators. Regular administration of these questionnaires may facilitate individualized care plans, allowing clinicians to detect fatigue, functional limitations, or dissatisfaction with care early.

In addition, providing feedback to patients based on their responses could promote shared decision-making, particularly when discussing renal replacement therapy options such as home hemodialysis, peritoneal dialysis, or transplantation.

## Conclusions

In a descriptive unadjusted analysis of HRQoL of patients in different stages of CKD, compared to a control group, we observed that patients on HHD exhibit the best outcomes in physical functioning and resemble both controls and transplant patients in terms of fatigue symptoms, while we found no between-group differences in social, emotional, vitality, or mental health domains. Notably, differences were observed in the perception of the quality of healthcare received, with the highest ratings from HHD patients, followed by transplant and peritoneal dialysis patients. All groups demonstrated high levels of empowerment, underscoring the vital importance of involving patients in their own treatment. Therefore, home hemodialysis should be presented as a renal replacement therapy with high indices of quality of life and patient-reported experience measures, similar to those achieved in kidney transplant patients. This aspect should be considered when informing patients and selecting the optimal renal replacement therapy.

## Conflict of interest

The authors declare no conflict of interest.

## Acknowledgements

We thank the Institutional Review Board of the Hospital Clínico Universitario de València for revising and approving the project.

This project has been made possible with the support of European funds for the EPRIEX program, "Program for First Professional Experience in Public Administrations". CD and AH received a scholarship from the EPRIEX project through INCLIVA Biomedical Research Institute.

## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.nefro.2026.501593.

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