

Original article

Factors associated with quality of life and its prediction in kidney patients on haemodialysis[☆]

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ABSTRACT

Background and objective: The present study aims to analyze the levels of health-related quality of life (HRQoL) in patients with end-stage kidney disease (ESKD) in haemodialysis, and to explore what demographic, medical and psychological variables are associated with HRQoL and contribute to its prediction.

Materials and methods: Cross-sectional study with 302 patients with ACKD on haemodialysis. They were assessed: (1) HRQoL (Shorter Form Health Survey Questionnaire); (2) Anxiety and depression (Goldberg Anxiety and Depression Scale); (3) Sociodemographic data and (4) Medical data. Correlational analyses, means comparison and a path analyses with latent variables (PALV) were conducted.

Results: The PALV showed that 42% of the variance in the HRQL could be explained by the variables evaluated ($\chi^2/df = 2.10$; GFI = .938; IFI = .920; CFI = .918; RMSEA = .062; SRMR = .056). Depression was the strongest predictor of HRQL ($-.71$; $p = .002$), followed by physical activity ($-.19$; $p = .044$). Age ($-.122$; $p = .034$) and comorbidity ($-.206$; $p = .001$) were weakly associated with physical HRQL. The practice of regular physical activity is related to the physical HRQoL ($r = .21$; $p = .00$) and mental ($r = .12$; $p = .028$).

Conclusions: A high percentage of the variance in HRQoL is explained by the levels of depression and physical activity. Interventions to promote HRQoL in patients with ESKD should focus in promoting physical activity and taking care of patient's mental health.

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Factores asociados a la calidad de vida y su predicción en pacientes renales en hemodiálisis

RESUMEN

Antecedentes y objetivo: El presente estudio tiene como objetivo analizar los niveles de calidad de vida relacionada con la salud (CVRS) de los pacientes con enfermedad renal crónica avanzada (ERCA) en hemodiálisis y conocer qué variables demográficas, médicas y psicológicas se asocian con la CVRS y contribuyen a predecirla.

Materiales y métodos: Estudio transversal con 302 pacientes con ERCA en tratamiento de hemodiálisis. Se evaluaron las siguientes variables: 1) CVRS (cuestionario *Shorter Form Health Survey Questionnaire*); 2) Ansiedad y depresión (*Escala de ansiedad y depresión de Goldberg*) 3) Datos sociodemográficos y 4) Datos médicos. Se realizaron análisis correlacionales, comparación de medias y análisis de vías con variables latentes (PALV).

Resultados: El PALV mostró que el 42% de la varianza en la CVRS podría explicarse por las variables evaluadas ($\chi^2/df = 2,10$; GFI = ,938; IFI = ,920; CFI = ,918; RMSEA = ,062; SRMR = ,056). La depresión fue el predictor más fuerte de la CVRS ($-,71$; $p = ,002$), seguida de la actividad física ($-,19$; $p = ,044$). La edad ($-,122$; $p = ,034$) y la comorbilidad ($-,206$; $p = ,001$) se asociaron débilmente con la CVRS física. La práctica de una actividad física regular está relacionado con la CVRS física ($r = ,21$; $p = ,00$) y mental ($r = ,12$; $p = ,028$).

Conclusiones: Un alto porcentaje de la varianza en CVRS se explica por los niveles de depresión y actividad física. Las intervenciones para promover la CVRS en pacientes con ERCA deben centrarse en promover la actividad física y cuidar la salud mental del paciente.

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Introduction

Suffering from advanced chronic kidney disease (ACKD) and undergoing treatment with haemodialysis may have a profound emotional, functional and social impact both for the patient and for their environment. These patients find themselves within a challenging context that involves a multitude of behavioural and lifestyle changes, such as adapting to the treatment duration and schedule, fluid and dietary restrictions, and taking multiple medications.¹

The ACKD is, therefore, a disease that has a significant impact on the patient's health-related quality of life (HRQoL).^{1,2} HRQoL is defined as the patient's subjective assessment of the impact of their disease and treatment on their physical, mental and social perception,^{3,4} and it can be influenced by the clinical manifestations of the disease, the side effects of the treatments and even by the quality of the relationships between patients and their relatives and health-care professionals⁵. HRQoL provides information about the patient's physical and mental status and can serve as a marker for the development of associated health problems.⁶ In the case of haemodialysis patients, several studies have found that lower levels of HRQoL are associated with a higher risk of death and hospitalisation.^{6,7}

In ACKD, as in most chronic diseases, the main objective of treatment is not to achieve a cure, but instead to maximise the HRQoL of patients.^{8,9} As such, and given that HRQoL is the patient's subjective assessment of his or her own state of health,^{3,4} in order to treat renal patients with criteria based on excellence, the interdisciplinary team must take into account

both clinically objective results and patient perceptions about their physical and mental health.^{8,9}

The patient's state of mind is one of the variables most commonly related to their HRQoL.^{3,10,11} Previous studies have found in haemodialysis patients rates of depression between 22.8% and 39.3%^{10,11} and rates of anxiety between 21% and 35.3%.^{3,11} Many studies have found that patients with high levels of anxiety and depression perceive a worse physical and mental HRQoL.^{3,9–11}

In terms of gender, the literature has shown that women have higher levels of anxiety and depression both in the normal population and in patients.^{3,11}

Several studies have found a positive relationship between HRQoL levels –both physical and mental– and the practice of moderate physical activity.^{12,13} Different meta-analyses have confirmed that for patients with ACKD, any physical exercise performed for eight weeks or more at least three times a week for more than 30 min per session effectively improves physical fitness, blood pressure, nutritional status and HRQoL.^{12,13} With regard to the variables associated with HRQoL, numerous studies have highlighted the effect of factors such as anaemia, age or comorbidity on HRQoL.^{4,14} Others have found that in elderly patients and with greater comorbidity, functional capacity is lower and the repercussions of the disease on their HRQoL is greater.^{14,15} Similarly, being a woman, having diabetes and a lower haematocrit level are factors that are negatively related to HRQoL.^{3,15}

The objective of this study was to gain an understanding of the physical and mental dimensions of HRQoL in patients with ACKD undergoing haemodialysis treatment, and to find out which demographic, medical and psychological variables

are associated, and the variables on which we can work in order to maximise HRQoL.

Materials and methods

Participants

A total of 302 patients participated in the study. All patients received haemodialysis treatment in three out-of-hospital haemodialysis units in the Community of Madrid during the period between January 2014 and December 2017. The inclusion criteria for this study were being over 18 years of age, having the diagnosis of ACKD and undergoing regular haemodialysis, and having completed a full psychological and social evaluation, which is part of the reception protocol of the participating units. The exclusion criteria were having an intellectual disability, cognitive impairment, not having a sufficient understanding of Spanish or not having completed a full psychological and social evaluation. Of a total of 406 eligible patients, 61 patients were excluded because they did not meet the inclusion criteria and 43 were considered lost due to incomplete data.

Design

All the data used for this study were collected through the process of a medical, social and psychological evaluation that was carried out routinely at the site where the research was performed, and were used retrospectively for this article. This was a non-experimental, cross-sectional and correlational study that measured the following psychological variables: (1) physical and mental HRQoL; (2) anxiety; and (3) depression. In addition, sociodemographic variables collected through semi-structured interviews were evaluated. The medical data were extracted from the medical records of the patients participating in the study.

Instruments

- 12-Item Short Form Health Survey (SF-12).¹⁶ Spanish version validated by Alonso, Prieto and Antó.¹⁷ The SF-12 survey is an instrument used for HRQoL evaluation. It consists of 12 items selected by multiple regression from the items of the 8 dimensions of the 36-Item Short Form Health Survey (SF-36).¹⁸ The SF-36 health survey is one of the world's most widely used generic instruments for evaluating HRQoL.^{17,18} The SF-12 yields scores that correspond to the Physical Component Summary (PCS) and Mental Component Summary (MCS). It is answered using Likert scales of between two and six points depending on the item. The scale has an internal consistency greater than 0.70 (Cronbach's alpha)¹⁹ and adequate construct validity¹⁸. In this study, the overall internal consistency of the survey was 0.808, 0.715 for the physical component and 0.727 for the mental component.
- Goldberg Anxiety and Depression Scale (GADS).²⁰ Spanish version validated by Mortón et al.²¹ This scale consists of two subscales, one to evaluate anxiety and the other for depression, with nine items each, and with dichotomous responses (Yes/No). The first four questions of each subscale

are mandatory, and the other five depend on the responses to the previous questions (in the anxiety subscale, questions five to nine are asked if the patient answers *yes* to at least two of the four initial questions, and in the depression subscale if the patient answers *yes* to at least one). It is considered a scale for healthcare and epidemiological use, useful as a guide for the detection of anxiety, depression or mixed problems. Goldberg et al. (1988) proposed a cut-off point of ≥ 4 for the anxiety scale and ≥ 2 for the depression scale. These cut-off values have demonstrated a sensitivity of 83.1% and a specificity of 81.8%, as well as a positive predictive value of 95.3% in the Spanish population.²¹ In this study, the internal consistency of the overall scale was 0.782, while it was 0.654 in the anxiety subscale and 0.705 in the depression subscale.

- Sociodemographic questionnaire. A document designed *ad hoc* that included gender, marital status, living arrangements, level of education, employment status and legal recognition of the degree of disability and dependency. These data were collected in the evaluation interviews that were conducted during routine healthcare carried out at the site where the patients were receiving dialysis treatment. The degree of disability is expressed as a percentage and constitutes individual recognition of a physical, mental, intellectual or sensory limitation, to which other social factors that hinder the social integration of the person are added. For haemodialysis patients, the degree of disability corresponds to a mild-moderate degree and the percentage is between 50% and 70%.²² Dependency is expressed in degrees and constitutes recognition of a situation of permanent loss of physical, mental, intellectual or sensory autonomy, which requires the help of other people to perform the basic activities of daily living (ADLs), either due to age, illness or disability.²³ This study only considered the legal recognition of the degree of disability and dependency.
- Clinical questionnaire to collect the patient's medical variables. This included the aetiology of ACKD, characteristics of entry into haemodialysis, time (months) on haemodialysis, weekly hours of treatment, status concerning the transplant list, number of previous kidney transplants, age-adjusted Charlson comorbidity index (ACCI)²⁴ and evaluation of physical activity. This last item was evaluated by a question about the level of physical activity that the person performs, and was answered using a Likert scale with the following options: frequently (does regular physical activity or walks at least three days/week for a period of at least an hour), sometimes (occasional physical activity or walks fewer than three days/week and for less than an hour) and never (reports not doing any type of physical exercise).

Procedure

The patients were individually evaluated between January 2014 and December 2017. Regarding informed consent, exceptionally, specific consent was not requested for this study, since it is a retrospective study that uses data obtained in the psychological and social assessment that is part of the healthcare process that is carried out routinely for all patients receiving dialysis treatment at the study sites. The size of the sample (302) and the period analysed (four years) made

it very difficult (or even impossible in the case of transfers, transplants or deaths) to obtain consent for a large number of patients in the sample. However, this study was approved by the Independent Ethics Committee of the Hospital Universitario Fundación Alcorcón [Alcorcón Foundation University Hospital] (IEC-HUFA), the referral hospital of one of the dialysis sites participating in the study. The IEC was duly informed of the lack of informed consent and, understanding the reasons for this, the committee approved the conduct of this research based on the data already collected in the patients' medical records.

Statistical analysis

First, the descriptive statistics of the variables evaluated were obtained. Subsequently, the Kolmogorov-Smirnov normality test was performed. If the data followed a normal distribution, parametric tests were used; otherwise, their non-parametric version was used. To study the relationship between continuous variables, Pearson correlations were performed, while to study the differences in anxiety, depression and HRQoL scores as a function of categorical variables, Student's t-tests or one-way ANOVAs were performed. Once the variables significantly related to HRQoL in this study were known, a structural equation model called Path Analysis with Latent Variables (PALV) was performed with the aim of exploring the degree to which the different variables evaluated contributed to predicting the level of HRQoL. The PALV entails an extension of the multiple regression analysis since it allows us to not only find out to what degree various dependent variables (in this case comorbidity, depression, anxiety, physical activity, etc.) help to predict a dependent variable (in this case HRQoL), but also how the different predictors relate to each other, directly and indirectly influencing the dependent variable.²⁵ However, it is important to note that the model does not allow causality to be inferred in itself, but rather facilitates understanding regarding to what degree a possible causal hypothesis is compatible with or fits the data obtained.²⁶ To evaluate the degree of fit of the PALV, the Chi square absolute fit index divided by degrees of freedom (χ^2 , χ^2/df), the Goodness of Fit index (GFI), the Incremental Fit Index (IFI) and the following non-central tendency indices of fit were used: Comparative Fit Index (CFI); Root Mean Square Error of Approximation (RMSEA); Standardised Root Mean Square Residual (SRMR), as well as the criteria for acceptance or rejection of the model described by Hair, Black, Babin, Anderson, & Tathan (2010)²⁷ (χ^2/df ratio <5; SRMR <0.08; RMSEA and SRMR <0.08; GFI, CFI and IFI >0.90).

Results

The sample (N = 302) had a mean age of 64.9 years (SD = 15). The mean time on haemodialysis at the time of evolution was 10 months (SD = 33.92).

Of the 302 patients, 87 (28.8%) were diabetic and CKD was of undetermined origin in 59 patients (17.9%). Entry into dialysis was planned and known for 84.4% of patients, while 23.5% of the total sample was on the kidney transplantation waiting list (Table 1).

Of the 302 patients, 153 claimed to do physical exercise frequently (frequency ≥ 3 days/week, time ≥ 1 h/day). 27.8% (n = 84) had a disability certificate; physical disability was the most common, accounting for 75%, and only 16 patients (5.3%) had recognition of dependency (Table 1).

Relationship of sociodemographic variables with HRQoL scores, anxiety and depression

HRQoL scores on the SF-12 Health Survey, on a scale of 0–100, were 45.03 (SD = 14.22) on average for the Physical Component Summary (PCS) and 58.73 (SD = 12.79) for the Mental Component Summary (MCS). When comparing the values found in the sample for the HRQoL components, the results were significantly lower than the population mean (mean PCS and MCS reference score for the Spanish population 50)¹⁸ for the PCS (t = -4.96; $p < 0.001$) and significantly higher for the MCS (t = 11.87; $p < 0.001$) (Table 2).

The mean score for anxiety was 1.54 (SD = 2.14) and 1.54 for depression (SD = 2.11). Women showed higher levels of anxiety ($p = 0.014$) and depression than men ($p = 0.045$) (Table 2).

None of the other sociodemographic variables evaluated was related to HRQoL, anxiety or depression except for age, which showed a statistically significant, inverse and weak correlation with physical HRQoL ($r = -0.122$; $p = 0.034$).

Relationship of medical variables with HRQoL, anxiety and depression

The data showed a significant, inverse and weak correlation between physical HRQoL and comorbidity. Statistically significant, positive and weak correlations between HRQoL (both dimensions) and physical activity were also found. No statistically significant differences were found regarding HRQoL, anxiety and depression with regard to the rest of the medical variables evaluated (cause of kidney disease, form of entry to haemodialysis, time on haemodialysis, etc.) (Table 3).

Relationship between anxiety, depression and HRQoL

Anxiety and depression were more closely related to the mental dimension of HRQoL than to the physical dimension. Depression showed higher correlations with both dimensions of HRQoL than anxiety (Table 3).

HRQoL prediction (path analysis or PALV)

The results so far have demonstrated that the only variables related to HRQoL are physical activity, depression, anxiety and comorbidity. To study the joint effect of these variables in predicting HRQoL, and considering the existing correlation between anxiety and depression, a PALV was performed. In this model, only items one to four of the anxiety and depression subscales of the Goldberg Anxiety and Depression Scale questionnaire were included, because they were the only items that all the patients answered, and the PALV does not allow for the inclusion of variables with missing values in the model. Fig. 1 shows this model, with the regression weights and the percentage of variance explained in HRQoL. The model indices of fit are shown at the bottom of Fig. 1.

Table 1 – Description of the sample (n = 302).

Marital status	n	%
Married	189	62.6
Widowed	40	13.2
Single	38	12.6
Divorced	35	11.6
<i>Living arrangements</i>		
With family	213	70.5
Alone	72	23.8
With friends	3	1
<i>Level of education</i>		
No education	1	0.3
Unfinished primary education	46	15.2
Completed primary education	154	51
Secondary/Vocational training	50	16.6
University	51	16.9
<i>Employment status</i>		
Disabled or retired	214	70.9
Unemployed	60	19.8
Working	28	9.3
<i>Cause of ACKD</i>		
Diabetes	87	28.8
Undetermined	54	17.9
Glomerular	49	16.2
Vascular	45	14.9
Cystic	25	8.3
Other	42	13.9
<i>Form of entry to HD</i>		
Planned	255	84.4
Unplanned	47	15.6
<i>Transplant list</i>		
Pending inclusion or temporary contraindication	118	39.1
Not on the list	113	37.4
On the list	71	23.5
<i>No. of kidney transplants</i>		
0	254	84.1
1	40	13.2
2 or more	8	2.7
<i>Physical activity</i>		
Frequent	153	50.7
Never	108	35.8
Sometimes	41	13.6
<i>Disability</i>		
No	218	72.2
Yes	84	27.8
<i>Type of disability*</i>		
Physical	63	20.9
Sensory	19	6.3
<i>Dependence</i>		
No	286	94.7
Yes	16	5.3

ACKD, advanced chronic kidney disease; HD, haemodialysis; n, frequency; %, percentage.
 * Includes only those patients who had a recognised degree of disability.

Overall, 42% of the variance in HRQoL can be explained from the variables included in the model. Depression was the variable with the highest weight in the prediction (-0.71 , $p=0.002$), followed by physical activity (0.12 , $p=0.044$). Neither anxiety (0.10 , $p=0.628$) nor comorbidity (-0.08 , $p=0.176$) contributed significantly to the prediction of HRQoL (Fig. 1).

Regarding the model indices of fit, all were found to be within the acceptance limits, as shown in Fig. 1, and it can be concluded that it is well estimated.

Discussion

The central objective of this study was to gain an understanding of the physical and mental dimensions of HRQoL in patients with ACKD undergoing haemodialysis treatment, and to find out which demographic, medical and psychological variables are associated with this. The most relevant finding of this study is the fact that a high percentage of the variance in HRQoL (42%) can be predicted from anxiety and depression

Table 2 – Anxiety, depression and HRQoL levels.

	Mean		Mean	SD
	Minimum	Maximum		
<i>Evaluation (N = 302)</i>				
Physical HRQoL	5	70	45.03	14.22
Mental HRQoL	11.11	77.78	58.73	12.79
Anxiety	0	9	1.54	2.14
Depression	0	9	1.54	2.11
<i>Gender comparisons</i>				
Gender	Mean (SD)		t	p
<i>Physical HRQoL</i>				
Male	45.71 (13.45)		1.184	0.238
Female	43.44 (15.88)			
<i>Mental HRQoL</i>				
Male	59.36 (12.58)		1.320	0.19
Female	57.24 (13.20)			
<i>Anxiety</i>				
Male	1.32 (1.97)		-2.71	0.014
Female	2.04 (2.44)			
<i>Depression</i>				
Male	1.37 (2.00)		-2.13	0.045
Female	1.93 (2.30)			

SD: standard deviation.

Table 3 – Pearson correlations.

Between medical and psychological variables			
	Charlson Index	Physical activity	
Physical HRQoL	-0.206***	0.215**	
Mental HRQoL	-0.062	0.186***	
Anxiety	-0.009	0.065	
Depression	0.036	-0.045	
Between HRQoL, anxiety and depression			
	Mental HRQoL	Anxiety	Depression
Physical HRQoL	0.546***	-0.162**	-0.313**
Mental HRQoL		-0.343***	-0.466***
Anxiety			0.602***

Note: ** $p \leq 0.01$; *** $p \leq 0.001$.

levels, the practice of physical activity and the comorbidity index, with depression being the variable most closely related to a worsening of HRQoL.

Regarding the mental health of the participants, it is interesting to note that the anxiety levels in this study (15.9%) are slightly lower than in previous studies.^{3,11} However, depression levels (35.8%) are similar to previous studies.^{3,10,11} Regarding HRQoL, the results obtained for the physical dimension (below the Spanish average) confirm those obtained in other studies^{1,2}; this is not so for the results obtained for the mental dimension, where there are few studies with scores above the average for the reference population.²⁸ An explanation for this difference could be that in the present study, the surveys were completed by an interview and not directly by the patient. This could have had an influence in that patients may have tried to present a more positive image of themselves.

With regard to the relationship between the sociodemographic and psychological variables evaluated (anxiety, depression and HRQoL), it was found that age is inversely related to physical HRQoL, which is a finding consistent with previous research.^{3,15} Regarding gender, as in previous studies,^{3,11} women experienced higher levels of anxiety and depression. From a gender perspective, multiple explanations have been proposed for these differences.^{29,30} One of them is based on the fact that, as in this study, most of the evaluations consist of self-reported measures and that the differences can be explained, at least in part, by the traditional masculine gender stereotype that can make men less likely to recognise their own symptoms.²⁹ Other explanations have to do with unequal distribution of resources between genders, greater physical activity in men, poorer health status in women³¹ and differences in coping styles, for example, a greater tendency towards reflexion in women.³²

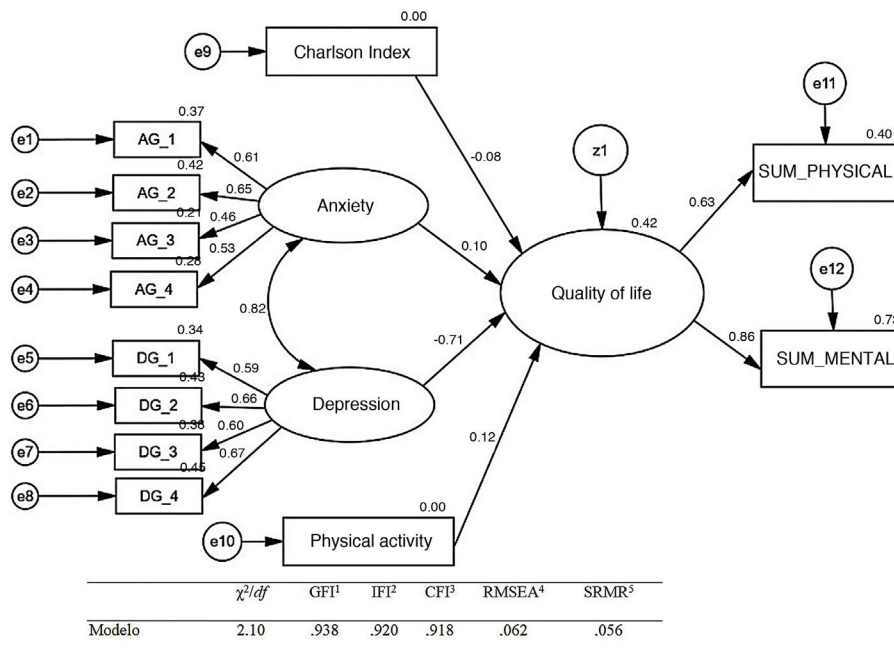


Fig. 1 – Path Analysis with Latent Variables for predicting quality of life and its indices of fit.

Note: 1 = Goodness of Fit Index; 2 = Incremental Fit Index; 3 = Comparative Fit Index; 4 = Root Mean Square Error of Approximation; 5 = Standardised Root Mean Square Residual. The model was calculated with a sample of 283 patients, after eliminating from the sample patients with missing data for any of the variables included in the model. AG_1 to AG_4 and DG_1 to DG_4 = items 1–4 of the anxiety and depression subscales, respectively, of the Goldberg Anxiety and Depression Scale.

In relation to the influence of medical variables, comorbidity was found to be inversely related to physical HRQoL, and this is consistent with other previous studies.^{3,15} In addition, physical activity was directly related to both physical and mental HRQoL, in line with previous studies,^{12,13} confirming the importance of renal patients practising physical activity.

Regarding the relationship between HRQoL, anxiety and depression, a strong direct relationship between physical and mental HRQoL was identified. Therefore, anxiety and depression are conceptualised as a risk factor for low physical and mental HRQoL. We therefore hypothesise that a possible way to comply with the recommendation to look after the HRQoL of patients^{8,9} is to properly address their emotional state.

With regard to the prediction of HRQoL from the variables evaluated, it was found that the depression variable contributes significantly and inversely to this prediction, and to a lesser extent physical activity in a direct correlation, which is in line with data from previous studies.^{3,10,11} Furthermore, this study supports the potential of physical activity to be a direct predictor of HRQoL. Both the practice of physical activity³⁰ and the reduction in levels of depression³³ are factors on which intervention is possible with cognitive-behavioural psychological therapy in order to enhance HRQoL in renal patients.³²

Regarding the limitations of this study, it is worth mentioning that only data related to one renal replacement therapy technique (hemodialysis) have been obtained and,

consequently, it is not possible to compare the variables evaluated based on the RRT technique. Also, the fact that the study is correlational prevents causal relationships from being established. Finally, the dependency, disability and physical activity assessments could be improved by using standardised questionnaires for their evaluation, as has been done for depression, anxiety and HRQoL.

The data as a whole support the importance of evaluating and recording those aspects reported by the patient (Patient Reported Outcome Measures, PROM) as recommended by the CKD working group of the International Consortium for Health Outcomes Measurement (ICHOM).³⁴ In addition, they reflect the relevance of adopting a comprehensive approach that includes mental health care for patients with ACKD undergoing haemodialysis treatment in order to maximise their HRQoL and improve the quality of care for these patients. More specifically, this study highlights the importance of promoting physical activity and addressing depression in haemodialysis patients.

Conclusions

In kidney patients on haemodialysis, anxiety, depression, greater comorbidity and lower level of physical activity are significantly associated with worse HRQoL, especially depression and physical activity. Promoting physical activity and treating depression would have a positive impact on both physical and mental aspects of HRQoL.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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