

Adherence to treatment, emotional state and quality of life in patients with end-stage renal disease undergoing dialysis

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Abstract

Background: A low rate of adherence to treatment is a widespread problem of great clinical relevance among dialysis patients. The objective of the present study is to determine the relationship between adherence, emotional state (depression, anxiety, and perceived stress), and health-related quality of life (HRQOL) in renal patients undergoing dialysis. **Method:** Two patient groups (30 in hemodialysis and 31 in peritoneal dialysis) participated in this study. We evaluated aspects of adherence, depression, anxiety, perceived stress, and HRQOL with self-report and standardized instruments. **Results:** Peritoneal dialysis patients reported significantly higher levels of adherence to treatment and better HRQOL in Physical Function and Bodily Pain domains. Depression level is associated with HRQOL indicators. We did not find any differences regarding specific adherence to antihypertensive and phosphate binder drugs or in psychological variables depending on the modality of dialysis. Patients with adherence to antihypertensive drugs show better physical HRQOL. The predictors of HRQOL in dialysis patients were: work, gender and depression. **Conclusions:** Our results suggest that the modality of dialysis does not differentially affect the emotional state or specific adherence to drugs, but it is nevertheless related to their overall adherence to treatment and to their HRQOL.

Keywords: adherence, anxiety, depression, quality of life, dialysis.

Resumen

Adhesión al tratamiento, estado emocional y calidad de vida en pacientes con insuficiencia renal crónica en tratamiento con diálisis.

Antecedentes: la escasa adhesión al tratamiento y un estado psicológico negativo constituyen potenciales factores de riesgo para la calidad de vida relacionada con la salud (CVRS) de los pacientes en diálisis. El objetivo del presente trabajo fue estudiar las relaciones entre adhesión, estado emocional (depresión, ansiedad y estrés percibido) y CVRS en pacientes en hemodiálisis y diálisis peritoneal. **Método:** participaron dos grupos de pacientes (30 en hemodiálisis y 31 en diálisis peritoneal). Evaluación mediante autoinformes e instrumentos estandarizados. **Resultados:** los pacientes en diálisis peritoneal informaron de niveles significativamente más altos de adhesión y mejor CVRS en función física y dolor corporal. La depresión se relaciona de manera significativa con la CVRS. No encontramos diferencias en adhesión específica a fármacos hipotensores y quelantes del fósforo ni en las variables psicológicas en función de la modalidad de diálisis. Al analizar la muestra en conjunto los pacientes adherentes a los hipotensores tienen mejor CVRS física. Los predictores de CVRS en pacientes en diálisis fueron: trabajo, género y depresión. **Conclusiones:** nuestros resultados sugieren que la modalidad de diálisis no afecta al estado emocional ni a la adhesión específica a fármacos, pero sí está asociada al grado de adhesión global al tratamiento y CVRS.

Palabras clave: adhesión, ansiedad, depresión, calidad de vida, diálisis.

Patients with advanced chronic kidney disease are suitable for substitutive renal treatment to replace kidney function. Currently and according to the Epidemiological Study of Chronic Renal Failure in Spain (EPIRCE), there is a prevalence of 6.8% of chronic renal failure at stages 3 to 5 among Spain's population (Otero, de Francisco, Gayoso, García, & EPIRCE study group, 2010). There are three possible treatment modalities for the disease: hemodialysis, peritoneal dialysis, and transplant. Hemodialysis was the first treatment designed for this purpose and it is currently the most extensively used technique in Spain. Peritoneal dialysis is an alternative to hemodialysis and is carried out in the patient's

home, and the patient is responsible for self-administering the treatment by means of a peritoneal catheter.

Low adherence to medical treatment is a widely extended problem among chronically ill patients (Cvengros, Christensen, & Lawton, 2004). Although therapeutic compliance has been defined as the extent to which the patient's behavior coincides with the healthcare professional's instructions (Haynes, Taylor, & Sackett, 1979), more recently, therapeutic adherence has been shown to be a complex and multidimensional behavior (Remor, 2011), which goes beyond the simple intake of prescribed medication. For example, in both its modalities, dialysis is a highly invasive non-curing treatment, which should be accompanied by a specific diet, fluid restriction, and a large number of daily pills, all of which involve a high cost for the patients and their families (Cukor, Cohen, Peterson, & Kimmel, 2007). Within this complex treatment regime, the prescription of oral phosphate binders is practically universal (Tonelli, Pannu, & Manns, 2010). The problem of phosphorus control is an arduous task for the medical professional

and the patient, since it is one of the lesser known aspects of the treatment and one with the lowest rates of adherence (Arenas, Malek, Álvarez-Ude, Moledus, & Reig-Ferrer, 2010). Likewise, managing hypertension has classically been linked to the patient's lack of adherence, both in the general population and in that with kidney disease (Moser & Setaro, 2006). Hence, management of both complications can be considered a challenge in the treatment of kidney disease, and it may be possible relevant indicators of non-adherence that should be studied in these patients.

Kidney patients present a decrease in their perception of health and an increase in anxious-depressive states (Abdel-Kader, Unruh, & Weisbord, 2009). Some of the causes that are attributed to this decrease in quality of life are associated with comorbidity, lack of professional occupation, and complex therapeutic regimes (Rodríguez-Fructuoso, Castro, Oliveira, Prata, & Morgado, 2011).

The current state of knowledge of the behavior of adherence, the emotional state, and quality of life of patients on hemodialysis and peritoneal dialysis has revealed the need to study these phenomena relatedly in order to describe dialytic technique that may be of greater benefits for the patient.

Considering the above-mentioned variables, we propose to describe the level of adherence to treatments, emotional state (depression, anxiety and perceived stress), as well as health-related quality of life (HRQOL) of patients on hemodialysis and peritoneal dialysis. We shall also determine whether there are differences in the variables assessed as a function of dialysis modalities, and the relations among the variables of the study.

Method

Participants

Sixty-one patients on dialysis in a nephrology unit of a university hospital of the Region of Madrid were assessed for the present study. Details of the sociodemographic characteristics and health status of the sample are summarized in Tables 1 and 2.

Instruments

Survey of clinical profile, sociodemographic data, and biochemical parameters. This survey collects data on age, months on dialysis, date of diagnosis, cause of kidney disease, Charlson comorbidity index, use of psychotropic drugs, daily number of pills, gender, civil status, work, educational level, potassium, calcium, phosphorus, hypertension, and hyperphosphoremia.

Survey of facilitators of general adherence to treatment ($\alpha = .67$). We selected and adapted items from a prior measure of adherence to treatment (Remor, 2002). The survey gathers information on: the treatment, the relation with the healthcare team, family support, knowledge of medication and diet, self-administration of medication, perceived benefits of medication and diet, patients' following nephrologists' instructions, perceived effort and perceived capacity to follow treatment.

Morisky-Green-Levine Test (Morisky, Green, & Levine, 1986). We used this 4-item test to measure adherence to oral treatment for hypertension and hyperphosphoremia. The Spanish version was validated by Val-Jiménez, Amorós, Martínez, Fernández, & León (1992). This instrument has been shown to be effective in the detection of noncompliant patients in chronic pathologies such as diabetes and hypertension (Roos, Pittman, & Koo, 2002).

Beck Depression Inventory, version 2 ($\alpha = .90$; BDI-II; Beck, Steer, & Brown, 1996). We used the Spanish version of Sanz, Perdigón, and Vázquez (2003). According to the original authors, scores of 17 or higher discriminate depressive episodes that require treatment with a reliability of 90%.

State-Trait Anxiety Inventory ($\alpha = .59$; STAI, Spielberger, Gorsuch, & Lushene, 1983). We used the Spanish version of Seisdedos (1982). For the present study, we selected the State Anxiety subscale (STAI-S). The data reflected on the scale are of a transitory nature, that is, they should be considered a representative sample of the subject's anxiety response only at the moment of administering the test. Higher scores indicate a greater state-anxiety.

Perceived Stress Scale, 10-item version ($\alpha = .88$; PSS-10, Cohen, Kamarck, & Mermelstein, 1983). We used the Spanish version of Remor (2006). This tool assesses the stress perceived during the past month. Higher scores correspond to more perceived stress.

Short-form Health Survey (MOS SF-36, McHorney, Ware, & Raczek, 1993). We used the Spanish version of Alonso, Prieto, and Antó (1995). This survey assesses 8 dimensions of physical and mental health status: Physical Function ($\alpha = .90$), Physical Role ($\alpha = .97$), Bodily Pain ($\alpha = .93$), General Health ($\alpha = .65$), Vitality ($\alpha = .83$), Social Function ($\alpha = .79$), Emotional Role ($\alpha = .94$), and Mental Health ($\alpha = .78$). There are two component summaries: physical (PCS) and mental (MCS). Higher scores indicate greater HRQOL.

Procedure

Approval from the Clinical Research Ethics Committee of the hospital was obtained before beginning the study. The nephrology unit attends 110 patients on dialysis. Fifty-five of them received treatment in the hemodialysis unit, and the rest in the peritoneal dialysis unit. During the months of April and May of 2010, all the patients who met the inclusion criteria (18 years or older, more than 3 months in the dialysis program, no diagnosed psychiatric disease, ability to understand the assessment protocol and having signed the informed consent) were offered the possibility to participate in this study. Of the patients who met the inclusion criteria ($n = 63$), two refused to participate due to lack of time. Sixty-one patients (55% of the total patients in the unit) accepted and were assessed by a trained psychologist when they came for their medical examination.

Data analysis

The statistical analyses were performed with the SPSS 17.0 program. To compare quantitative variables in the two groups, we used Student's *t* for independent variables as the parametric test and the Mann-Whitney *U* as the nonparametric test. The qualitative variables were compared by means of chi-square. The relation between the variables was explored with Spearman and Pearson correlation coefficients. To determine which variables contributed to the prediction of the physical and mental component summaries of HRQOL, we used stepwise multiple linear regression analysis. In all the analyses, we used 95% confidence intervals.

Results

Clinical profile, sociodemographic data and biochemical parameters

Of all the patients on hemodialysis and peritoneal dialysis, 56.6 and 87.0%, respectively, were in oral treatment with

antihypertensive drugs, and 83.3 and 83.8%, respectively, were in oral treatment with phosphate binders. The Charlson comorbidity index was significantly higher in patients on hemodialysis ($p = .000$). The patients in peritoneal dialysis were significantly younger ($p = .003$), they were occupationally active ($p = .003$), and they had a higher educational level ($p = .005$) than the patients on hemodialysis (see Table 1).

Adherence profile, psychological variables, and HRQOL

As shown in Table 2, patients on peritoneal dialysis reported higher general adherence to treatment ($p = .004$), they were better informed ($p = .000$), and they perceived a better relationship with the healthcare team ($p = .000$). In contrast, the patients on hemodialysis

reported having greater knowledge of the recommended diet than patients on peritoneal dialysis ($p = .000$). In both dialysis modalities, we observed high rates of nonadherence to antihypertensive drugs (90.9% on hemodialysis and 82.8% on peritoneal dialysis) and to phosphate binders (68.4% on hemodialysis and 85.2% on peritoneal dialysis). No group differences in adherence as measured by the Morisky-Green-Levine Test, or in the psychological variables were observed. In the analysis of the HRQOL dimensions, patients in peritoneal dialysis presented better Physical Function ($p = .007$) and less Bodily Pain ($p = .023$), as well as a higher PCS ($p = .030$). Taking into account the gender variable, we observed differences in the following HRQOL dimensions in favor of the men: Physical Function (men: $M = 66.19$, $SD = 23.9$; women: $M = 41.38$, $SD = 26.94$, $t = 3.544$, $p = .001$); Physical Role (men: ($M = 61.75$,

Table 1
Clinical profile, sociodemographic data and biochemical parameters in the two dialysis modalities

Variables	Total sample (N= 61)		HD (N= 30)		DP (N= 31)		Statistic	p
	Mean (SD) Range	N (%)	Mean (SD) Range	N (%)	Mean (SD) Range	N (%)		
Age	54.2 (17.36) 21-90		60.6 (16.66) 23-90		47.9 (15.86) 21-75		$t = 3.06$	.003
Months on dialysis	43.9 (61.68) 4-384		56.9 (81.73) 4-384		31.4 (28.64) 4-132		$t = 1.64$	.106
Charlson	5.82 (3.15) 2-14		7.23 (3.11) 14-2		4.45 (2.55) 12-2		$t = 3.88$	.000
Date of CRD diagnosis								
<6 years		18 (29.5)		7 (23.3)		11 (35.5)	$\chi^2 = 1.16$	.559
6-10 years		12 (19.7)		6 (20.0)		6 (19.4)		
>10 years		31 (50.8)		17 (56.7)		14 (45.2)		
Cause of kidney disease								
Diabetes Mellitus		9 (14.8)		6 (20.0)		3 (9.7)	$\chi^2 = 1.29$	.256
Other		52 (85.2)		24 (80.0)		28 (90.3)		
Current psychotropic drugs								
Yes		14 (23.0)		5 (16.7)		9 (29.0)	$\chi^2 = 1.31$	.251
No		47 (77.0)		25 (83.3)		22 (71.0)		
Number of daily pills								
0-10		28 (47.5)		17 (58.6)		19 (36.7)	$\chi^2 = 2.85$	.091
>10		33 (52.5)		13 (42.4)		12 (63.3)		
Sex								
Male		43 (70.5)		18 (60.0)		25 (80.6)	$\chi^2 = 3.12$	.977
Female		18 (29.5)		12 (40.0)		6 (19.4)		
Is living								
Alone		22 (36.1)		10 (33.3)		12 (38.7)	$\chi^2 = 0.19$	.662
With someone else		39 (63.9)		20 (66.7)		19 (61.3)		
Work								
Yes		14 (23.0)		2 (6.7)		12 (38.7)	$\chi^2 = 8.85$	.003
No		47 (77.0)		28 (93.3)		19 (61.3)		
Educational level								
Primary		24 (39.3)		18 (60.0)		6 (19.4)	$\chi^2 = 0.68$	.005
Secondary		14 (23.0)		4 (13.3)		10 (32.3)		
University studies		23 (37.7)		8 (23.3)		15 (48.4)		
Biochemical parameters								
Potassium	4.57 (0.85) 3.10-6.90		5.07 (0.79) 3.40-6.90		4.09 (0.58) 3.10-5.30		$t = 5.44$	.000
Calcium	9.22 (0.81) 7.30-11.30		9.24 (0.86) 7.30-11.30		9.21 (0.77) 7.30-10.40		$t = 0.14$	.888
Phosphorus	4.37 (1.28) 1.80-8.40		4.21 (1.38) 1.80-7.20		4.54 (1.19) 2.80-8.40		$t = 0.96$	.341
Hypertension								
Yes		44 (73.3)		17 (56.6)		27 (87.0)	$\chi^2 = 8.52$	.004
No		17 (26.7)		13 (43.4)		4 (13.0)		
Hyperphosphoremia								
Yes		51 (83.3)		25 (83.3)		26 (83.8)	$\chi^2 = 0.00$	1
No		10 (16.7)		5 (16.7)		5 (16.2)		

Note: HD= hemodialysis, PD= peritoneal dialysis, CRD= chronic renal disease, Charlson= modified Charlson comorbidity index

SD= 33.87; women: M= 37.50, SD= 30.01, t= 2.626, p= .011); Emotional Role (men: M= 87.69, SD= 23.07; women: M= 65.27, SD= 37.29, t= 2.842, p= .006); Mental Health (men: M= 61.58, SD= 9.77; women: M= 52.50, SD= 16.82, t= 2.611, p= .012); PCS (men: M= 60.58, SD= 8.06; women: M= 53.44, SD= 8.29, t= 23.082, p= .003); MCS (men: M= 49.64, SD= 4.55; women: M= 45.00, SD= 7.34, t= 2.927, p= .05).

Effects of depression on the indicators of adherence and of HRQOL

Of the total sample, 23% presented some degree of depression suitable to treatment (BDI >17). As shown in Table 3, patients classified as presenting clinical depression (BDI-II) reported power adherence to treatment (p= .010) and lower HRQOL in the Physical Function (p= .021), Physical Role (p= .002), Emotional

Role (p= .000), and Mental Health (p= .020) subscales. PCS (p= .002) and MCS (p= .023) were also lower in depressed patients. No significant relationship between specific markers of adherence (BP and HP Morisky-Green-Levine Test) and depression were found.

Associations between indicators of specific adherence to antihypertensive drugs and phosphate binders, psychological variables and HRQOL

The patients who reported adherence to antihypertensive drugs presented greater HRQOL in the Physical Role subscale (p= .018) and in the PCS (p= .046). In contrast, no statistically significant differences were observed in any of the psychological variables. With regard to specific adherence to phosphate binders, no statistically significant differences were observed between

Table 2
Adherence profile, psychological and quality of life variables in the total sample and on both dialysis modalities

Variables	Possible range	Total sample (N= 61) Mean (SD) Range	HD (N= 30) Mean (SD) Range	PD (N= 31) Mean (SD) Range	Statistic	p
Facilitators of adherence to treatment						
Treatment information	1 (not at all) - 5 (very much)	3.28 (1.40) 1-5	2.43 (1.33) 1-5	4.10 (0.90) 2-5	U= 153.50	.000
Relation with healthcare team	1 bad to 5 good	4.34 (0.94) 1-5	3.93 (1.10) 1-5	4.74 (0.57) 3-5	U= 239.00	.000
Family support	1 bad to 5 good	4.44 (1.16) 1-5	4.27 (1.38) 1-5	4.61 (0.88) 1-5	U= 423.00	.432
Knowledge of medication	0 no - 1 yes	0.72 (0.45) 0-1	0.67 (0.47) 0-1	0.77 (0.42) 0-1	$\chi^2= 0.877$	.349
Do you self-administer the medication?	0 no - 1 yes	0.85 (0.35) 0-1	0.83 (0.37) 0-1	0.87 (0.34) 0-1	$\chi^2= 0.172$	.679
Benefits of medication	1 none to 5 many	3.97 (0.78) 2-5	3.87 (0.77) 3-5	4.07 (0.79) 3-5	U= 378.50	.360
Knowledge about diet	0 no - 1 yes	0.82 (0.38) 0-1	1 (0.00) 1-1	0.65 (0.48) 0-1	$\chi^2= 12.98$	.000
Benefits of diet	1 none to 5 many	3.72 (0.83) 2-5	3.67 (0.88) 2-5	3.77 (0.80) 2-5	U= 425.00	.539
Do you follow the nephrologist's instructions?	5 (100%) to 1 (0%)	4.24 (0.69) 2-5	4.27 (0.69) 2-5	4.23 (0.71) 3-2	U= 448.50	.792
Perceived effort	1 much 5 not at all	4.33 (0.98) 1-5	4.40 (0.96) 1-5	4.27 (1.01) 2-5	U= 421.00	.634
Perceived capacity	1 much 5 not at all	1.45 (0.69) 1-4	1.57 (0.77) 1-4	1.33 (0.60) 1-3	U= 375.00	.187
Global score (GS) (0-43)*	Min 0 - Max 43	32.06 (3.25) 24-38	30.90 (3.02) 24-38	33.27 (3.09) 25-38	t= -3.00	.004
BP Morisky-Green-Levine Test¹						
		(%) Yes / No	(%) Yes / No	(%) Yes / No		
Do you ever forget to take the antihypertensive drugs?	0 No - 1 Yes	50.0 / 50.0	45.5 / 54.4	51.7 / 48.3	$\chi^2= 0.125$	.723
Are you careless about the schedules?	0 No - 1 Yes	57.5 / 42.5	72.7 / 27.3	51.7 / 48.3	$\chi^2= 1.440$	.230
If you feel good, do you stop taking the antihypertensive drugs?	0 No - 1 Yes	2.5 / 97.5	9.1 / 90.9	0.0 / 100.0	$\chi^2= 0.270$	.100
If you feel bad, do you stop taking the antihypertensive drugs?	0 No - 1 Yes	22.5 / 77.5	27.3 / 72.7	20.7 / 79.3	$\chi^2= 0.198$	.656
Score**	0 No - 1,2,3,4, Yes	15.0 / 85.0	9.1 / 90.9	17.2 / 82.8	$\chi^2= 0.416$	.519
HP Morisky-Green-Levine Test²						
Do you ever forget to take the phosphate binders?	0 No - 1 Yes	43.5 / 56.5	68.4 / 31.6	51.9 / 48.1	$\chi^2= 1.865$	.172
Are you careless about the schedules?	0 No - 1 Yes	50.0 / 50.0	42.1 / 57.9	55.6 / 44.4	$\chi^2= 0.807$	.369
If you feel good, do you stop taking the phosphate binders?	0 No - 1 Yes	2.2 / 97.8	5.3 / 94.7	0.0 / 100.0	$\chi^2= 1.453$	.228
If you have side-effects, do you stop taking the phosphate binders?	0 No - 1 Yes	21.3 / 78.9	21.1 / 78.9	22.2 / 77.8	$\chi^2= 0.009$	.925
Score**	0 No - 1,2,3,4, Yes	21.7 / 78.3	31.6 / 68.4	14.8 / 85.2	$\chi^2= 1.842$	.175
Psychological variables						
BDI-II	0-63	12.78 (9.67) 0-44	14.50 (10.37) 0-44	11.07 (8.76) 0-44	t= 1.38	.171
STAI-S	0-60	18.31 (12.60) 3-56	18.40 (12.59) 4-56	18.21 (12.84) 3-55	t= 0.06	.954
PSS-10	0-40	14.28 (8.18) 2-38	15.43 (8.66) 3-38	13.13 (7.64) 2-33	t= 0.96	.348
Standardized SF-36 v2 subscales						
Physical Function	0-100	58.75 (27.16) 5-100	48.50 (26.95) 5-95	69.00 (23.61) 5-100	t= -2.80	.007
Physical Role	0-100	54.48 (34.39) 0-100	46.25 (31.17) 0-100	62.71 (36.98) 0-100	t= -1.88	.074
Bodily Pain	0-100	32.00 (30.52) 0-90	54.40 (37.13) 0-100	76.60 (27.36) 0-100	t= -2.34	.023
General Health	0-100	49.30 (12.87) 30-100	36.37 (17.62) 5-85	34.82 (17.71) 5-75	t= 0.33	.741
Vitality	0-100	56.04 (11.95) 31-87	44.82 (22.47) 0-81	51.11 (26.79) 0-100	t= -0.96	.341
Social Function	0-100	46.49 (13.10) 12-75	64.22 (28.48) 12-100	70.08 (29.13) 0-100	t= -0.77	.446
Emotional Role	0-100	80.97 (29.64) 0-100	73.56 (33.78) 0-100	87.79 (24.37) 8-100	t= -1.83	.073
Mental Health	0-100	58.81 (12.91) 20-80	65.51 (21.47) 20-95	74.28 (19.03) 20-100	t= -1.63	.109
PCS	0-100	58.33 (8.73) 37-76	34.30 (8.66) 21-52	39.42 (8.67) 13-52	t= -2.23	.030
MCS	0-100	48.18 (5.92) 31-57	47.11 (10.71) 27-62	49.83 (11.50) 19-62	t= -0.93	.361

Note: HD= hemodialysis, PD= peritoneal dialysis * = higher score indicates greater degree of treatment adherence, BP= hypertension, ** Nonadherent with only one positive response¹ = (N= 17HD, N= 27PD), HP= hyperphosphoremia, ² = (N= 25HD, N= 26PD), PCS= physical component summary, MCS= mental component summary

compliant and noncompliant patients either in the psychological variables or in HRQOL. See Table 4.

Associations between indicators of adherence, psychological variables, and HRQOL

In order to study in depth the relations between indicators of adherence to treatment, psychological variables, and HRQOL, we performed a correlational analysis with the total sample.

Beforehand, we assessed the associations between the variables separately in each dialysis group, obtaining no data of interest for this study. We therefore decided to analyze the sample as a whole. The correlations are presented in Table 5.

After determining the relations between the variables, we decided to appraise the relative weight of the variables on the PCS and MCS of the HRQOL. For this purpose, we performed multiple linear regression analysis for each outcome variable. We entered the variables that were previously associated with the physical and

Table 3
Effect of depression (BDI-II) on the facilitators of adherence and indicators of quality of life of the 61 patients on dialysis

Variables	No depression (N= 47) Mean (SD) Range	Depression (N= 14) Mean (SD) Range	U Statistic	p
Facilitators of adherence to treatment (GS)*	32.80 (2.85) 25-38	30.10 (3.67) 24-37	166.50	.010
Standardized SF-36 v2 subscales				
Physical Function	62.80 (25.46) 5-100	42.90 (26.36) 5-75	186.00	.021
Physical Role	61.50 (33.04) 0-100	30.40 (28.99) 0-93	145.50	.002
Bodily Pain	31.80 (29.79) 0-90	35.00 (33.68) 0-90	305.00	.855
General Health	69.90 (12.32) 45-100	69.30 (13.71) 30-85	290.00	.939
Vitality	54.70 (10.62) 31-81	60.30 (15.43) 38-87	256.00	.335
Social Function	44.90 (12.05) 13-62	50.00 (15.50) 25-75	242.00	.289
Emotional Role	89.30 (23.34) 0-100	53.00 (32.13) 0-100	92.00	.000
Mental Health	61.10 (11.61) 20-80	51.40 (14.86) 20-75	181.00	.020
PCS	60.40 (7.81) 43-76	51.80 (8.63) 37-66	133.50	.002
MCS	49.40 (4.79) 36-57	44.30 (7.52) 31.54	174.00	.023

Note: *= higher score indicates higher degree of adherence to treatments, PCS= physical component summary, MCS= mental component summary

Table 4
Relations between indicators of specific adherence to antihypertensive drugs (N= 44) and phosphate binders (N= 51) with quality of life in the total sample of patients on dialysis

Variables	BP Morisky-Green-Levine Test Mean (SD) Range		U Statistic	p
	Adherence (N= 7)	Nonadherence (N= 37)		
Standardized SF-36 v2 subscales				
Physical Function	80.00 (14.14) 65-100	63.03 (25.21) 5-100	58.50	.114
Physical Role	89.58 (10.20) 75-100	52.46 (33.83) 0-100	38.50	.018
Bodily Pain	25.00 (35.07) 0-90	28.48 (27.39) 0-90	87.50	.646
General Health	62.50 (12.94) 45-80	70.16 (13.80) 30-100	60.00	.198
Vitality	58.33 (7.56) 50-68	53.71 (9.76) 37-81	64.00	.183
Social Function	52.08 (9.40) 37-62	46.25 (11.44) 12-75	62.00	.195
Emotional Role	95.83 (10.20) 75-100	81.56 (29.07) 8-100	69.50	.197
Mental Health	60.83 (4.91) 55-70	56.87 (14.46) 20-80	95.00	.967
PCS	66.33 (5.31) 61-76	58.53 (8.55) 43-74	43.00	.046
MCS	51.16 (1.72) 49-53	47.43 (6.22) 33-57	56.00	.147
HP Morisky-Green-Levine Test				
	Adherence (N= 11)	Nonadherence (N= 40)		
Standardized SF-36 v2 subscales				
Physical Function	64.50 (25.86) 15-95	64.14 (22.83) 20-100	172.50	.945
Physical Role	68.12 (31.38) 0-100	55.35 (34.27) 0-100	137.00	.296
Bodily Pain	33.00 (37.13) 0-90	28.57 (26.47) 0-80	171.00	.911
General Health	67.50 (12.07) 50-90	70.78 (12.64) 45-100	131.50	.395
Vitality	55.00 (7.68) 43-68	54.04 (10.86) 31-81	158.50	.738
Social Function	47.50 (11.48) 25-62	47.65 (13.25) 12-75	159.00	.975
Emotional Role	88.33 (31.47) 0-100	84.28 (26.94) 8-100	145.50	.346
Mental Health	64.00 (8.43) 55-80	60.00 (13.14) 20-80	153.00	.626
PCS	61.60 (8.04) 50-76	59.43 (7.57) 47-74	136.50	.487
MCS	50.00 (4.59) 38-54	48.62 (5.44) 36-57	130.00	.373

Note: BP= hypertension, HP= hyperphosphoremia, PCS= physical component summary, MCS= mental component summary

Table 5
Correlation coefficients between variables of adherence to treatment, psychological variables, and HRQOL in 61 patients on dialysis

	Adherence to treatment			Psychological variables				HRQOL (MOS-SF-36)								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Adherence to treatment (GS) ¹																
2. BP Morisky Test	.204*															
3. HP Morisky Test	.245*	.829**														
4. BDI-II	-.376**	-.154	-.091													
5. STAI-S	-.120*	-.110	-.121	.586**												
6. PSS-10	-.295*	-.024	-.080	.767**	.477**											
7. Physical Function	.275*	.257	.010	-.400**	-.083	-.337*										
8. Physical Role	.204	.384*	.158	-.443**	-.298*	-.349**	.528**									
9. Bodily Pain	.177	.074	.017	-.298*	-.038	-.275*	.261*	.363**								
10. General Health	.060	.218	.133	-.384**	-.281*	-.249	.351**	.249*	.319*							
11. Vitality	.200	.219	.051	-.572**	-.438**	-.416**	.459**	.662**	.496**	.532**						
12. Social Function	.132	.219	.005	-.435**	.444**	-.359**	.263*	.533**	.411**	.303*	.599**					
13. Emotional Role	.346**	.209	.142	-.533**	-.265*	-.359**	.320*	.558**	.397**	.224	.624**	.471**				
14. Mental Health	.261*	.007	.074	-.687**	-.462**	-.632**	.296*	.483**	.480**	.480**	.624**	.411**	.621**			
15. PCS	.168	.338*	.109	-.329*	-.056	-.266*	.798**	.668**	.615**	.615**	.595**	.447**	.235	.278*		
16. MCS	.257	.245	.139	-.640**	-.525**	-.509**	.128	.490**	.392**	.392**	.720**	.662**	.840**	.828**	.133	

Note: ¹= survey of treatment adherence facilitators (GS 0-43), BP Morisky Test= Morisky-Green-Levine Test for specific adherence to antihypertensive drugs, HP Morisky Test= Morisky-Green-Levine Test for specific adherence to phosphate binders, PCS= physical component summary, MCS= mental component summary
* $p < .05$; ** $p < .01$

mental health components in the regression model (Table 5; the results of the sociodemographic and clinical variables were omitted to save space). Thus, the regression model for the variable PCS ($F = 8.699, p = .000$) accounted for 30% of the variance in the outcome variable ($R^2c = 0.30$), explained by the variables work (yes / no) ($B = 6.478, SE = 2.56, \beta = .319, t = 2.525, p = .015$), depression ($B = -0.254, SE = 0.110, \beta = -.263, t = -2.129, p = .038$), and gender (male / female) ($B = -4.641, SE = 2.19, \beta = -.251, t = -2.120, p = .039$). For the MCS ($R^2c = .23, F = 16.632, p = .000$), 23% of variance was accounted for a single variable: depression ($B = -0.298, SE = 0.73, \beta = -.489, t = -4.078, p = .000$). The remaining variables were not entered in the model.

Discussion

The present study yields some original and interesting results to further our understanding of the relation between therapeutic adherence, psychological processes, and the experience of disease in patients on dialysis.

For example, this study reveals a lack of specific adherence to phosphate binders in 72.9% of patients on hemodialysis and in 85.2% of patients in peritoneal dialysis. The reports on adherence difficulties to treatment in chronic disease patients can be found in several studies (Cvengros et al., 2004; Reach, 2008; Remor, 2011). However, there are few that specifically address the topic of adherence to hyperphosphoremia treatment and their data vary between 22 and 74%, according to authors (Arenas, Malek, Moledous, Álvarez-Ude, & Reig-Ferrer, 2010; Karamanidou, Clatworthy, Weinman, & Horne, 2008). Our data support the literature that describes high rates of non-adherence in this sphere.

In our study, patients on peritoneal dialysis present a higher educational level, they have more information about the treatments, a better relationship with their healthcare team, and greater self-reported adherence. In line with this, a review of the literature on adherence to treatment in dialysis (Maldaner, Beuter, Brondani, Budó, & Pauletto, 2008) identified nine factors that affect adherence, underlining the relationship with the healthcare team, information, and high educational level. As it is a self-administered technique, peritoneal dialysis draws patients nearer to their assistential team, and it implies that patients are well informed and perceive the team's accessibility.

The relation between information and adherence to treatment in nephrology is still controversial. In this sense, our hemodialysis patients reported having more information about diet than patients on peritoneal dialysis, and this makes sense because any dietary transgression can be a life threatening emergency for a patient on hemodialysis. However, and coinciding with our results, Durose, Holdsworth, Watson, and Przygodzka (2004), have observed that patients on hemodialysis who had greater dietary knowledge on phosphorus control were also the patients who displayed the least adherence. We could thus state that although information is necessary it is not enough to change adherence behavior.

No significant differences were found in the psychological variables between the two dialysis modalities, although the mean scores in depression, anxiety, and stress were lower in patients on dialysis compared with the reference population (i.e., [PSS-10] Remor, 2006; [BDI-II] Sanz et al., 2003; [STAI] Seisdedos, 1982).

In contrast, differences in HRQOL that favored peritoneal dialysis patients were found in the Physical Function and Bodily Pain subscales and in the PCS. Along the same lines, Rodríguez-Fruitoso et al., (2011) also found that patients on peritoneal

dialysis presented better HRQOL scores in the Physical Function and Bodily Pain subscales than patients on hemodialysis. In a systematic review of the impact of the two dialysis modalities on HRQOL, it is concluded that patients on peritoneal dialysis report higher scores in its physical health components, but that there are no observed differences in its mental health ones (Boateng & East, 2011). The same pattern is observed in the results of this study. Due to the aggressiveness of the technique, the patients on hemodialysis present an important symptomatological burden (i.e., pruritus, cramps, and nausea) that can interfere with their HRQOL. In contrast, patients on peritoneal dialysis usually have greater symptomatological control, although they sometimes present episodic complications derived from the technique (i.e., peritonitis). In any case, patients on peritoneal dialysis were younger and presented less comorbidity, which could explain higher HRQOL. In spite of this, the relation between quality of life and dialysis modality is still confusing. Other comparative studies carried out in Spain (Ruiz de Alegría et al., 2009) show no HRQOL advantage associated with peritoneal dialysis. The HRQOL scores observed in this study are lower than those of the reference population (Alonso et al., 1998).

Another noteworthy aspect is that, in our study, the variables depression, anxiety, and stress were negatively associated with the adherence facilitators to treatment, thus indicating that negative emotional states could be a risk to therapeutic compliance. These results corroborate those described by Cukor, Rosenthal, Jindal, Brown, and Kimmel (2009). Moreover, these negative emotional states can negatively affect diverse domains of HRQOL and its two summary components. These results have also been described by Walters, Hays, Spritzer, Fridman, and Carter (2002). It is important to remember, specifically with regard to the BDI-II results, that its use in population with chronic health problems should be interpreted with precaution because it is difficult to ensure that the

patient's answers to items on energy, appetite, and sleep included in the questionnaire are not affected by the experience of the disease.

Upon analyzing in the total sample the relation between specific adherence to antihypertensive drugs and phosphate binders and the psychological and HRQOL variables, it was found that patients who reported compliance with the prescribed schedule of antihypertensive drugs presented a better HRQL in the Physical Role subscale and in the PCS.

The data reported herein indicate the complexity of factors that can affect perceived quality of life. We have observed that situational (occupational), gender, and psychological state characteristics partially explain HRQOL. Other authors (i.e., Morales-Jaimes, Salazar-Martínez, Flores-Villegas, Bochicchio-Ricardelli, & López-Caudana, 2008; Varela, Vázquez, Bolaños, & Alonso, 2011) have described similar results.

As a limitation of this study, we mention the small size of the sample, although this is the first study of its kind in Spain that has assessed more than 50% of dialysis patients treated in a medical unit.

To conclude, the results of this study point out the difficulties experienced by patients to adhere to oral medication in both dialysis modalities, and the role that negative emotional states, especially depression, can play in the quality of life of kidney patients. Therefore, early detection and intervention in these potential factors of HRQOL deterioration may help improve the physical and mental health status of chronic renal failure patients.

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