




Quality of life in primary caregivers of patients in peritoneal dialysis and hemodialysis

Qualidade de vida em cuidadores primários de pacientes em diálise peritoneal e hemodiálise

Authors

Joel Monárrez-Espino^{1, 2, 3} 
 José Alberto Delgado-Valles¹ 
 Gastón Ramírez-García¹ 

¹Hospital Christus Muguerza, Departamento de Investigación, Chihuahua, México.

²Universidad de Monterrey, San Pedro Garza García, México.

³Claustro Universitario de Chihuahua, Grupo de Investigación en Salud Pública, Chihuahua, México.

ABSTRACT

Background: Peritoneal dialysis (PD) is gaining track as an efficient/affordable therapy in poor settings. Yet, there is little data regarding differences in quality of life (QoL) of primary caregivers (PCG) of patients in PD and hemodialysis (HD). **Aim:** To compare the QoL of PCG of patients in PD and HD from an upper middle-income population in a Mexican city. **Methods:** Cross-sectional study was carried out with PCG of patients in PD (n=42) and HD (n=95) from 4 hospitals (response rate=70.2%). The SF 36-item QoL questionnaire, the Zarit burden interview, and the Goldberg anxiety/depression scale were used. Mean normalized scores for each QoL domain were compared by dialysis type. Adjusted odds were computed using logistic regression to determine the probability of low QoL (<70% of maximum possible score resulting from the added scores of the 8 dimensions). **Results:** The PD group had higher mean scores for emotional role functioning (+10.6; p=0.04), physical functioning (+9.2; p=0.002), bodily pain (+9.2; p=0.07), social functioning (+5.7; p=0.25), and mental health (+1.3; p=0.71); the HD group had higher scores for physical role functioning (+7.9, p=0.14), general health perception (+6.1; p=0.05), and vitality (+3.3; p=0.36). A non-significant OR was seen in multivariate regression (1.51; 95% CI 0.43-5.31). Zarit scores were similar, but workload levels were lower in the PD group (medium/high: PD 7.2%, HD 14.8%). Anxiety (HD 50.5%, PD 19%; p<0.01) and depression (HD 49.5%, PD 16.7%; p<0.01) were also lower in the PD group. **Conclusion:** Adjusted analysis showed no differences in the probability of low QoL between the groups. These findings add to the value of PD, and strengthen its importance in resource-limited settings.

Keywords: Renal Dialysis; Quality of Life; Mexico; Peritoneal Dialysis; Caregivers.

RESUMO

Histórico: A diálise peritoneal (DP) vem ganhando terreno como terapia eficiente/acessível em ambientes pobres. Contudo, há poucos dados sobre diferenças na qualidade de vida (QV) dos cuidadores primários (CP) de pacientes em DP e hemodiálise (HD). **Objetivo:** Comparar QV dos CP de pacientes em DP e HD de uma cidade mexicana de renda média. **Métodos:** Estudo transversal com CP de pacientes em DP (n=42) e HD (n=95) de 4 hospitais (taxa resposta=70,2%). Aplicou-se o questionário QV-36 itens, entrevista de sobrecarga de Zarit e escala de ansiedade/depressão Goldberg. Escores médios normalizados para cada domínio de QV foram comparados por tipo de diálise. Probabilidades ajustadas foram calculadas usando regressão logística para determinar a probabilidade de baixa QV (<70% da pontuação máxima possível resultante das pontuações adicionadas das 8 dimensões). **Resultados:** O grupo DP apresentou escores médios mais altos para aspectos emocionais (+10,6; p=0,04), capacidade funcional (+9,2; p=0,002), dor (+9,2; p=0,07), aspectos sociais (+5,7; p=0,25), saúde mental (+1,3; p=0,71); o grupo HD teve pontuação maior para aspectos físicos (+7,9, p=0,14), estado geral de saúde (+6,1; p=0,05), vitalidade (+3,3; p=0,36). Uma probabilidade não significativa foi observada na regressão multivariada (OR=0,66; 95% IC 0,18-2,31). Os escores de Zarit foram semelhantes, mas os níveis da sobrecarga foram menores na DP (médio/alto: DP 7,2%, HD 14,8%). Ansiedade (50,5% vs 19%; p<0,01) e depressão (49,5% vs 16,7%; p<0,01) foram menores na DP. **Conclusão:** O risco de baixa QV entre grupos não foi diferente na análise ajustada. Estes achados fortalecem a importância da DP em ambientes com recursos limitados.

Descritores: Diálise Renal; Qualidade de Vida; México; Diálise Peritoneal; Cuidadores.

Submitted on: 10/23/2020.

Approved on: 03/08/2021.

Correspondence to:

Joel Monárrez-Espino.
 E-mail: joel.monarrez@christus.mx.

DOI: <https://doi.org/10.1590/2175-8239-JBN-2020-0229>



INTRODUCTION

Globally, an estimated 5-10 million people die every year from chronic kidney disease¹. This is an irreversible illness that progressively erodes the patients' health and quality of life (QoL). In Mexico, incidence and prevalence have been increasing steadily^{2,3} to the point that, soon, nearly 200 thousand individuals will require renal replacement therapy⁴. Currently, peritoneal dialysis (PD) and hemodialysis (HD) are the two main alternatives available for most patients⁵.

While HD is by far the most common modality worldwide, especially in developed countries⁶, PD is becoming a major alternative in low- and middle-income settings^{5,7-10}, as it has shown to be the most economically efficient dialysis modality¹¹⁻¹², in fact, two out of three patients who receive PD live in developing nations¹³.

Mexico is the leading country in the world using PD, partly due to the costs involved (PD can be 44-78% cheaper than HD)¹⁴⁻¹⁶. According to the Mexican Institute of Social Security, the largest public provider of health services in Mexico, 77% of the patients in this institution were treated with PD and 23% with HD in 2015¹⁵.

Patients in dialysis have to modify their lifestyle in terms of nutrition, daily habits, mental health, physical activity, and social/family relations due to the restrictions linked to the procedure itself^{17,18}. In most developing countries, patients in dialysis rely on a primary caregiver (PCG) for their care, usually the spouse or an adult child¹⁹. PCGs are individuals who voluntarily assume responsibility for an ill patient in its broader sense, usually without financial remuneration¹⁸.

It has been reported that PCGs need appropriate knowledge, skills, and guidance to provide adequate care to patients in dialysis²⁰⁻²², as they require comprehensive therapeutic measures, especially those in PD, which is generally performed at home²².

Caregiving is regarded as a chronic stressor due to the emotional burden, and the persistent and often physically demanding activities; the logistics and management of symptoms and treatment associated with the dialysis process (e.g. transportation to the dialysis unit, medical appointments, diet control, personal hygiene support, etc.) can have an important impact on the caregiver's QoL^{18,21,23}.

The PCGs' work overload can also affect their QoL. This relates to factors such as the main illness

leading to the end-stage renal disease (ESRD), the ability and existing resources available to take care of patients, and the concomitant morbidities^{18,20,24}. The daily and long-term care of a sick family member can also entail health risks for caregivers, especially when the responsibility falls on a single person.

The fact that caregivers enter a process of physical and emotional erosion, derived from the implications of treatment and permanent care at home for prolonged periods of time, added to the economic hardships and family difficulties associated with the existence of this condition that frequently prevents PCGs from living in a conventional family, social, and work life^{18,25,26}.

As a result, these modifications translate into lifestyle changes of PCGs^{27,28}. These changes, however, seem to differ between PCGs of patients in HD and PD. Being a home-based modality, PD in low- and middle-income countries can have some advantages for PCGs compared with HD, including lower transportation and other costs associated with hospital visits, greater convenience as patients can be dialyzed at home avoiding the 5-6 h required for each hospital visit, and increased autonomy and flexibility as patients are not dependent on a hospital^{5,9,11,12}. On the other hand, PD PCGs require more training, might need to deal with more complications, and have to take care of the logistics involved with the procedure²⁹.

In a systematic review on QoL among PCGs published in early 2019, it was concluded that QoL was "comparable" between dialysis types¹⁹. Yet, such conclusion was based on only three studies, two that used data collected nearly 20 years ago, one showing differences in some QoL dimensions³⁰, and the other reporting no differences²⁷; the third showed a lower level of burden in PCGs of HD patients compared with those in PD (13 vs. 35%)³¹. However, two recent studies from Turkey and India, not included in that review, reported contrary results, showing a higher burden for caregivers of HD patients^{32,33}. While this topic still remains contentious, based on the available evidence from countries relatively similar to Mexico, we hypothesized that PCGs of PD patients would have at least the same burden or possibly lower burden compared with that of those caring for HD patients. Therefore, this study was done to shed light on this issue by comparing the QoL of PCGs of patients in HD and PD from an upper middle-income city of northern Mexico.

The research proposal was revised and approved by the Ethics and Research Committee at Christus Muguerza Hospital Chihuahua (CEI-HCMP-03042018-1). Informed consent was obtained from all participant caregivers.

MATERIAL AND METHODS

STUDY DESIGN

This was a cross-sectional multicenter study with PCGs of patients in PD and HD carried out between May and October 2019.

STUDY POPULATION AND SETTING

Patients and PCGs were male and female adult residents of the northern Mexican city of Chihuahua, the capital of the homonymous State that has a high prevalence of patients with ESRD³⁴. The city is industrialized, and ranks high in human and social development among cities in Mexico.

Eight hospitals provide dialysis services to patients with ESRD in this city of nearly one million inhabitants. This study was carried out in the four hospitals that provided permission to collect data from patients and PCGs.

Patients were asked if they had a main caregiver responsible for helping them withstand their health condition and dialysis, but the degree of assistance provided by the caregiver was not assessed. Yet, the vast majority of the participant PCGs accompanied their patient to the medical appointments and reported duties associated with the illness and dialysis process.

INCLUSION CRITERIA

Eligible patients had to be dialyzed at least within one month prior to the interview. PCGs of patients from three out of the five public hospitals that provide dialysis services in Chihuahua were included (Hospital of the Institute of Services and Social Security for State Workers, the State Civil Pensions Hospital, and the General Hospital). Also, PCGs from one of the three private hospitals that offer dialysis were included (Christus Muguerza Hospital). PCGs had to consent and be able to answer questionnaires through face-to-face interviews.

SAMPLING

From the 207 eligible patients within the four hospitals sampled, 195 had a PCG (94.2%); from these, 137 were surveyed: 24 PCGs refused to participate, 31

could not be contacted, and three agreed but did not attend the interview. Thus, the participation rate for PCGs was 70.2%.

DATA COLLECTION AND MEASUREMENT INSTRUMENTS

Data was collected in 2019 by seven trained and standardized field workers. PCGs of both HD and PD patients were interviewed in a medical office. The average interview duration was 30 min for each PCG.

Four instruments were administered:

1. **General questionnaire:** It was used to collect sociodemographic (i.e. sex, age, civil status, schooling years, religion, occupation, number of dependents, and hospital of care), anthropometric (i.e. weight and height), and clinical data (i.e. comorbidities, medical treatments, surgeries, and smoking/alcohol/drug history). It also included some questions related to the patient care (e.g. type of relationship –kinship– with the patient, duration of care, and approximate amount of money spent per month for the care of his/her patient).
2. **Short form 36-item QoL questionnaire:** It consists of 36 items that fit into 8 QoL domains: physical functioning, physical role, body pain, general health, vitality, social function, emotional role, and mental health³⁵. The number of items per domain varies from two to ten. Depending on the item, the score can range from 1 to 3 to 1 to 6 points. The total raw score for each domain is then normalized so that the final scale ranges from 0 to 100³⁵. The internal consistency is >0.7 ³⁶.
3. **Zarit burden interview:** It consists of 22 items that measure the burden perceived by the caregiver using a Likert scale ranging from 0 (never) to 4 (always). Adding the 22 scores, a unique burden index is obtained with a score ranging from 0 to 88 points. The total score is then grouped as: without (≤ 21), light (22-46), medium (47-55), and severe (≥ 56 points) burden. Cronbach's alpha for the validation study in Mexico was 0.84 with a model fit with values ≥ 0.90 ³⁷.
4. **Goldberg anxiety and depression scale:** This screening tool consists of scales for anxiety and depression with 9 items each. Responses are dichotomous. An independent score is totalized for each scale. The patient is questioned about whether he/she has presented any of the relevant symptoms; those lasting <2 weeks or of mild intensity are not scored. The cut-off

point for anxiety and depression was ≥ 4 and ≥ 2 , respectively. An adequate internal and external validity has been reported; correlation coefficient with the Hamilton Depression Scale is 0.74³⁸.

STATISTICAL ANALYSIS

Frequencies of selected sociodemographic characteristics of PCGs of patients in HD and PD were tabulated and compared using Pearson Chi-square and Fisher's tests. Mean normalized scores and standard deviation (s.d.) for the eight QoL domains were computed and compared by dialysis type using Student's t-tests. Means were also depicted using a radial graph. Also, Zarit and Goldberg scores of PCGs of patients in HD and PD were compared using parametric and non-parametric statistics.

Crude and adjusted odds ratios (OR) with 95% confidence intervals (CI) were computed from binary logistic regression for the probability that PCGs had a low QoL, conventionally defined as less than 70% of the maximum possible score resulting from the added normalized scores of the eight dimensions. This cut-off was deemed as a fair definition for insufficient QoL, even though other authors have even proposed a more stringent cut-off of <60% for a similar population group³⁹. All variables collected from the general questionnaire, Zarit interview, and Goldberg scale were tested in bivariate analyses (QoL as continuous dependent variable) using parametric (Student's t-tests and ANOVA) and non-parametric (Mann-Whitney and Kruskal-Wallis tests) statistics. Variables considered potential confounders⁴⁰, both conceptually (i.e. covariates that are related to both the exposure and outcome) and statistically (p-value ≤ 0.10) were entered in the full model, but the final adjusted model included only statistically significant (p<0.05) variables. The model's goodness-of-fit was assessed using the Hosmer & Lemeshow Chi-square test with a non-significant p-value indicating a good fit. The Nagelkerke R² statistic was used to determine the percentage of prediction of the model. All data was entered and analyzed in SPSS® v.24.

RESULTS

Table 1 compares sociodemographic data for PCGs of patients in HD and PD. There was a higher proportion of female PCGs in both dialysis groups (HD 80%, PD 92.9%). However, the proportion of male PCGs was higher in HD patients (20%) compared with PD patients (7.1%). No statistical differences were

observed in all other variables tested. Regardless of dialysis group, most PCGs were aged 41-60 years (HD 56.8, PD 42.9), married (HD 80%, PD 73.8%), had more than 12 years of formal education (HD 54.7%, PD 62.9%), and half were married or cohabiting with the patient (HD 53.7%, PD 50%).

Table 2 compares mean normalized scores for the eight QoL domains between HD and PD PCGs. The mean total normalized score was slightly higher in the PD compared with the HD group, but the difference did not reach statistical significance (PD 606, HD 587; p=0.37). However, PCGs of patients in PD had higher scores for emotional role functioning (+10.6; p=0.04), physical function (+9.2; p=0.002), bodily pain (+9.2; p=0.07), social functioning (+5.7; p=0.25), and mental health (+1.3; p=0.71). Conversely, PCGs of patients in HD had somewhat higher mean scores for physical role functioning (+7.9, p=0.14), general health (+6.1; p=0.05), and vitality (+3.3; p=0.36).

The mean normalized scores for the eight QoL domains for PCGs of patients in HD (n=95) and PD (n=42) is graphically presented in Figure 1.

Table 3 compares work overload levels and prevalence of anxiety and depression between PCG of patients in HD and PD. Both mean (HD 23.6, PH 22.8; p=0.77) and median (HD 18, PH 21.5; p=0.85) Zarit scores were relatively similar, yet, workload levels tended to be lower in PCGs of patients in PD (medium + high load: HD 14.8%, PD 7.2%). The proportion of anxiety (HD 50.5%, PD 19%; p<0.01) and depression (HD 49.5%, PD 16.7%; p<0.01) was also considerably lower among PCGs of patients in PD according to the Goldberg scale.

The logistic regression to determine the probability of low QoL among PCGs by type of dialysis of the patient is presented in Table 4. Crude OR for HD compared with PD was 1.86 (95% CI 0.79-4.36). PCGs' age group, care time in months, work overload, anxiety, and depression showed significantly higher ORs in crude analyses, and were thus adjusted for. The multivariate model using these variables led to an adjusted OR of 1.54 (95% CI 0.43-5.31) for HD in relation to PD. Notably, the care time in months was negatively associated with low QoL (adj. OR 0.96; 95% CI 0.93-0.98). Work overload was also associated, but with a higher probability of low QoL (1.04; 1.01-1.08), as was for the presence of anxiety (5.53; 1.71-17.84). The adjusted model fitted well (p=0.34), and explained 49% of the outcome variability.

TABLE 1 SELECTED SOCIODEMOGRAPHIC CHARACTERISTICS OF CAREGIVERS OF PATIENTS IN HEMODIALYSIS AND PERITONEAL DIALYSIS

Variable	Category	n (%)		
		Hemodialysis	p-value*	Peritoneal dialysis
Sex	Male	19 (20.0)	0.07	3 (7.1)
	Female	76 (80.0)		39 (92.9)
Age group in years	15-40	18 (18.9)	0.28	12 (28.6)
	41-60	54 (56.8)		18 (42.9)
	>60	23 (24.2)		12 (28.6)
Civil status	Married or cohabiting	76 (80.0)	0.25	31 (73.8)
	Single or divorced	16 (16.8)		11 (26.2)
	Widowed	3 (3.2)		0 (0.0)
Formal schooling (years)	1-6 (primary)	9 (9.5)	0.52	3 (7.1)
	7-9 (secondary)	15 (15.8)		9 (21.4)
	10-12 (high school)	17 (17.9)		4 (9.5)
	>12 (college or more)	52 (54.7)		26 (62.9)
	Unknown	2 (2.1)		0 (0.0)
Religion	Catholic	84 (88.4)	0.54	35 (83.3)
	Protestant	6 (6.3)		5 (11.9)
	None or other	5 (5.3)		2 (4.8)
Relationship to patient	Spouse/partner	51 (53.7)	0.24	21 (50.0)
	Daughter/son	28 (29.5)		16 (38.1)
	Parent/sibling	10 (10.5)		1 (2.4)
	Others (relative, nurse)	4 (4.2)		4 (9.5)
	Unknown	2 (2.1)		0 (0.0)
Total		95		42

* Pearson Chi-square and Fisher's tests were used.

TABLE 2 MEAN NORMALIZED SCORES AND STANDARD DEVIATION (S.D.) FOR THE EIGHT DOMAINS OF THE QUALITY OF LIFE SF-36 BETWEEN CAREGIVERS OF PATIENTS IN HEMODIALYSIS AND PERITONEAL DIALYSIS

Domain	Mean±s.d.		
	Hemodialysis n=95	p-value*	Peritoneal dialysis n=42
Physical functioning	82.1±22.4	0.00	91.3±11.1
Physical role functioning	74.1±30.4	0.14	66.2±24.6
Bodily pain	71.2±27.3	0.07	80.4±27.4
General health	66.4±22.0	0.05	60.3±14.2
Vitality	64.9±24.9	0.36	61.6±17.2
Social functioning	77.7±27.7	0.25	83.4±23.7
Emotional role functioning	78.2±30.7	0.04	88.8±20.7
Mental health	73.1±25.8	0.71	74.4±14.1
Total score ¹	587.9±156	0.37	606.6±88.8

* Student t-tests were used.¹ Computed by adding the normalized individual scores for the 8 dimensions.

DISCUSSION

We aimed at comparing the QoL between PCGs of patients in PD and HD from a middle-income city of northern Mexico. Results showed that caregivers in the PD group had better mean scores than those in the HD group in five out the eight dimensions studied. Except for general health, which was significantly higher in the HD group, caregivers in the PD group

had a statistically higher means for emotional role functioning, physical functioning, and bodily pain.

Our findings can be compared with the Brazilian study with data from 2003-2006 that included caregivers of elderly patients in HD (n=84), non-elderly patients in HD (n=77), and elderly patients in PD (n=40). The authors reported differences for the physical functioning (p<0.05) and emotional role functioning (p<0.01), dimensions

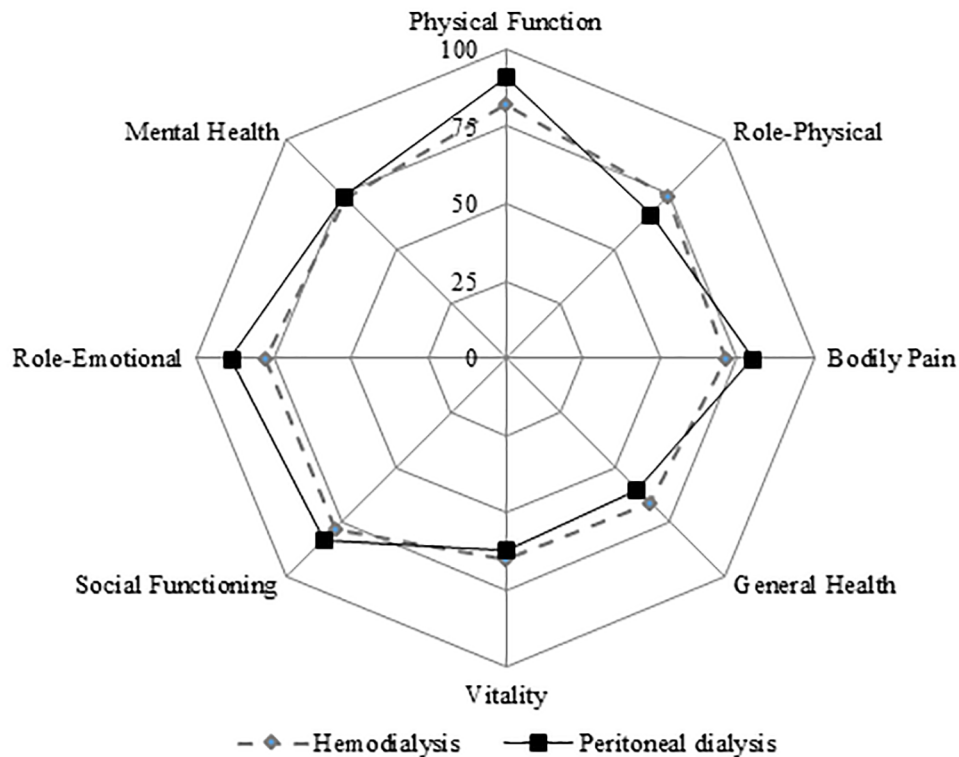


Figure 1. Average normalized scores for the eight QoL domains studied for primary caregivers of patients in hemodialysis (n=95) and peritoneal dialysis (n=42).

TABLE 3 COMPARISON OF THE ZARIT (WORK OVERLOAD) AND GOLBERG (ANXIETY AND DEPRESSION) SCALES BETWEEN CAREGIVERS OF PATIENTS IN HEMODIALYSIS AND PERITONEAL DIALYSIS

Scale used	Hemodialysis n=95	p-value*	Peritoneal dialysis n=42
Zarit (work overload)			
Mean ± standard deviation	23.6±17.4	0.77	22.8±14.2
Median (min-max)	18.0 (0-67)	0.85	21.5 (0-75)
Light load: 22-46 points, n (%)	30.5%	0.25	45.2%
Medium load: 47-55 points, n (%)	9.5%		2.4%
Severe load: >56 points, n (%)	5.3%		4.8%
Goldberg			
Anxiety: ≥2/9 items, n (%)	50.5%	0.00	19.0%
Depression: ≥1/9 items, n (%)	49.5%	0.00	16.7%

* Student t and Mann-Whitney tests were used for continuous data, and Pearson Chi-square, and Fisher tests were used for nominal data.

favoring HD caregivers, in contrast with our results that showed better mean scores among PD caregivers. Unlike us, they also found differences for vitality ($p<0.05$), social functioning ($p<0.05$), and mental health ($p<0.01$), but again, favoring HD (19). The other relevant study with 221 Spanish caregivers using data from the early 2000s showed comparable results between caregivers of patients in HD and PD³⁰. However, when multivariate adjusted analysis was carried out to predict low QoL (using <70% as cut-off), type of dialysis had no significant impact (adj. OR 1.51; 95% CI 0.43-5.31); the adjusted effect remained non-significant when the cut-off was lowered to <60% (2.11; 0.36-12.3) and <50% (4.71; 0.40-55.5).

Nearly half of the caregivers were middle-aged (41-60 y: 52.5%), and two out of three (78.1%) were married or cohabiting with the patient (51.8%), as others have also noted^{19,21,27,28,41,42-44}. Even though the large majority of PCGs in this study were women (83.9%), as it has been reported extensively^{19,21,27-29,31,32,41-46}, the proportion of male PCGs was particularly higher in the HD (20%) compared with the PD group (7.1%). This finding has not been documented earlier. Apparently, since men are the primary breadwinners, they have to work during the day precluding them to provide the care PD patients require.

No significant differences in the mean or median Zarit burden scores were seen, but PCGs of patients

TABLE 4 CRUDE AND ADJUSTED ODDS RATIOS (OR) WITH 95% CONFIDENCE INTERVALS (CI) FROM BINARY LOGISTIC REGRESSION FOR THE PROBABILITY OF LOW QUALITY OF LIFE OF CAREGIVERS (<70% OF THE MAXIMUM POSSIBLE SCORE RESULTING FROM THE ADDED NORMALIZED SCORES OF THE EIGHT DIMENSIONS), BASED ON THE STUDY ON QUALITY OF LIFE OF CAREGIVERS OF PATIENTS WITH CHRONIC RENAL DISEASE IN DIALYSIS IN NORTHERN MEXICO, 2019 (N=137)

Variable	Category	OR (95% IC)	
		Crude	Adjusted ³
Type of dialysis	Peritoneal	1.00	1.00
	Hemodialysis	1.86 (0.79-4.36)	1.51 (0.43-5.31)
Caregivers' age group in years	15-40	1.00	1.00
	41-60	2.86 (0.89-9.17)	2.05 (0.49-8.54)
	>60	4.87 (1.40-16.97)	4.01 (0.87-18.47)
Care time in months	Continuous	0.97 (0.95-0.99)	0.96 (0.93-0.98)
Work overload ¹	Continuous	1.06 (1.03-1.09)	1.04 (1.01-1.08)
Anxiety ²	No	1.00	1.00
	Yes	10.66 (4.46-25.5)	5.53 (1.71-17.84)
Depression ²	No	1.00	1.00
	Yes	5.79 (2.61-12.86)	1.07 (0.32-3.60)

¹Based on the Zarit scale score (min 0, max 88): in this sample the minimum value was 0 and maximum value was 71 points. ²Dichotomized based on the Goldberg's scale: anxiety ($\geq 2/9$ items), depression ($\geq 1/9$ items). ³Only statistically significant variables ($p < 0.05$) remained in the final adjusted model; Hosmer & Lemeshow goodness-of-fit test $\chi^2=8.96$ ($p=0.34$); Nagelkerke $R^2=0.49$.

in the HD group had twice the prevalence of medium/severe workload (HD 14.8%, PD 7.2%). These finding replicates what it has been previously reported. In a Turkish study with 127 caregivers, the burden score was significantly higher in the HD group compared with the PD group³². Another Turkish study with 114 caregivers also found higher prevalence of intermediate/high burden in caregivers of patients in HD (HD 87%, PD 65%)³¹, and an Indian study of 90 caregivers also reported a higher prevalence of moderate/severe burden in the HD group (HD 40%, PD 23%)³³. In the adjusted analysis, work overload was associated with a higher probability of low QoL (4% increase risk for each additional point in the Zarit scale) independently of type of dialysis.

According to the Goldberg scale, the prevalence of anxiety (HD 50.5%, PD 19%) and depression (HD 49.5%, PD 16.7%) was much higher in the HD group. These findings can be compared with the Turkish study of 127 caregivers that also showed a lower mean score for anxiety, but a higher mean score for depression in the HD group using the Hospital Anxiety and Depression Scores³². In multivariate analysis, only anxiety remained predictive of low QoL among PCGs (i.e., the risk was five times higher), indirectly corroborating the higher levels of anxiety seen in caregivers compared with the general population⁴⁷.

Notably, care time in months was negatively associated with low QoL in multivariate analysis regardless of dialysis type; for each additional month caring for the patient there was a 4% lower chance

of having a low QoL. This finding is analogous to that observed in patients with cardiac arrest that showed improvement in caregivers' wellbeing during the first year associated with adaptive coping styles and resilience⁴⁸; it is possible that PCGs find efficient mechanisms to deal with the physical and emotional burden derived from their care giving activities.

This study had some limitations that ought to be mentioned. One relates to the cross-sectional nature of the study design, as only one assessment of QoL was available precluding relevant longitudinal comparisons. Another limitation relates to the level of patients' dependency, which can have an impact on the PCGs' QoL resulting in a possible bias about the significant difference between the comparison groups; while we were unable to assess the dependency level, we adjusted the analyses for the patients' QoL, measured with the kidney disease QoL short form questionnaire⁴⁹⁻⁵⁰, as a proxy for the dependency level (i.e. the higher the QoL, the lower PCGs' dependency and vice versa), and found no significant effect ($p=0.61$), suggesting a non-differential bias. Another limitation relates to the convenience sampling used, which restricts the validity of the results for PCGs in the four hospitals not included, as well as the generalizability of the findings to different settings; yet, the fact that both crude and adjusted analyses led to non-significant differences in PCGs' QoL among hospitals ($p > 0.30$) points to the possibility of similar findings across hospitals. Lastly, the failure to control for relevant unmeasured factors (e.g. degree of support from other family

members), the partial assessment of some variables (e.g. socioeconomic status), and the lack of adjustment due non-statistical significance resulting from a small sample, could have led to residual confounding; in fact, the relatively large confidence intervals observed in the multivariate regression model point to the need for a larger study to better address this topic.

CONCLUSION

While PCGs in the PD group had significantly better mean QoL scores for emotional role functioning, physical functioning, and bodily pain, multivariate adjusted analysis showed no differences in the risk of low QoL between PCGz of patients in PD and HD. If these findings are confirmed, they would add to the financial efficiency of the PD modality, and would strengthen its value in resource-limited settings.

ACKNOWLEDGEMENTS

We are grateful to patients and PCGs for their participation. We also acknowledge the medical personnel and hospital authorities for their support and assistance during the data collection. Finally, we thank Liliana Guevara, Demis Lerma, Mario Ordoñez, Brianda Aragón, Arlette Tejada, and Valerie Bustillos for their assistance during the data collection.

CONFLICT OF INTEREST

The authors declare no conflict of interests.

AUTHOR'S CONTRIBUTION

JME: Principal project leader, conceived and designed the study, coordinated data collection, conducted analyses, wrote the first draft, and approved the final version. JADV: Collected primary data, conducted analyses, participated in the writing of the manuscript, and approved the final version. GRG: Conceived and designed the study, assisted during data collection, participated in the writing of the manuscript, and approved the final version.

REFERENCES

- Luyckx VA, Tonelli M, Stanifer JW. The global burden of kidney disease and the sustainable development goals. *Bull World Health Organ* [Internet]. 2018; [last accessed in 2020-10-22]; 96:414-22D. Available from: www.who.int/bulletin/volumes/96/6/17-206441/en/
- Méndez-Durán M, JMéndez-Bueno JF, Tapia-Yáñez T, Muñoz Montes A, Aguilar-Sánchez L. Epidemiology of chronic kidney failure in Mexico. *Dialisis y Trasp* 2010;31(1):7-11.
- Chávez-Gómez NL, Cabello-López A, Gopar-Nieto R, Aguilar-Madrid G, Marin-López KS, et al. Chronic kidney disease in Mexico and its relation with heavy metals. *Rev Med Inst Mex Seguro Soc* 2017;55(6):725-34.
- Tamayo-Orozco J, Lastiri-Quirós S. La enfermedad renal crónica en México. In: *Enfermedad renal crónica en México: una política nacional todavía pendiente*. Mexico City: CONACyT 2016:82.
- Sinnakirouchenan R, Holley JL. Peritoneal Dialysis Versus Hemodialysis: Risks, Benefits, and Access Issues. *Adv Chronic Kidney Dis* 2011;18(6):428-32.
- Liyanage T, Ninomiya T, Jha V, Neal B, Patrice HM, et al. Worldwide access to treatment for end-stage kidney disease: a systematic review. *Lancet* 2015;385:1975-82.
- Abu-Aisha H, Elamin S. Peritoneal dialysis in Africa. *Perit Dial Int* 2010;30(1):23-8.
- Kwong VW, Li PK. Peritoneal Dialysis in Asia. *Kidney Dis (Basel)* 2015;1(3):147-56.
- Kaplan AA. Peritoneal Dialysis or Hemodialysis: Present and Future Trends in the United States. *Contrib Nephrol* 2017;189:61-4.
- Luxardo R, Kramer A, González-Bedat MC, Massy ZA, Jager KJ, et al. The epidemiology of renal replacement therapy in two different parts of the world: the Latin American Dialysis and Transplant Registry versus the European Renal Association-European Dialysis and Transplant Association Registry. *Rev Panam Salud Pública* 2018;42:1-11.
- Niang A, Iyengar A, Luyckx VA. Hemodialysis versus peritoneal dialysis in resource-limited settings. *Curr Opin Nephrol Hypertens* 2018;27(6):463-71.
- Klarenbach SW, Tonelli M, Chui B, Manns BJ. Economic evaluation of dialysis therapies. *Nat Rev Nephrol* 2014;10(11):644-52.
- Jain AK, Blake P, Cordy P, Garg AX. Global trends in rates of peritoneal dialysis. *J Am Soc Nephrol* 2012;23(3):533-44.
- Durán-Arenas L, Avila-Palomares P, Zendejas-Villanueva R, Vargas-Ruiz MM, Tirado-Gómez LL, et al. Direct cost analysis of hemodialysis units. *Salud Publica Mex* 2011;53(S4):516-24.
- Cortés-Sanabria L, Rodríguez-Arreola BE, Ortiz-Juárez VR, Soto-Molina H, Pazarín-Villaseñor L, et al. Comparison of direct medical costs between automated and continuous ambulatory peritoneal dialysis. *Perit Dial Int* 2013;33(6):679-86.
- Peña-Rodríguez JC, Ramos-Gordillo JM. Panorama de la hemodiálisis y la diálisis peritoneal en México: perspectivas y propuesta para el siglo XXI (Chapter 6). In: *La enfermedad renal crónica en México: Hacia una política nacional para enfrentarla*. Tamayo-Orozco JA & Lastiri-Quirós HS (Eds.) *Intersistemas*, Mexico City, 2016:49-62.
- Moghadasian S, Sahebi Hagh MH, Aghaallah Hokmabadi L. Lifestyle of hemodialysis patients in comparison with outpatients. *J Caring Sci* 2012;1(2):101-7.
- Grapsa E, Gerogianni G. Caregivers of Patients on Haemodialysis. In: Mollaoglu M, editor. *Caregiving and Home Care*. IntechOpen 2017:75-84.
- Gilbertson EL, Krishnasamy R, Foote C, Kennard AL, Jardine MJ, et al. Burden of Care and Quality of Life Among Caregivers for Adults Receiving Maintenance Dialysis: A Systematic Review. *Am J Kidney Dis* 2019;73(3):332-43.
- Barnieh L, King-Shier K, Hemmelgarn B, Laupacis A, Manns L, Manns B. Views of Canadian patients on or nearing dialysis and their caregivers: A thematic analysis. *Can J Kidney Heal Dis*. 2014;1(1):1-10.
- Alnazly EK. Burden and coping strategies among Jordanian caregivers of patients undergoing hemodialysis. *Hemodial Int* 2016;20(1):84-93.
- Figueiredo AE, Bernardini J, Bowes E, Hiramatsu M, Price V, Su C, et al. A syllabus for teaching peritoneal dialysis to patients and caregivers. *Perit Dial Int*. 2016;36(6):592-605.
- Suri RS, Larive B, Hall Y, Kimmel PL, Kliger AS, Levin N, et al. Effects of frequent hemodialysis on perceived caregiver burden in the frequent hemodialysis network trials. *Clin J Am Soc Nephrol*. 2014;9(5):936-42.
- Sajadi SA, Ebadi A, Moradian ST. Quality of life among family caregivers of patients on hemodialysis and its relevant factors: A systematic review. *Int J Community Based Nurs Midwifery*. 2017;5(3):206-18.

25. Morton RL, Tong A, Howard K, Snelling P, Webster AC. The views of patients and carers in treatment decision making for chronic kidney disease: Systematic review and thematic synthesis of qualitative studies. *BMJ*. 2010;340(7742):350.
26. Pereira B dos S, Fernandes N da S, de Melo NP, Abrita R, Grincenkov FR dos S, Fernandes NM da S. Beyond quality of life: A cross sectional study on the mental health of patients with chronic kidney disease undergoing dialysis and their caregivers. *Health Qual Life Outcomes*. 2017;15(1):1–10.
27. Belasco A, Barbosa D, Bettencourt AR, Diccini S, Sesso R. Quality of Life of Family Caregivers of Elderly Patients on Hemodialysis and Peritoneal Dialysis. *Am J Kidney Dis* 2006;48(6):955-63.
28. Hoang VL, Green T, Bonner A. Informal caregivers of people undergoing haemodialysis: associations between activities and burden. *J Ren Care* 2019;1-8.
29. Kang A, Yu Z, Foo M, Chan C, Griva K. Evaluating Burden and Quality of Life among Caregivers of Patients Receiving Peritoneal Dialysis. *Perit Dial Int* 2019;39(2):176-80.
30. Alvarez-Ude F, Valdes C, Estebanez C, Rebollo P. Health related quality of life of family caregivers of dialysis patients. *J Nephrol* 2004;17(6):841-50.
31. Cantekin I, Kavurmaci M, Tan M. An analysis of caregiver burden of patients with hemodialysis and peritoneal dialysis. *Hemodial Int* 2016;20(1):94-7.
32. Bardak S, Demir S, Aslan E, Turgutalp K, Celikcan HD, et al. The other side of the coin in renal replacement therapies: the burden on caregivers. *Int Urol Nephrol* 2019;51(2):343-9.
33. Nagarathnam M, Sivakumar V, Latheef SAA. Burden, coping mechanisms, and quality of life among caregivers of hemodialysis and peritoneal dialysis undergoing and renal transplant patients. *Indian J Psychiatry* 2019;61(4):380-8.
34. Centro Nacional de Trasplantes. Boletín estadístico informativo del Centro Nacional de trasplantes. BEI-CENATRA, Mexico City, 2018.
35. Ware J, Kosinski M, Gandek B. SF-36 Health Survey: Manual and Interpretation Guide. Qual Inc., Lincoln, RI, 1993.
36. Brazier JE, Harper R, Jones NMB, O’Cathain A, Thomas KJ, Usherwood T, et al. Validating the SF-36 health survey questionnaire: New outcome measure for primary care. *Br Med J* 1992;305(6846):160-4.
37. Pardo X, Cárdenas S, Valencia A, Venegas JM, Mora-Magana I. Escala de carga del cuidador de Zarit: evidencia de validez en México. *Psicooncol* 2014;11.
38. Holm J, Holm L, Bech P. Monitoring improvement using a patient-rated depression scale during treatment with antidepressants in general practice: A validation study on the Goldberg Depression Scale. *Scand J Prim Health Care* 2001;19(4):263-6.
39. Silva SM, Santana ANC, Silva NNBD, Novaes MRCCG. VES-13 and WHOQOL-bref cutoff points to detect quality of life in older adults in primary health care. *Rev Saude Publica* 2019;53:26.
40. VanderWeele TJ. Principles of confounder selection. *Eur J Epidemiol* 2019;34(3):211-9.
41. Mollaoglu M, Mansur K, Birsan Y. Effects on caregiver burden of education related to home care in patients undergoing hemodialysis. *Hemodial Int* 2012;17(3):413-20.
42. Griva K, Goh CS, Kang WCA, Yu ZL, Chan MC, et al. Quality of life and emotional distress in patients and burden in caregivers: a comparison between assisted peritoneal dialysis and self-care peritoneal dialysis. *Qual Life Res* 2016;25(2):373-84.
43. Sotoudeh R, Saeid P, Mousa A. The Effect of a Family - Based Training Program on the Care Burden of Family Caregivers of Patients Undergoing Hemodialysis. *J Nurs Midwifery Res* 2019;24(2):144-50.
44. Farzi S, Farzi S, Moladoost A, Ehsani M, Shahriari M, et al. Caring burden and quality of life of family caregivers in patients undergoing hemodialysis: A descriptive-analytic study. *Int J Community Based Nurs Midwifery* 2019;7(2):89-96.
45. Urquhart-second R, Craig JC, Hemmelgarn B, Tam-tham H, Manns B, et al. Patient and Caregiver Priorities for Outcomes in Hemodialysis: An International Nominal Group Technique Study. *Am J Kidney Dis* 2016;68(3):4444-54.
46. Gerogianni G, Polikandrioti M, Babatsikou F, Zyga S, Alikari V, et al. Anxiety-Depression of Dialysis Patients and Their Caregivers. *Medicina (Kaunas)* 2019;55(5).
47. Ferrario S, Zotti A, Baroni A, Cavagnino A, Fornara R. Emotional reactions and practical problems of the caregivers of hemodialysed patients. *J Nephrol* 2002;15(1):54-60.
48. Van Wijnen HG, Rasquin SM, Van Heugten CM, Verbunt JA, Moulart VR. The impact of cardiac arrest on the long-term wellbeing and caregiver burden of family caregivers: A prospective cohort study. *Clin Rehabil* 2017;31(9):1267-75.
49. Hays RD, Kallich J, Mapes D, Coons S, Amin N, Carter WB, et al. Kidney disease quality of life short form (KDQOL-SF TM), Version 1.3: a manual for use and scoring [Internet]. Santa Monica: RAND Corporation; 1997; [last accessed 2020-10-22]. Available from: <https://www.rand.org/pubs/papers/P7994.html>
50. Dehesa-López E, Correa-Rotter R, Olvera-Castillo D, González-Parra C, Baizabal-Olarte R, Orozco-Vega R. Transcultural adaptation and validation of the Mexican version of the kidney disease questionnaire KDQOL-SF36 version 1.3. *Qual Life Res*. 2017;26(1):193–8.