Association between exercise self-efficacy and health-related quality of life among dialysis patients: a cross-sectional study

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Research

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Abstract

Background

Given the importance of exercise self-efficacy in the process of quality of life change, this study aimed to describe the relationship between exercise self-efficacy and health-related quality of life (HRQOL) in dialysis patients.

Methods

A cross-sectional study was conducted in Shanghai, China. Structured questionnaires applied to the patients collected basic information about gender, age, marital status, education, and income for socio-demographic and body mass index, causes for end-stage renal disease, dialysis modality, and dialysis vintage for the disease-related factors. Physical activity was assessed by a self-administered questionnaire. Exercise self-efficacy was measured through the Exercise Self-Efficacy Scale (ESES). Health-related quality of life was evaluated by the Kidney Disease Quality of Life Instrument-Short Form version 1.3 (KDQOL-SF™ v1.3). Data were analyzed using a univariate generalized linear model, Spearman correlation, and hierarchical multiple regression.

Results

A positive association was observed between exercise self-efficacy and HRQOL ($r = 0.310$, $P < 0.001$). Physical activity as predictor variables explained 9.8% of the variance in overall HRQOL ($P < 0.001$). Exercise self-efficacy explained an additional 7.1% of the HRQOL variance. In total, 24.6% of the variation in the HRQOL is explained by the socio-demographic variables, disease-related factors, physical activity, and exercise self-efficacy.

Conclusion

Overall, only 16.9% of the change in HRQOL was explained by physical activity and exercise self-efficacy. Future research is still needed to explore further the factors influencing the quality of life in dialysis patients. However, this finding suggests the need to consider the importance of HRQOL and physical activity as well as exercise self-efficacy when developing intervention programs.

Introduction

Chronic kidney disease is a progressive, debilitating illness defined by declining renal function that gradually progresses to end-stage renal disease (ESRD) [1]. The prevalence of ESRD has increased over the past decade in parallel with an increasing prevalence of diabetes, hypertension, and aging [2, 3]. Dialysis, including hemodialysis and peritoneal dialysis, is an effective renal replacement therapy

modality for patients with ESRD. Over the next five years, the number of dialysis patients is estimated to be nearly 900,000 cases in China [4], and it has emerged as one of the most critical public health problems worldwide [5]. Due to the complexity of the disease process and its management, dialysis treatment imposes significant security and financial burden on patients and their families, seriously affecting health-related quality of life (HRQOL) [6].

HRQOL is seen as a primary patient-centered outcome and is increasingly used as an assessment metric for medical interventions [7]. HRQOL can predict disease-related factors and assess prognosis, thus guiding the treatment of specific populations. Poor HRQOL was a common problem in dialysis patients and contributed to low survival rates [8, 9] and high emotional stress [8]. With this in mind, HRQOL is increasingly recognized as a key prognostic measure to evaluate the effectiveness of kidney disease treatment [9].

Exercise self-efficacy, the confidence a person has in developing and meeting exercise goals, is vital to exercise motivation [10]. Results of a previous study showed the level of exercise self-efficacy is low in patients with chronic diseases [11], which was associated with poor HRQOL in some populations, e.g., chronic heart failure [12], total knee arthroplasty recipients [13]. The literature indicated that exercise self-efficacy is a predictor of good HRQOL [14], and low exercise self-efficacy often leads to physical inactivity, causing poor prognosis [15–17]. In addition, good self-efficacy appears to be critical for improving HRQOL and health status, primarily when targeted secondary prevention strategies are working to achieve desired rates [18].

To address and help bridge the gap between exercise self-efficacy and HRQOL, we conducted a cross-sectional study to explore the association between exercise self-efficacy and HRQOL in ESRD patients receiving dialysis treatment.

Methods

Study design and population

The study was conducted between October 2020 to June 2021. Using a snowball sampling method, samples were obtained from the nephrology department of a hospital in Shanghai. The sample size should be 5-10 times the number of scale entries. Considering a 10% inefficiency of the questionnaire, it is expected that a minimum of 198 participants will be needed. The inclusion criteria were as follows: diagnosed with ESRD and already undergoing regular dialysis treatment; age older than 18 years; able to perform the activities of daily living independently; able to understand and speak Chinese; consent to participate in the study. The exclusion criteria were cognitive impairment or mental disorders; refusal to participate. Patients who used a cane daily or had difficulty walking without a walking aid device were also excluded.

Assessments

The assessment tools for collecting data included: (1) basic information questionnaire; (2) physical activity questionnaire; (3) Exercise Self-efficacy Scale; (4) Kidney Disease Quality of Life Scale.

Instruments

Basic information questionnaire

The socio-demographic questionnaire consisted of gender, age, marital status, education, and income. The disease-related factors included body mass index, causes for end-stage renal disease, dialysis modality, and dialysis vintage.

Physical activity

Physical activity level was evaluated by reporting how often an individual exercised (≤ 1 , 2-3, ≥ 4 sessions per week), and the mean duration of each exercise session (<30, 30-45, 45-60, >60 minutes per session).

Exercise Self-Efficacy Scale

The Exercise Self-Efficacy Scale was used to measure exercise self-efficacy, developed by Bandura [19]. For each item, individuals indicate their confidence to execute the behavior on a 100-point percentage scale comprised of 10-point increments, ranging from 0% (not at all confident) to 100% (highly confident). Total strength for each measure of self-efficacy is then calculated by summing the confidence ratings and dividing by the total number of items in the scale, resulting in a maximum possible efficacy score of 100. The Chinese version of the scale has good validity and reliability with a Cronbach's alpha of 0.966 [20].

Kidney Disease Quality of Life Scale

Kidney Disease Quality of Life Scale (KDQOL-SFTM v1.3), a 36-item disease-specific questionnaire, was employed to evaluate the patients' quality of life. The scale consists of five dimensions: Physical Component Summary (PCS), Mental Component Summary (MCS), Burden of Kidney Disease, Symptom/Problem, and Effects of Kidney Disease. The score was ranged from 0 to 100, with the higher the of each dimension indicating a better quality of life. The Chinese version of the KDQOL-36TM has demonstrated acceptable levels of internal consistency (Cronbach's $\alpha = 0.69-0.78$) and test-retest reliability (ICC=0.70-0.86) [21].

Statistical analysis

Categorical variables were presented as frequency (percentage) and Continuous variables as mean $\pm$ standard deviations because the overall HRQOL score was normally distributed.

A univariate generalized linear model was used to analyze the relationship between each independent variable and HRQOL. Consider the distribution of exercise self-efficacy scores was skewed, the spearman correlation was used to assess the relationship between exercise self-efficacy and HRQOL.

In the hierarchical regression analysis, the model was entered in 4 blocks. Block 1 consisted of gender, age, marital status, educational, and income which were operationally defined as socio-demographic and were entered first. Block 2 was disease-related factors, including body mass index, causes of end-stage renal disease, dialysis modality, and dialysis vintage. Block 3 included physical activity, and the exercise self-efficacy was added to block 4. After the entry of each block, the adjusted R^2 change is observed to determine the proportion of variance described by HRQOL. The significant level was set at 0.05. Statistical analysis was performed using SPSS software (version 21.0).

Results

A total of 203 participants were finally included in this survey. Table 1 demonstrates the socio-demographic of the participants. The mean age of participants was 58.57 ± 12.07 years and among the 203 patients. More than half of the participants ($n = 58.13\%$) had a lower physical activity (< 1500 min/week).

Table 1
Characteristics of included patients according to socio-demographic (n = 203)

Variables	n (%)	β (95% CI)	P value
Gender			
Male	114 (56.16%)	-	
Female	89 (43.84%)	-1.402 (-4.528, 1.729)	0.380
Age (years)			
<55	66 (32.51%)	-	
≥ 55	137 (67.49%)	0.023 (-0.108, 0.153)	0.731
Marital status			
Non-married	21 (10.34%)	-	
Married	162 (79.80%)	4.713 (-0.378, 9.805)	0.070
Widowed	20 (9.85%)	5.395 (-1.464, 12.255)	0.123
Educational			
Primary school or below	18 (8.87%)	-	
Junior high school	86 (42.36%)	-1.314 (-7.041, 4.412)	0.362
Senior high school	65 (32.02%)	-1.520 (-7.404, 4.365)	0.613
Undergraduate or above	34 (16.75%)	-2.996 (-9.436, 3.444)	0.653
Income			
Poor	50 (24.63%)	-	
Moderate	66 (32.51%)	3.900 (-0.200, 7.999)	0.062
Good	56 (27.59%)	0.236 (-4.019, 4.490)	0.913
Very good	31 (15.27%)	0.034 (-4.965, 5.033)	0.989
Causes			
Glomerulonephritis	77 (37.93%)	-	
Diabetic nephropathy	47 (23.15%)	0.032 (-4.057, 4.121)	0.988
Hypertensive nephropathy	35 (17.24%)	0.821 (-3.683, 5.325)	0.721
IgA nephropathy	22 (10.84%)	1.945 (-3.396, 7.285)	0.475
Other	22 (10.84%)	1.855 (-3.486, 7.196)	0.496
Body mass index			

Variables	n (%)	β (95% CI)	P value
Underweight	14 (6.90%)	-	
Normal	115 (56.65%)	2.711 (-3.525, 8.946)	0.394
Overweight	62 (30.54%)	2.034 (-4.484, 8.552)	0.541
Obesity	12 (5.91%)	-1.617 (-10.283, 7.048)	0.715
Dialysis modality			
Peritoneal dialysis	116 (58.13%)	-	
Hemodialysis	87 (42.86%)	4.443 (1.363, 7.523)	0.005
Dialysis vintage (months)			
<36	78 (38.42%)	-	
36–60	69 (33.99%)	-3.780 (-7.403, -0.158)	0.041
>60	56 (27.59%)	-1.546 (-5.385, 2.293)	0.430
Physical activity (min/week)			
<1500	118 (58.13%)	-	
≥ 1500	85 (41.87%)	3.842 (0.706, 6.978)	0.016

Health-related Quality Of Life

The mean score of dialysis patients' quality of life was 49.51 ± 11.33 . The comparison of the mean scores for each dimension of the scale in the study population showed that "Burden of Kidney Disease" (38.08 ± 26.73) had the lowest mean score and "Symptom/Problem" (77.85 ± 14.28) had the highest mean score among all the studied dimensions, see Fig. 1.

Figure 2 shows the Spearman correlation between exercise self-efficacy and HRQOL, and a positive association was observed ($r = 0.310$, $P < 0.001$).

Hierarchical Regression Models

Table 2 shows the results of the hierarchical regression models. In model 1, socio-demographic could explain 2.3% of the variation in KDQOL, with an R^2 value was 0.026. For model 2, disease-related factors have an explanatory strength of 5.3% for KDQOL, and the R^2 increased from 0.023 to 0.076. Model 3 showed a significant change in F-value ($P < 0.05$) with the addition of physical activity to model 2, implying that physical activity has an explanatory significance to the model. Moreover, the R^2 value increased from 0.076 to 0.174, implying that physical activity can generate an explanatory strength of

9.8% for KDQOL. Specifically, the regression coefficient value for physical activity is 8.242 ($t = 4.772$, $P < 0.001$), implying that physical activity can significantly positively correlate with KDQOL. In model 4, exercise self-efficacy was added, which explained an additional 7.1% variation, with the R^2 value increasing to 0.246. The regression coefficient value of exercise self-efficacy was 0.472 ($t = 4.234$, $P < 0.001$), implying that exercise self-efficacy would have a significant positive relationship with KDQOL.

Table 2
Hierarchical linear regression for prediction HRQOL

	Model 1	Model 2	Model 3	Model 4
Sex	-1.641 (-0.995)	-1.418 (-0.859)	-1.094 (-0.699)	-0.939 (-0.626)
Age	1.276 (0.682)	0.418 (0.221)	2.526 (1.366)	2.834 (1.599)
Income	-0.413 (-0.490)	1.140 (1.193)	1.399 (1.542)	1.209 (1.388)
Education	-0.589 (-0.574)	-1.736 (-1.609)	-1.877 (-1.834)	-1.277 (-1.289)
Marry	2.205 (1.163)	2.189 (1.165)	3.955* (2.174)	3.074 (1.751)
Dialysis		5.515** (2.980)	7.614** (4.209)	7.912** (4.561)
Dialysis vintage		-0.699 (-0.708)	-1.159 (-1.232)	-1.423 (-1.575)
Morbidity		0.479 (0.819)	0.751 (1.348)	0.555 (1.035)
Body mass index		-1.005 (-0.860)	-1.742 (-1.557)	-1.766 (-1.648)
Physical activity			8.242** (4.772)	6.703** (3.957)
SESE				0.472** (4.254)
R ²	0.023	0.076	0.174	0.246
Adjusted R ²	-0.002	0.033	0.131	0.202

* $P < 0.05$ ** $P < 0.001$

Values in the parenthesis are t values.

	Model 1	Model 2	Model 3	Model 4
<i>F</i>	<i>F</i> (5,197) = 0.924	<i>F</i> (9,193) = 1.773	<i>F</i> (10,192) = 4.053	<i>F</i> (11,191) = 5.657
<i>P</i> value for <i>F</i>	<i>P</i> = 0.466	<i>P</i> = 0.076	<i>P</i> < 0.001	<i>P</i> < 0.001
ΔR^2	0.023	0.053	0.098	0.071
ΔF	<i>F</i> (5,197) = 0.924	<i>F</i> (4,193) = 2.791	<i>F</i> (1,192) = 22.773	<i>F</i> (1,191) = 18.096
* <i>P</i> < 0.05 ** <i>P</i> < 0.001				
Values in the parenthesis are <i>t</i> values.				

Discussion

As dialysis technology improves and kidney disease patients live longer, healthcare providers are placing greater emphasis on patients' HRQOL.

A recent meta-analysis involving 147 studies reported a pooling mean HRQOL score for patients undergoing dialysis was 64.25 (95% CI 55.67 to 72.82) [22]. In the present study, the overall mean score of HRQOL was modestly lower than the results mentioned above. The reason may be that the average age of the patients enrolled in this study was older (58.57 ± 12.07). As described in the study by Ishiwatari et al., dialysis patients' quality of life decreased over time, especially among those older adults [23].

From the viewpoint of all dimensions, except MCS, all are lower than a large sample of the USA data [24], where only Symptom/Problem is not statistically significant, see Fig. 1. This may be related to the faster development of dialysis technology in the United States [25]. In addition, the results of low scores in each dimension may be related to the kidney disease itself, as well as existing comorbidities and related disease complications. The lowest burden of kidney disease score was similar to the results of the Peritoneal and Dialysis Outcomes and Practice Patterns Studies [26], indicating that disease burden is an important cause of lower quality of life for dialysis patients. As concluded by Abeywickrama et al., the symptoms burden score independently influenced all HRQOL (PCS: $\beta = -0.417$; MCS: $\beta = -0.464$) [27].

In the univariate analysis, dialysis type, dialysis vintage, and physical activity represented predictors for HRQOL in dialysis patients. Unlike previous studies [28], the results of this study showed that the HRQOL scores of hemodialysis patients were 4.443 (OR: 1.363, 7.523; *P* = 0.005) higher than those of peritoneal dialysis patients, but similar to the results of Gonçalves et al. [29] and de Abreu et al. [30] This happened because the limited sample size and the different inclusion criteria.

Regarding dialysis vintage, we found that patients with longer dialysis vintage had lower HRQOL scores than those with shorter ones. Early studies have shown that patients with kidney disease quality of life tend to decrease year by year after dialysis initiation [31, 32]. This is because the number of medications and co-morbidities increases with dialysis vintage, further eroding quality of life [33]. Therefore, Boini et

al. emphasized that HRQOL at dialysis initiation is significantly influenced by the quality of predialysis nephrology care and that emphasis should be placed on disease management [34].

The relationship of interest between physical activity and the prognosis of dialysis patients has been widely recognized [35]. As in previous studies, the results of this study showed that patients who participated in higher levels of physical activity had higher HRQOL scores compared to those who were less physically active than recommended. Previous studies have shown that physical activity increases the HRQOL of dialysis patients by improving cardiovascular health, inflammatory status, physical fitness, and reducing disease-related symptoms [36–38].

Moreover, in the current study, a significant positive interrelation was found between exercise self-efficacy and HRQOL. This positive relationship corroborates the social cognitive model proposed by McAuley et al. that exercise self-efficacy has a positive effect on PCS and MCS [39]. Self-efficacy has been reported to be the most dominant factor in the uptake and maintenance of exercise in populations with chronic conditions [40, 41]. Furthermore, self-efficacy is an essential determinant of health behavior, associated with a positive quality of life among patients living with chronic illnesses [42, 43].

In the stratified regression analysis, our study presented that physical activity remained statistically significant positive correlation with HRQOL. Also, physical activity as a predictor variable can explain an additional 9.8% of the variation in HRQOL. Most of the studies found a positive relationship between physical activity and HRQOL as well as a negative relationship between sedentary behavior and HRQOL among dialysis patients [44–46]. The present study further confirmed this positive finding. Moreover, we found that exercise self-efficacy was an important predictor of HRQOL in dialysis patients. Exercise self-efficacy is a strong determinant of behavior in physical activity and other health domains and has been shown to correlate with HRQOL in other populations [17, 18, 47]. The results of this study reinforce existing evidence on the importance of self-efficacy as a determinant of HRQOL in patients with chronic disease. Therefore, interventions aiming at increasing the HRQOL of dialysis patients should consider physical activity and exercise self-efficacy in these populations.

Our study has several limitations. Firstly, conducted in single-center, the results limit generalizability. Meanwhile, this study focused only on a sample of the dialysis population and has limited universality to non-dialysis CKD patients. Secondly, self-administered questionnaires were used to assess physical activity; an inaccurate estimation and recall bias was unavoidable. Thirdly, this study used a cross-sectional design and could not infer a causal relationship between exercise self-efficacy and HRQOL. Finally, we were unable to control the intensity of physical activity, and since we did not collect relevant data, this may have confounded the relationship between key variables.

Conclusions

The present study revealed that overall HRQOL in dialysis patients was low, while the burden of kidney disease dimension was the most impacted. Dialysis modality, dialysis vintage, physical activity, and exercise self-efficacy were significantly associated with poor overall HRQOL in our study population. In

total, only 16.9% of the variation of HRQOL was explained by the physical activity and exercise self-efficacy, and future studies still need to expand the sample size to explore potential predictors further. Nonetheless, this finding recommends the importance of considering HRQOL and physical activity and exercise self-efficacy when developing intervention programs.

Abbreviations

ESES: Exercise Self-Efficacy Scale; KDQOL-SFTMv1.3: Kidney Disease Quality of Life Instrument-Short Form version 1.3; ESRD: end-stage renal disease; HRQOL: health-related quality of life; BMI: body mass index.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee in Longhua Hospital Shanghai University of Traditional Chinese Medicine. All patients participated voluntarily in the survey and signed a free, informed consent form.

Consent for publication

Not applicable.

Availability of data and materials

Study data are available on reasonable request from the first author (Fan Zhang)

Competing interests

The authors declare that they have no competing interests in this section.

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Authors' contributions

Fan Zhang and Jing Liao worked in the conception and design of the study. Weihong Zhang, Jing Liao, and Liuyan Huang worked in data collection. Fan Zhang worked on data analysis and wrote the first draft. Liuyan Huang and Huachun Zhang revised the draft, and all authors have approved the final version for publication.

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Figures

Figure 1

Comparison of HRQOL with the USA dialysis population Figure legend: The USA data was extracted form Cohen DE, Lee A, Sibbel S, Benner D, Brunelli SM, Tentori F: Use of the KDQOL-36™ for assessment of

health-related quality of life among dialysis patients in the United States. BMC Nephrol 2019, 20(1):112. The comparison was based on a one-sample Wilcoxon test.

Figure 2

Correlation between exercise self-efficacy and HRQOL Figure legend: The x-axis represents exercise self-efficacy and the y-axis represents HRQOL, which are positively correlated.