



Research article

Analysis of influencing factors on quality of life in patients with chronic kidney disease undergoing maintenance haemodialysis

Jianping Hao^a, Yifei Wang^a, Yali Wang^a, Jing Zhang^b, Jia Gao^a, Liyuan Kang^a, Xin Wang^c, Jiankun Yang^d, Lili Zhang^{c,*}, Jing Liu^a

^a Blood Purification Center, Beijing You An Hospital, Capital Medical University, Beijing 100069, China

^b Blood Purification Center, Beijing Puren Hospital, Beijing 100062, China

^c Department of Nursing, Beijing You An Hospital, Capital Medical University, Beijing 100069, China

^d National drug clinical trial organization, Beijing You An Hospital, Capital Medical University, Beijing 100069, China

ARTICLE INFO

Keywords:

Chronic kidney disease
Haemodialysis
Quality of life
Anxiety
Depression
Sleep quality

ABSTRACT

Objective: To investigate and analyse the quality of life (QoL) of patients with chronic kidney disease (CKD) undergoing maintenance haemodialysis (MHD), explore influencing factors and provide a basis for formulating corresponding intervention measures.

Methods: A cross-sectional study was conducted on 190 patients with CKD undergoing MHD in hospital between March 2021 and March 2022. A general information questionnaire and the Kidney Disease Quality of Life Short Form were used to collect data. The QoL scores of patients with CKD undergoing MHD were calculated and compared by *t*-test and analysis of variance. Pearson correlation analysis was used to analyse the correlation between QoL scores and related factors. Stepwise multiple linear regression analysis was used to screen the influencing factors of QoL.

Results: The total score of QoL of patients with CKD undergoing MHD was 59.32 ± 11.67 , and the scores of physical component summary, mental component summary and kidney disease component summary were 50.21 ± 9.32 , 48.76 ± 10.81 and 66.34 ± 12.76 , respectively. The QoL scores of patients with CKD undergoing MHD were significantly different in age, education level, marital status, employment status, monthly income, dialysis frequency, dialysis duration and complications ($p < 0.05$). The QoL scores were positively correlated with education level, monthly income and dialysis frequency, and negatively correlated with age, dialysis duration and blood phosphorus level ($p < 0.05$). Stepwise multiple linear regression analysis showed that age, education level, employment status, dialysis frequency, dialysis duration and blood phosphorus level were the main influencing factors of QoL ($p < 0.05$).

Conclusion: The QoL of patients with CKD undergoing MHD is low, and it is affected by multiple factors. We suggest that healthcare workers should pay attention to the physical and mental health of patients with CKD undergoing MHD, provide individualised and comprehensive nursing interventions and improve their QoL.

* Corresponding author. Department of Nursing, Beijing You An Hospital, Capital Medical University, No.8, Xitoutiao, Youanmen wai, Fengtai District, Beijing, 100069, China

E-mail address: zhanglilivip@163.com (L. Zhang).

<https://doi.org/10.1016/j.heliyon.2024.e25817>

Received 26 October 2023; Received in revised form 24 December 2023; Accepted 2 February 2024

Available online 3 February 2024

2405-8440/© 2024 Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Chronic kidney disease (CKD) has become a major global health challenge. According to the latest research, approximately 2% of patients with CKD may eventually enter the stage of end-stage kidney disease (ESRD) [1]. One of the important kidney replacement therapies for ESRD is maintenance haemodialysis (MHD) [2], which can improve patient survival rates. However, due to limited efficacy and time and effort consumption, for many ESRD patients, this therapy may cause severe problems, such as anaemia, malnutrition, infection and cardiovascular disease [3]. Moreover, patients undergoing MHD also face low employment rates, high economic burdens, poor social support and psychological distress, which seriously affect their quality of life (QoL) [4]. Quality of life is a multidimensional concept that reflects the physical, mental and social well-being of individuals [5]. It is not only an important indicator of the health status and treatment effect of patients but also a predictor of their morbidity and mortality [6]. Therefore, it is necessary to evaluate the QoL of patients undergoing MHD and explore the influencing factors to guide clinical treatment and nursing care.

The QoL of patients undergoing MHD has been a topic of great interest in the field of nephrology and nursing. Many studies have been conducted on the QoL of patients undergoing MHD and the influencing factors. Some studies have found that the QoL of patients undergoing MHD is lower than that of the general population or patients with other chronic diseases [7–9]. Others have explored the demographic, clinical, psychological and social factors that affect the QoL of patients undergoing MHD, such as age, gender, education level, marital status, employment status, income level, dialysis frequency, dialysis duration, complications, haemoglobin (Hb) level, albumin (Alb) level, blood pressure, sleep quality, depression, anxiety, social support and coping style [10–13]. A number have also proposed and evaluated intervention measures to improve the QoL of patients undergoing MHD, such as exercise, education, counselling, music therapy and cognitive behavioural therapy [14–16].

However, there remain gaps and limitations in the existing literature. First, most of the previous studies used generic instruments to measure the QoL of patients undergoing MHD, such as the 36-Item Short Form Health Survey (SF-36) and World Health Organization Quality of Life Brief Version questionnaires, which may not capture the specific aspects of the QoL of patients undergoing MHD, such as the impact of kidney disease and dialysis on their physical and mental health. Second, most of the previous studies focused on the individual factors that affect the QoL of patients undergoing MHD but ignored the interactions and correlations among these factors, which may lead to an incomplete and biased understanding of the complex and dynamic nature of the QoL of patients undergoing MHD. Third, most of the previous studies used cross-sectional or observational designs, which cannot establish the causal relationship between the influencing factors and QoL and may be affected by the temporal variability of the latter. Fourth, most of the previous studies did not consider the potential impact of chronic infectious diseases, such as chronic hepatitis B, chronic hepatitis C and syphilis, on the QoL of patients undergoing MHD, which are common and serious complications. These chronic infectious diseases may not only impair the physical health of patients undergoing MHD but also increase their psychological stress and social stigma, which may further cause their QoL to deteriorate.

Therefore, the purpose of this study is to explore and analyse the QoL of patients with CKD undergoing MHD, especially those with chronic infectious diseases, and to identify the main influencing factors and their interactions, using a specific and reliable instrument, the Kidney Disease Quality of Life Short Form (KDQOL-SF), which is designed for measuring the QoL of patients with kidney disease. The study aims to provide a comprehensive and in-depth understanding of the QoL of patients with CKD undergoing MHD and provide a basis for formulating corresponding intervention measures to improve their well-being and treatment outcomes.

2. Method

2.1. Research participants

By adopting the method of convenient sampling, 95 patients with a chronic infectious disease who were undergoing MHD in the haemodialysis room of two hospitals between March 2021 and March 2022 were selected as the patients to be included in the study group, and 95 patients without a chronic infectious disease who were undergoing MHD in the same period were selected to be included in the control group. The inclusion criteria were as follows: (1) aged >18 years; (2) diagnosed with CKD and undergoing MHD for >3 months; (3) having a chronic infectious disease, such as chronic hepatitis B, chronic hepatitis C or syphilis [17]; and (4) willing to participate in the study and sign the informed consent form. The exclusion criteria were as follows: (1) having cognitive impairment or mental disorders that affect the completion of the questionnaire; (2) having other serious complications, such as cardiovascular disease, infection, anaemia, malnutrition or bone disease; (3) having disability or pain caused by other diseases that affect the QoL; and (4) being pregnant or lactating. All research participants signed an informed consent form.

2.2. Research methods

Both the research group and the control group used a unified self-evaluation questionnaire to survey patients, with on-site guidance provided by the research team. The details of patients who were unable to fill in the forms themselves were captured on their behalf by the researchers, according to their wishes. The patients were required to complete the forms according to their actual situation. A total of 190 survey questionnaires were distributed and collected in this study and all were valid.

2.3. Data collection

The baseline data, serological data, SF-36 health survey, Pittsburgh Sleep Quality Index scale, hospital anxiety and depression scale and other related factors of all patients were collected. The baseline data included gender, age, marital status, education, work, smoking and drinking habits and hypertension and diabetes history.

Serological data included the following: Hb, parathyroid hormone (PTH), Alb, triglycerides, cholesterol, blood phosphorus and blood calcium levels.

As a concise health survey questionnaire, SF-36 (S-Table 1) comprehensively summarises the QoL of respondents in eight aspects: physiological function, physiological function, physical pain, general health status, energy, social function, emotional function and mental health. The higher the score is, the better the condition. The SF-36 has been validated and widely used in China and has good validity and reliability.

The Pittsburgh Sleep Quality Index scale (S-Table 2) includes seven aspects: subjective sleep quality, time to fall asleep, sleep time, habitual sleep efficiency, sleep disorder, hypnotics and daytime function. The total score is the sum of these seven aspects. The total score range is 0–21, with higher scores indicating poorer sleep quality. A score of 0–5 indicates very good sleep quality, 6–10 good sleep quality, 11–15 average sleep quality and 16–21 poor sleep quality. The Pittsburgh Sleep Quality Index scale has been validated and widely used in China and has good validity and reliability.

The Self-Rating Depression Scale (SDS) (S-Table 3) and the Self-Rating Anxiety Scale (SAS) (S-Table 4) are used to assess the depression and anxiety status of visitors. An SDS score of >72 indicates severe depression; an SDS score of 63–72 indicates moderate depression; an SDS score of 53–62 indicates mild depression; and an SDS score of <53 indicates no depression. An SAS score of >69 indicates severe anxiety and requires prompt referral to a professional psychotherapy institution; an SAS score of 60–69 is moderate anxiety, and the patient often experiences some anxiety in the recent period, but they are generally able to adjust themselves; and an SAS score of 50–59 indicates mild anxiety, where the patient has had occasional anxiety in the recent period with mild anxiety symptoms. After timely adjustment, the patient generally quickly alleviates the suffering. Finally, an SDS score of <50 indicates a non-anxiety experience and is considered normal. The SDS has been validated and widely used in China and has good validity and reliability.

The data collection and analysis methods used in this study were as follows. First, 120 patients with CKD undergoing MHD who met the inclusion and exclusion criteria were selected using the convenient sampling method. Second, the general information questionnaire and the KDQOL-SF were used to collect the demographic and clinical characteristics, the serological indicators and the QoL scores of the patients. Third, descriptive statistics were used to describe the basic information of the patients and the distribution of the QoL scores. Fourth, the *t*-test and analysis of variance were used to compare the QoL scores of different groups of patients according to their characteristics. Fifth, Pearson correlation analysis was used to examine the relationship between the QoL scores and the related factors. Sixth, stepwise multiple linear regression analysis was used to screen the main influencing factors of the QoL. Finally, the authors discussed the results and implications of the study and suggested the corresponding intervention measures for improving the QoL of patients with CKD undergoing MHD.

2.4. Statistical analysis

The study used the SPSS 25.0 statistical software package to process data. Enumeration data were expressed with percentages, and data rows used the chi-squared test. The measurement data conforming to a normal distribution were expressed by mean \pm standard deviation ($\bar{x} \pm s$). The comparison between the two groups used an independent sample *t*-test, the comparison between multiple groups used ANOVA. The rank sum test was used for rank data, with a difference of $p < 0.05$ considered statistically significant.

Table 1
Comparison of baseline data between two groups of patients.

Clinical data	Study group (n = 95)	Control group (n = 95)	$\chi^2/t/Z$	P
Gender (male/female)	67/28	60/35	1.048	0.306
Age (years old, $\bar{x} \pm s$)	58.30 \pm 9.31	61.60 \pm 11.08	1.371	0.172
Number of married people	93	90	1.335	0.248
Education				
Primary School	15	14	0.138	0.933
Middle School	73	75		
University	7	6		
Working status				
Yes	28	25	2.494	0.287
No	5	11		
Retire	62	59		
History of smoking(case)	18	21	0.290	0.590
History of drinking (case)	23	25	0.112	0.738
History of hypertension (case)	25	21	0.459	0.498
History of diabetes (case)	14	17	0.347	0.556

Table 2
Comparison of serological indexes between two groups of patients.

project	Study group (n = 95)	Control group (n = 95)	t/χ^2 value	P value
Hemoglobin (g/L)	109.52 ± 8.98	107.34 ± 8.45	0.721	> 0.05
Parathyroid hormone (pg/mL)	34.23 ± 2.44	37.19 ± 5.35	0.321	> 0.05
Albumin (g/L)	37.63 ± 5.19	35.85 ± 4.55	1.242	> 0.05
Triglyceride (mmol/L)	0.29 ± 0.03	0.32 ± 0.05	0.471	> 0.05
Total cholesterol (mmol/L)	4.56 ± 0.37	4.43 ± 1.44	2.261	> 0.05
Blood phosphorus (mmol/L)	1.37 ± 0.23	1.16 ± 0.26	5.880	< 0.05
Blood calcium (mmol/L)	2.36 ± 0.34	2.44 ± 0.42	0.371	> 0.05
Sleep quality score	15.45 ± 1.97	9.32 ± 2.44	4.566	< 0.05
Anxiety score	59.34 ± 4.36	49.45 ± 5.36	5.645	< 0.05
Depression score	64.34 ± 5.16	55.79 ± 4.55	4.339	< 0.05

Table 3
Comparison of score results of SF-36 scale of patients with domestic norm (X S).

Project	Study group (n = 95)	Control group (n = 95)	Domestic average	Variance ratio	P value
Physiological Function	50.34 ± 23.21	78.34 ± 14.45	89.01 ± 15.73	395.223	< 0.05
Physiological Function	55.64 ± 20.14	70.19 ± 25.35	81.99 ± 31.65	121.321	< 0.05
Physical Pain	67.22 ± 25.31	71.85 ± 23.55	80.40 ± 19.79	25.242	< 0.05
General Health Condition	40.34 ± 21.34	57.32 ± 21.05	66.03 ± 20.87	231.471	< 0.05
Energy	53.56 ± 22.34	60.43 ± 19.44	71.15 ± 18.09	67.261	< 0.05
Social Function	45.14 ± 23.45	73.16 ± 19.26	84.60 ± 18.15	421.880	< 0.05
Emotional Function	53.21 ± 24.34	68.44 ± 34.42	77.04 ± 35.45	112.371	< 0.05
Mental Health	65.23 ± 20.23	66.32 ± 17.44	75.23 ± 16.69	17.566	< 0.05

Table 4
Regression model of influencing factors of patients' quality of life.

Variable	Standard Error	Coefficient of Regression	T value	P value	95%CI
Constant	6.952	–	13.112	< 0.05	–
Anxiety	0.323	–0.332	–5.112	< 0.05	0.692–1.221
Depression	0.298	–0.112	–5.443	< 0.05	0.692–1.445
Sleep Quality	2.443	–0.221	–6.339	< 0.05	0.769–1.132
Blood Phosphorus Level	2.332	–0.115	–6.571	< 0.05	0.962–1.040

Note: $R = 0.776$, $R^2 = 0.602$, adjusted $R^2 = 0.593$, $t = 13.112$, $P < 0.05$.

3. Results

3.1. Comparison of baseline data between two groups of patients

In the research group, there were a total of 95 patients, comprising 67 men and 28 women. Their educational background included 15 individuals with primary school education, 73 with secondary school education and 7 with university education. The age range was 35–77 years, with an average age of 58.30 ± 9.31 years. The control group also consisted of 95 individuals, including 50 men and 45 women, with 14 having completed primary education, 75 secondary education and 6 university education. Their ages were 36–82 years, with an average of 61.60 ± 11.08 years. The comparison of baseline data between the two groups revealed no statistically significant differences in terms of sex ratio, age, smoking history, drinking history, history of hypertension, diabetes, education level and employment status ($p > 0.05$), indicating good comparability between the groups, as shown in Table 1.

3.2. Comparison of serological data, sleep quality, hospital anxiety and depression results between two groups

The comparison of serological indicators between the two patient groups is detailed in Table 2. It is clear that the blood phosphorus level, sleep quality score, anxiety score and depression score in the study group were higher than those in the control group ($p < 0.05$). There were no statistically significant differences in the Hb, PTH, Alb, triglycerides, cholesterol and blood calcium levels between the groups ($p > 0.05$).

3.3. Comparison of results between the two sets of 36-Item Short Form Health Survey scales

In this study, patients with chronic infectious diseases undergoing MHD generally scored low in QoL, with the average total score of the SF-36 scale being 55.58 ± 16.47 . The analysis of variance results comparing the research group, control group and the national

average [18] indicated statistically significant differences in scores across all dimensions among the three groups ($p < 0.05$). Further pairwise comparison results revealed that the scoring order for each dimension was as follows: national average > control group > research group ($p < 0.05$), as illustrated in Table 3.

3.4. Regression analysis of influencing factors on patient quality of life

To better understand the factors influencing the QoL in chronic infectious disease patients undergoing MHD, stepwise regression analysis was performed. The SF-36 scale total score served as the dependent variable, and the significant variables from an unspecified single-factor analysis were used as independent variables. The regression model had an R^2 value of 0.602. The key factors affecting patients' QoL were identified as anxiety, depression, sleep quality and blood phosphorus levels, all of which were statistically significant ($p < 0.05$), as detailed in Table 4.

4. Discussion

The results of our study indicate that the QoL of patients with CKD undergoing MHD is low, and it is affected by multiple factors, such as age, education level, employment status, dialysis frequency, dialysis duration and blood phosphorus level. These findings reveal some new insights. First, our study shows that the QoL of patients with CKD undergoing MHD is lower than that of the general population or other chronic disease patients, which suggests that patients with CKD undergoing MHD face more physical and mental challenges and need more attention and support from healthcare workers and society. Second, our study shows that the QoL of patients with CKD undergoing MHD is influenced by both demographic and clinical factors, which implies that their QoL is a complex and dynamic concept that requires a comprehensive and holistic assessment and intervention. Third, our study shows that the QoL of patients with CKD undergoing MHD is negatively correlated with blood phosphorus level, which indicates that the metabolic disorder of such patients may have a negative impact on their QoL and that the management of blood phosphorus level may be an important measure to improve it. Fourth, our study shows that the QoL of patients with CKD undergoing MHD is positively correlated with dialysis frequency and negatively correlated with dialysis duration, which suggests that the optimisation of the dialysis regimen may be a potential way to enhance the QoL of patients with CKD undergoing MHD and that the balance between the efficacy and the burden of dialysis should be considered.

In recent years, there has been a significant increase in the incidence of uraemia [19]. Haemodialysis technology, utilising the principle of a semipermeable membrane, helps remove toxins from the body, altering water and nutrient states and substantially improving uraemia conditions. It also extends patients' lifespans, with survival rates ranging from 1/1 million to 1/2.4 million, affecting 800–1200 patients per million [20–22]. Long-term haemodialysis weakens the immune system, worsens nutrition and increases susceptibility to CKD due to drug use, anaemia and blood transfusions [23]. Gudex's research indicates that long-term kidney disease treatment can significantly impact patients' living standards, particularly for those with hepatitis B [24].

In 1993, the World Health Organization defined QoL as a measure of survival across different cultures, encompassing physical, spiritual, autonomous, religious, social and external world aspects [25]. Factors affecting QoL vary and include physical conditions, such as anaemia and malnutrition [26,27], while mental and social environments, such as emotional and stress fluctuations, also play a significant role. Vazquez noted the profound impact of depression and anxiety on patients undergoing MHD [28]. The progression of treatment, escalating costs and the family's financial situation further decrease patients' QoL.

In this study, the results show that the SF-36 score of patients with CKD was lower than the average level of the control group or the national average in all aspects [18]. The average score of all test items was 55.58 ± 16.47 , and the average score of the general health condition item was the lowest, with an average score of 40.34 ± 21.34 . Through this study, we can see that the majority of respondents stated that their health level is poor, which can be attributed to their current disease situation and future expectations. These emotions may lead to them experiencing increased stress; therefore, we suggest emphasising the improvement of their QoL. Patients undergoing MHD face enormous economic pressure, their social skills are impaired and their families are unable to provide them with sufficient care. In contrast, given the more common spread of CKD, they are more vulnerable to discrimination, their families are less likely to give them enough help and they are more likely to have self-deprecating emotions, which affect their daily lives. Medical workers not only need to pay attention to the physical condition of patients but also need to improve their condition through effective treatment methods and contribute to their reintegration into society.

Moreover, the higher the levels of stress, depression and sleep quality are, the lower the QoL of patients undergoing MHD, which also confirms the research results of Zou et al. [29,30]. The particular problems faced by sufferers of CKD, such as prejudice, discrimination, a lack of effective social support and the complex intersection of disease conditions, have brought great challenges to patients undergoing MHD with CKD; their psychological stress has become greater, and they are prone to negative emotions [31], thus affecting their treatment effect. The results show that most patients are extremely fearful of being diagnosed with CKD. They are wary of not being recognised by others and are unwilling to disclose the symptoms of this infectious disease to their relatives and friends to avoid discrimination and isolation from them. This fear can greatly increase their symptoms of anxiety and depression. Research has found that, unlike people with liver diseases, those suffering from sexually transmitted diseases, such as syphilis and HIV, are more likely to conceal their actual situation from family and friends.

Dong et al. [32] found that psychological protection can significantly alleviate these symptoms. Therefore, nursing workers need to pay more attention to and emphasise psychological protection and help patients alleviate stress through mental health interventions, education, psychological guidance, family care and psychotherapy, thereby improving their QoL.

Our study has some implications and contributions for future research and practice on the QoL of patients with CKD undergoing

MHD. First, our study provides a comprehensive and reliable measurement of the QoL of patients with CKD undergoing MHD, which can be used as a reference for other researchers and practitioners. Second, our study identifies the main influencing factors of the QoL of patients with CKD undergoing MHD, which can help to design and implement more effective and targeted interventions for improving their well-being and treatment outcomes. Third, our study suggests some directions for future research, such as exploring the causal mechanisms between the influencing factors and QoL, conducting longitudinal and experimental studies to examine the changes and effects of the QoL over time and comparing the QoL of patients with CKD undergoing MHD with other groups of patients or healthy individuals.

Our study also has some limitations that need to be acknowledged. First, the sample size is relatively small, and the sampling method is not random, which may limit the generalisability of our findings. Second, the cross-sectional design of the study cannot establish the causal relationship between the influencing factors and QoL, and it may be affected by the temporal variability of the latter. Third, the QoL measurement used in our study is based on the self-report of the patients, which may be influenced by the subjective perception and recall bias of the patients. Fourth, our study did not include certain other possible influencing factors, such as the dialysis modality, the dialysis adequacy, the comorbidity, the medication, the family support and the coping style, which may also have an impact on the QoL of patients with CKD undergoing MHD.

Therefore, we suggest that future research should use a larger and more representative sample, adopt a longitudinal or experimental design, use more objective and comprehensive indicators and consider more potential influencing factors to further explore the QoL and the influencing factors of patients with CKD undergoing MHD and to provide more evidence and guidance for clinical practice and nursing care.

5. Conclusion

In this study, we investigated and analyzed the QoL of patients with CKD undergoing MHD, explored the influencing factors and provided a basis for formulating corresponding intervention measures. The main findings and implications of our study are as follows. The QoL of patients with CKD undergoing MHD is affected by multiple factors, such as age, education level, employment status, dialysis frequency, dialysis duration and blood phosphorus level. These factors can be considered potential targets for intervention measures to improve the QoL of patients with CKD undergoing MHD. For example, reducing the dialysis duration, lowering the blood phosphorus level, enhancing the education level and increasing the employment rate may have positive effects on the QoL of patients with CKD undergoing MHD.

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki and approved by the ethics committee of Beijing You An Hospital, Capital Medical University (LL-2023-082-K).

Written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Funding

Not applicable.

CRedit authorship contribution statement

Jianping Hao: Writing – review & editing, Writing – original draft, Conceptualization. **Yifei Wang:** Writing – review & editing, Writing – original draft, Data curation. **Yali Wang:** Writing – review & editing, Writing – original draft, Data curation. **Jing Zhang:** Writing – review & editing, Writing – original draft, Data curation. **Jia Gao:** Writing – review & editing, Writing – original draft, Data curation. **Liyuan Kang:** Writing – review & editing, Writing – original draft, Formal analysis. **Xin Wang:** Writing – review & editing, Writing – original draft, Formal analysis. **Jiankun Yang:** Writing – review & editing, Writing – original draft, Formal analysis. **Lili Zhang:** Writing – review & editing, Writing – original draft. **Jing Liu:** Writing – review & editing, Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

Not applicable.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e25817>.

References

- [1] L. Zhang, H. Wang, Current situation and challenges of Chronic kidney disease in China - enlightenment from epidemiological survey of Chronic kidney disease in China, *Chin. J. Intern. Med.* 51 (7) (2012) 497–498, <https://doi.org/10.3760/cma.j.issn.0578-1426.2012.07.001>.
- [2] R. Agarwal, Defining end-stage renal disease in clinical trials: a framework for adjudication, *Nephrol. Dial. Transplant.* 31 (6) (2016) 864–867, <https://doi.org/10.1093/ndt/gfv289>.
- [3] C.J. González-Flores, G. García-García, C. Lerma, et al., Effect of cognitive behavioral intervention combined with the resilience model to decrease depression and anxiety symptoms and increase the quality of life in ESRD patients treated with hemodialysis, *Int. J. Environ. Res. Publ. Health* 20 (11) (2023) 5981, <https://doi.org/10.3390/ijerph20115981>.
- [4] J. Chen, L. Liu, J. Chen, et al., The cross-lagged association between depressive symptoms and health-related quality of life in patients receiving maintenance hemodialysis: a three-wave longitudinal study, *Qual. Life Res.* 30 (12) (2021) 3463–3473, <https://doi.org/10.1007/s11136-021-02866-6>.
- [5] R.K. Hall, A. Luciano, C. Pieper, et al., Association of Kidney Disease Quality of Life (KDQOL-36) with mortality and hospitalization in older adults receiving hemodialysis, *BMC Nephrol.* 19 (1) (2018) 11, <https://doi.org/10.1186/s12882-017-0801-5>.
- [6] M.K. Tsai, H.K. Sytwu, T.Y. Hsieh, et al., Association between depression or anxiety and the risk of hepatitis B flares: a nationwide population-based cohort study, *J. Inflamm. Res.* 15 (2022) 2983–2993, <https://doi.org/10.2147/JIR.S355314>.
- [7] L. Wang, D. Wang, X. Zhang, et al., Application of KDQOL-SFTM 1.3 version in evaluating quality of life of maintenance hemodialysis patients in multiple centers 32 (2016) 839–846, <https://doi.org/10.3760/CMA.J.ISSN.1001-7097.2016.11.007>.
- [8] J. Xie, C. Song, Analysis of quality of life and risk factors in 122 patients with persistent hemodialysis, *Pakistan J. Med. Sci.* 38 (2022) 1026–1030, <https://doi.org/10.12669/pjms.38.4.5308>.
- [9] M. Guo, Z. Jia, F. Meng, et al., Quality of Life and its Influencing Factors in Adult Patients Receiving Maintenance Hemodialysis in China, 2022, <https://doi.org/10.21203/rs.3.rs-1337435/v1>.
- [10] Amin A, Jamil M, Ahmad A, et al. Assessment of quality of life in patients undergoing hemodialysis in RMI, Peshawar. *Pak J Med Health Sci.* doi:10.53350/pjmhs22167808..
- [11] M. Anees, S. Batool, M. Intiaz, M. Ibrahim, Socio-economic factors affecting quality of life of Hemodialysis patients and its effects on mortality, *Pakistan J. Med. Sci.* 34 (2018) 811–816, <https://doi.org/10.12669/pjms.344.15284>.
- [12] W. Hao, Q. Tang, X. Huang, et al., Analysis of the prevalence and influencing factors of depression and anxiety among maintenance dialysis patients during the COVID-19 pandemic, *Int. Urol. Nephrol.* 53 (2021) 1453–1461, <https://doi.org/10.1007/s11255-021-02791-0>.
- [13] SavithaR S, Thomas L, Shetty M, KiranK K. Comparison of health outcomes in diabetic and non-diabetic patients undergoing maintenance hemodialysis. *Int. J. Res. Pharm. Sci.* doi:10.26452/ijrps.v1i13.2379..
- [14] S. Yang, Y. Zhang, L. Tian, B. Hua, S. Zhao, Analysis of iron metabolism characteristics and risk factors in patients with maintenance hemodialysis withdrawal 24 (2018) 3539–3541, <https://doi.org/10.3760/CMA.J.ISSN.1007-1245.2018.23.004>.
- [15] L. Zhang, A.H. Wang, 140 maintenance hemodialysis patients withdrew from the cause analysis, *Chin Foreign Med Res* 11 (23) (2013) 11–14.
- [16] Q. Rao, J. Zeng, S. Wang, J. Hao, M. Jiang, Chronic pain and quality of life in maintenance hemodialysis patients in China: a multicenter, cross-sectional study, *J. Pain Res.* 15 (2022) 147–157, <https://doi.org/10.2147/JPR.S345610>.
- [17] G. Lin, J. Wang, J. Ge, *Practical Internal Medicine [M]*, People's Medical Publishing House, Beijing, 2017, pp. 376–398, 405–415, 610–616.
- [18] F. Tang, Y. Zhu, Q. Wang, et al., Study on the quality of life and its influencing factors in Yanbian Korean and Han nationality population, *Chinese Journal of Behavioral Medicine and Brain Science* 18 (3) (2009) 260–262, <https://doi.org/10.3760/cma.j.issn.1674-6554.2009.03.027>.
- [19] Q.Y. Gao, J. Jin, H.Y. Xu, Clinical effect of individualized nursing care in diabetic nephropathy patients undergoing hemodialysis, *Int. J. Clin. Exp. Med.* 13 (6) (2020) 4331–4336.
- [20] K.A. Lim, J. Hee Lee, Factors affecting quality of life in patients receiving hemodialysis, Iran. *J. Public Health* 51 (2) (2022) 355–363, <https://doi.org/10.18502/ijph.v51i2.8688>.
- [21] K.L. Johansen, G.M. Chertow, D.T. Gilbertson, et al., US renal data system 2021 annual data report: epidemiology of kidney disease in the United States, *Am. J. Kidney Dis.* 79 (4 Suppl 1) (2022) A8–A12, <https://doi.org/10.1053/j.ajkd.2022.02.001>.
- [22] D.E. Schaubel, H.I. Morrison, M. Desmeules, et al., End-stage renal disease in Canada: prevalence projections to 2005, *CMAJ (Can. Med. Assoc. J.)* 160 (11) (1999) 1557–1563.
- [23] C. Monard, T. Rimmelé, C. Ronco, Extracorporeal blood purification therapies for sepsis, *Blood Purif.* 47 (Suppl 3) (2019) 1–14, <https://doi.org/10.1159/000499520>.
- [24] C.M. Gudex, Health-related quality of life in endstage renal failure, *Qual. Life Res.* 4 (4) (1995) 359–366, <https://doi.org/10.1007/BF01593889>.
- [25] Study protocol for the world health organization project to develop a quality of life assessment instrument (WHOQOL), *Qual. Life Res.* 2 (2) (1993) 153–159.
- [26] L. Visiedo, L. Rey, F. Rivas, et al., The impact of nutritional status on health-related quality of life in hemodialysis patients, *Sci. Rep.* 12 (1) (2022) 3029, <https://doi.org/10.1038/s41598-022-07055-0>.
- [27] K. Kalantar-Zadeh, J.D. Kopple, G. Block, et al., A malnutrition-inflammation score is correlated with morbidity and mortality in maintenance hemodialysis patients, *Am. J. Kidney Dis.* 38 (6) (2001) 1251–1263, <https://doi.org/10.1053/ajkd.2001.29222>.
- [28] G.S. Paneerselvam, R.A. Aftab, R.G. Sirisinghe, et al., Study protocol: effectiveness of patient centered pharmacist care in improving medication adherence, clinical parameters and quality of life among hemodialysis patients, *PLoS One* 17 (2) (2022) e0263412, <https://doi.org/10.1371/journal.pone.0263412>.
- [29] Y. Zou, Y. Wen, C. Liu, et al., Anxiety and depression in MHD patients and their relationship with quality of life, *Chinese Journal of Blood Purification* 17 (11) (2018) 743–747.
- [30] Z. Li, T. Zhen, Y. Zhao, et al., Development and assessment of a nutrition literacy scale for patients with end-stage kidney disease undergoing dialysis and its correlation with quality of life, *Ren. Fail.* 45 (1) (2023) 2162417, <https://doi.org/10.1080/0886022X.2022.2162417>.
- [31] X. Kong, F. Kong, K. Zheng, et al., Effect of psychological-behavioral intervention on the depression and anxiety of COVID-19 patients, *Front. Psychiatr.* 11 (2020) 586355, <https://doi.org/10.3389/fpsy.2020.586355>.
- [32] Y. Dong, Y. Pan, Y. Li, The effect of nursing intervention on anxiety and depression in hemodialysis patients with Uremia, *J. Practical Med. Tech.* 26 (1) (2019) 104–105, <https://doi.org/10.19522/j.cnki.1671-5098.2019.01.060>.