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Original Paper

Health Literacy in Non-dialyzed Chronic Kidney Disease Patients: A Cross-Sectional Study

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Abstract

Objective: *To explore the current status and influencing factors of health literacy in non-dialyzed chronic kidney disease (CKD) patients, and to provide a basis for developing more comprehensive and effective interventions.* ***Methods:*** *206 CKD patients hospitalized or followed up in outpatient clinics in the Department of Nephrology of a tertiary hospital in Baoding City were conveniently selected from June to August 2024. General information questionnaire, Health Literacy Scale for Chronic Disease Patients, Perceived Social Support Scale, and Positive Psychological Questionnaire were used to conduct the survey.* ***Results:*** *The health literacy score of non-dialyzed CKD patients was (91.04±15.17); The results of multiple linear regression analysis showed that the number of comorbidities, education level, per capita monthly household income, family support, and optimism were the influencing factors of health literacy in CKD patients.* ***Conclusion:*** *The health literacy of non-dialyzed CKD patients is low, and healthcare professionals should develop scientific and reasonable intervention programs based on their influencing factors in order to enhance the health literacy and delay disease progression.*

Keywords

chronic kidney disease, non-dialyzed, health literacy, social support, positive psychological capital

1. Introduction

CKD is characterized by abnormalities in the structure or function of the kidneys, and is mainly manifested by a series of symptoms such as oliguria, proteinuria, anemia, and endocrine and metabolic disorders[1]. The survey showed that there are 697.5 million CKD patients worldwide, accounting for 9.1% of the total global population, of which China is the country with the largest number of CKD patients, accounting for 19% of the global CKD patients[2]. With the gradual decline of renal function, patients may develop a variety of complications, such as water-electrolyte disorders, metabolic acidosis, and cardiovascular disease, leading to a greatly increased risk of adverse outcomes[3]. CKD treatment centers on slowing the decline of renal function and preventing complications[4]. Studies have shown that CKD patients with inadequate knowledge of the disease, limited health information support, and poor disease management skills have more rapid disease progression and are more likely to have adverse outcomes[5]. Therefore, improving patients' ability to acquire, understand and utilize health information is a prerequisite for improving patients' health behaviors and delaying disease progression, and this ability is known as health literacy. In 2000, Prof. Nutbeam[6] defined health literacy as the personal, cognitive, and social skills of individuals to access, understand, and utilize information to promote and maintain good health. Health literacy is the goal of health education and is vital for improving health outcomes.

Most of studies on health literacy in CKD patients focus on dialysis patients[7–9], while relatively few studies have been conducted on non-dialyzed patients in the early stages of the disease. In view of this, this study focuses on non-dialyzed CKD patients to assess their health literacy level, identify those with low health literacy as early as possible, and carry out health education to delay disease progression.It is worth noting that in the process of improving health literacy, two factors, social support and positive psychological capital, gradually highlight their potential importance. Social support, as an external force, encompasses support and help from family, friends, the community, and the medical team, etc., which positively affects patients' health literacy. Positive psychological capital, as an internal positive psychological resource, can stimulate patients' own potential and enable them to face the challenges of the disease in a more positive and proactive manner. Thus, this study will innovatively introduce two variables, social support and positive psychological capital, with the aim of deeply exploring the intrinsic associations between them and health literacy, with the expectation that by revealing these relationships, it will provide a theoretical basis for the development of more comprehensive and effective interventions to better enhance the health literacy of non-dialyzed CKD patients and to improve health outcomes.

2. Objects and Methods

2.1 Subjects

From June to August 2024, 206 CKD patients who were hospitalized or followed up as outpatients in the nephrology department of a tertiary hospital in Baoding City, were conveniently selected for the

study.

Inclusion criteria: ①age≥18 years old; ②diagnosed as CKD stage 1 to 5 by clinicians (based on the 2012 KDIGO guidelines[10]); ③no communication barriers; ④informed consent and voluntary participation.

Exclusion criteria: ①patients who have or intend to have renal replacement therapy (e.g., peritoneal dialysis, hemodialysis, or kidney transplantation); ② patients with serious complications or comorbidities.

2.2 Methods

2.2.1 Survey Instrument

(1) General information questionnaire. The researcher designed a general information questionnaire. Among them, the socio-demographic data included gender, age, education level, marital status, residence, residential situation, nature of occupation, per capita monthly household income, and medical payment method; the clinical disease data included CKD stage, number of hospitalizations in the past year, and number of comorbidities. Socio-demographic information was completed by the researcher by surveying the patients, and clinical disease information was completed by the researcher by reviewing the medical records or assessing the patients on site.

(2) Health Literacy Scale for Chronic Disease Patients. Based on the Health Literacy Management Scale (HeLMS) developed by Prof. Jordan, Sun Haolin[11] compiled the Health Literacy Scale for Chronic Disease Patients in 2012, which is suitable for China's national conditions and population characteristics. The scale is widely used in chronic disease and includes 4 dimensions and 24 items, including information acquisition ability (9 items), communication and interaction ability (9 items), willingness to improve health (4 items), and willingness to provide financial support (2 items). The Likert 5-point scale was used, with 1 to 5 points for each item and a total score of 24 to 120 points, with higher scores suggest higher health literacy, and scores above 96 points were considered good health literacy, while scores below 96 points were considered lack of health literacy. The reliability of the scale was good, with a Cronbach's alpha coefficient of 0.894, and the Cronbach's alpha coefficients for each dimension ranged from 0.857 to 0.940.

(3) Perceived Social Support Scale. The scale was developed by Zimet et al.[12] and translated by Jiang Qianjin[13]. The scale was used to assess the degree of perceived social support, including 3 dimensions: family support (4 items), friend support (4 items), and other support (4 items), with a total of 12 items. The Likert 7-point scale was used, and the total score ranged from 12 to 84 points. Higher scores represent better social support, with scores from 12 to 36 being low, scores from 37 to 60 being intermediate, and scores from 61 to 84 being high. The Cronbach's alpha coefficient of the Chinese version of the Perceived Social Support Scale was 0.941, with good reliability.

(4) Positive Psychological Questionnaire. The questionnaire was developed by Zhang Gao et al.[14] in 2010, and consists of four dimensions: optimism (6 items), hope (6 items), resilience (7 items), and self-efficacy (7 items), for a total of 26 items. A Likert 7-point scale was used, and the total score

ranged from 26 to 182, with higher scores represent higher levels of positive psychology. Among them, the 8, 10, 12, 14, and 25 items are reverse-scoring questions. The Cronbach's alpha coefficients for each dimension of the questionnaire ranged from 0.76 to 0.86, and the Cronbach's alpha coefficient for the whole questionnaire was 0.90, which showed that the internal consistency of the questionnaire had good reliability; the factor loadings for each item were all greater than 0.5, and the item differentiation was greater than 0.6, which gave the questionnaire a high structural validity.

2.2.2 Data Collection Methods

An on-site survey was used, which was completed anonymously. The informed consent form was signed with the patient's consent, and the paper version of the questionnaire was then distributed, or the electronic version was sent online through the Questionnaire Star platform. It took about 15-20 minutes to complete the questionnaire. When it was completed, the investigator conducted on-site verification, and if omissions were found, the investigator asked the participants to supplement the questionnaire in a timely manner to ensure the completeness of the survey content. This study was approved by the Ethics Committee of the Affiliated Hospital of Hebei University (No.: HDFYLL-KY-2024-165).

2.2.3 Statistical Methods

Data from the questionnaires were entered and verified in pairs. IBM SPSS 25.0 software was used for statistical analysis. In this study, the measured data were normally distributed and statistically described by means and standard deviations; the count data and rank data were statistically described by rates and percentages. One-way ANOVA and independent samples t-test were used to analyze the differences in health literacy among patients with different socio-demographic and clinical disease information. Pearson's correlation was used to analyze the correlation between social support, positive psychological capital, and health literacy in CKD patients. Multiple linear regression analysis was used to determine the influencing factors of health literacy in CKD patients. Statistical tests were two-sided, and $P < 0.05$ was considered statistically significant.

3. Results

3.1 Scores of Health Literacy, Social Support, Positive Psychological Capital in Non-dialyzed CKD Patients

Table 1 shows the scores of health literacy, social support, and positive psychological capital in non-dialyzed CKD patients.

Table 1. The Scores of Health Literacy, Social Support, and Positive Psychological Capital in Non-dialyzed CKD Patients (mean ± SD, *n*=206)

Item	Score range	Total score	Item average score
Health literacy	51-120	91.04±15.17	3.79±0.63
Information acquisition skills	20-45	33.78±5.10	3.75±0.57

Ability to communicate and interact	19-45	33.62±5.97	3.74±0.66
Willingness to improve health	4-20	16.23±3.75	4.06±0.94
Willingness for financial support	4-10	7.42±1.95	3.71±0.98
Social support	23-84	61.70±12.90	5.14±1.08
Family support	9-28	21.41±4.15	5.35±1.04
Friend support	6-28	20.21±4.93	5.05±1.23
Other support	6-28	20.09±4.78	5.02±1.19
Positive psychological capital	64-176	125.68±24.85	4.83±0.96
Self-efficacy	18-49	34.95±6.82	4.99±0.97
Resilience	15-49	30.25±6.53	4.32±0.93
Hope	11-42	29.95±6.78	4.99±1.13
Optimism	11-42	30.53±6.97	5.09±1.16

3.2 Results of a Univariate Analysis of Health Literacy in Non-dialyzed CKD Patients

The results of univariate analysis showed that the health literacy scores of CKD patients varied by age, educational level, residence, nature of occupation, per capita monthly household income, medical payment method, CKD stage, number of hospitalizations in the last year, and the number of comorbidities were statistically significant in nine variables (P<0.05). See Table 2.

Table 2. Univariate Analysis of Health Literacy in Non-dialyzed CKD Patients (mean ± SD, *n*=206)

Item	Classification	*n*	Health literacy score	*t* / *F*	*P*
Gender	Male	92	90.28±15.46	-0.646[a]	0.519
	Female	114	91.66±14.98		
Age (years)	18-39	10	94.90±10.30	19.091[b]	< 0.001
	40-59	101	96.77±12.03		
	≥ 60	95	84.55±16.08		
Educational level	Elementary and below	36	77.39±13.20	32.628[b]	< 0.001
	Junior high school	92	87.91±13.77		
	High school or junior college	55	100.98±10.05		
	College or bachelor degree or above	23	101.17±11.66		
Marital status	Spouse	151	92.03±14.17	1.412[a]	0.162
	No spouse	55	88.33±17.49		
Residence	Rural	78	83.94±15.52	28.832[b]	< 0.001
	town	68	90.06±12.71		
	urban	60	101.40±11.19		

Residential situation	Living alone	55	88.65±17.62	-1.235[a]	0.220
	Not living alone	151	91.91±14.15		
Nature of occupation	Manual labor	72	80.47±15.11	45.910[b]	< 0.001
	Semi-mind and semi-manual labor	91	93.86±12.42		
	Mental labor	43	102.79±7.57		
Per capita monthly household income (RMB)	< 3,000	46	76.57±14.48	48.920[b]	< 0.001
	3,000-6,000	111	92.36±12.25		
	> 6,000	49	101.65±11.11		
Medical payment method	Public expense	12	106.33±8.25	20.760[b]	< 0.001
	Employee medical insurance	71	98.62±10.76		
	Urban and rural residents' medical insurance	115	85.10±14.26		
	Self-funded	8	86.38±24.02		
CKD stage	1	33	95.52±11.47	9.356[b]	< 0.001
	2	51	96.47±13.70		
	3	57	93.14±12.29		
	4	47	84.30±16.50		
	5	18	78.44±17.51		
Number of hospitalizations in the past year	< 2	75	96.12±14.96	3.747[a]	< 0.001
	≥ 2	131	88.14±14.57		
Number of comorbidities	< 2	71	98.54±11.94	5.920[a]	< 0.001
	≥ 2	135	87.10±15.25		

Note. [a] Two independent samples t-test; [b] One-way ANOVA.

3.3 Correlation Analysis of Social Support, Positive Psychological Capital, and Health Literacy in Non-dialyzed CKD Patients

The results of correlation analysis show that social support, positive psychological capital, and health literacy were all positively correlated in non-dialyzed CKD patients ($P < 0.01$). See Table 3.

Table 3. Correlation Analysis of Social Support, Positive Psychological Capital, and Health Literacy in Non-dialyzed CKD Patients (*r*, *n*=206)

	Health literacy	Social support	Positive psychological capital
Health literacy	1		
Social support	0.779**	1	
Positive psychological capital	0.767**	0.818**	1

Note. At the 0.01 level (two-tailed), the correlation is significant.

3.4 Multivariate Analysis of Health Literacy in Non-dialyzed CKD Patients

In this study, we used multiple linear regression to analyze the influencing factors of health literacy in CKD patients, taking the total score of health literacy as the dependent variable and variables with statistical significance in the above univariate and correlation analyses as independent variables, and constructed a multiple regression model for the multiple linear regression analysis to clarify the influencing factors of health literacy in CKD patients. The categorical variables in the independent variables were assigned values and dummy variables were set, and the continuous variables in the independent variables were directly included in the regression model with their original values.

The diagnosis of covariance between independent variables is based on variance inflation factor (VIF) and tolerance, and if the VIF value is >10 or tolerance <0.1, then there is multicollinearity[15]. In this study, the VIF values ranged from 1.461 to 7.025 and the tolerance ranged from 0.142 to 0.685, indicating that there was no significant covariance between the variables. The Durbin-Watson test value was 2.011, suggesting that the variables in the regression equation were not autocorrelated. The results showed that literacy, per capita monthly household income, number of comorbidities, family support, and optimism, entered the regression equation (F = 31.041, P < 0.001). The above variables explained a total of 71.4% of the total variance in health literacy. The results suggested that the number of comorbidities is a barrier to health literacy in CKD patients, and educational level, per capita monthly household income, family support, and optimism are facilitators. See Table 4.

Table 4. Multivariate Analysis of Health Literacy in Non-dialyzed CKD Patients

Independent variable	Unstandardized coefficient		Standardized coefficient	*t*	*P*
	B	*SE*	*β*		
(Constant)	30.255	6.265		4.829	< 0.001
Educational level	3.164	0.811	0.186	3.900	< 0.001
Per capita monthly household income	2.792	1.188	0.125	2.350	0.020
Number of comorbidities	-3.021	1.439	-0.095	-2.099	0.037
Family support	0.875	0.259	0.239	3.370	0.001
Optimism	0.458	0.216	0.210	2.122	0.035

Note. R^2 = 0.737, adjusted R^2 = 0.714, F = 31.041, P < 0.001.

4. Discussion

4.1 Limited Health Literacy in Non-dialyzed CKD Patients

In this study, the health literacy score of 206 CKD patients was (91.04±15.17), indicating that the health literacy of CKD patients was at a moderate to low level. Compared with national studies, this result was lower than the findings of Huang Yueyang et al.[16], but higher than the findings of Zhang

Yang et al.[17], which may be related to the age of the selected participants. The average age in this study was (58.92±10.68) years old, which was higher than the survey study of Huang Yueyang et al.[16]. The results showed that 57.8% (119 cases) of CKD patients had a lack of health literacy (health literacy score <96), which was higher than the findings of a related foreign study[18] (31.1%), and the reason may be that compared with developed countries, such as Singapore, the domestic health education system is not sufficiently developed and popularized, and there are domestic and international cultural, healthcare system, and information dissemination environments with a certain gap.

This study showed that among the four dimensions of health literacy, the dimension of "willingness to improve health" had the highest score, which was consistent with the results of Zhang Yang et al.[17], and may be related to the improvement of people's health awareness and the advancement of medical technology, which enhances their willingness to improve their health and confidence; the dimension of "willingness to financial support" had the lowest score, which was consistent with the results of Huang Yueyang et al.[16], which may be related to factors such as delayed CKD, high medical costs, limited health insurance coverage, and insufficient family support. In conclusion, the health literacy of CKD patients is still not optimistic, but people's willingness to improve their health has increased, suggesting that healthcare professionals should pay attention to the health literacy of non-dialyzed CKD patients and take the necessary intervention programs to improve their health literacy, in order to satisfy people's demand for health and promote the sustainable development of healthcare.

4.2 Analysis of Factors Influencing Health Literacy in Non-dialyzed CKD Patients

4.2.1 Educational Level and Per Capita Monthly Household Income

In this study, we found that educational level was a significant predictor of health literacy in CKD patients, which was consistent with the findings of Zhu Fengxiu[19] and Dinh et al.[20], as well as those of patients with coronary heart disease[21]. The results also showed that CKD patients with high school education or higher had significantly higher health literacy than those with less than middle school education. This suggests that healthcare professionals should stratify education, adjust communication methods, and provide personalized support for patients with different educational levels in order to improve the overall health literacy of CKD patients.

We also found that per capita monthly household income was an influential factor in the health literacy of CKD patients, which is consistent with the findings of Huang Yueyang et al.[16] and Dinh et al.[20]. In this study, patients with a per capita monthly household income of more than 6,000 yuan had the highest scores on the dimension of willingness to improve health, which also indicates that a good economic foundation enhances patients' confidence and thus stimulates a strong willingness to improve health. This suggests that healthcare professionals should focus on health education for low-income patients to ensure that patients with different income levels have access to equitable and accessible healthcare services.

4.2.2 Number of Comorbidities

In this study, multifactorial analysis showed that the number of comorbidities was a barrier to health

literacy in CKD patients, which is consistent with the findings in diabetes patients[22]. Patients with ≥2 comorbidities had the lowest scores for the item "going to the hospital alone to see a doctor". Another study has also shown that CKD patients with multiple comorbidities are often unclear about which doctor should see them for their particular health problem, making it difficult to navigate through the healthcare system[23]. As the number of comorbidities increases, the amount of knowledge about the disease that patients need to know and master increases geometrically, which makes it challenging for patients to understand and memorize this knowledge, making it difficult to do so fully and accurately, and thus decreasing health literacy.

4.2.3 Social Support

In this study, social support was positively correlated with health literacy, and family support in social support was a facilitator of health literacy in CKD patients, which is consistent with the findings of Wu Yingying et al.[24]. The results of the study by Kita et al.[25] found that CKD patients with high health literacy had more social activities. Another qualitative study also pointed out that family understanding and support are contributing factors to health literacy in CKD patients[26]. CKD can cause both physical and psychological stress to patients, such as fear of disease progression[27]. Social support, especially family support, can provide emotional comfort and encouragement to patients and help them relieve psychological stress.

In this study, only family support among social support entered the multiple regression model, and friend support and other support (teachers, classmates, relatives) did not, which may be because family is usually the most central source of social support, and the relationship between family members is more stable and lasting. Moreover, family support is usually more accessible, and this highly accessible support may have a positive effect on patients' health literacy improvement. In summary, it is suggested that healthcare professionals should encourage family members to actively participate in the patient's treatment and care process, and help patients and family members to establish a family support network, such as by organizing communication activities for patients' families.

4.2.4 Positive Psychological Capital

The results of this study found that positive psychological capital was positively correlated with health literacy. Several studies[16,18,28] have shown that health literacy and self-efficacy in CKD patients are positively correlated, and the two are mutually reinforcing and interactive. Patients with high levels of positive psychological capital tend to have high self-efficacy; they believe they are capable of coping with various challenges brought about by the disease, and they are also confident in their ability to effectively manage their chronic diseases, and this confidence motivates them to proactively learn about health and improve their self-management skills.

The analysis showed that of the four dimensions, only optimism entered the multiple regression model, which may be explained that optimistic patients are more inclined to view their illnesses in a positive light. This mindset motivates them to be more proactive in obtaining health information and understanding disease treatments and self-management strategies. Self-efficacy, although it allows

patients to have confidence in their abilities in specific domains, may be more affected by specific situations; hope is a positive expectation of the future, but there may be a certain degree of uncertainty in this expectation, and due to the complexity of the disease and the long-term nature of the treatment, hope may be difficult to be transformed into specific health behaviors; and resilience may require a certain amount of time and process to play out, and in the short term, the impact on health literacy may not be evident. Together, healthcare professionals should pay attention to the cultivation of patients' optimism, encourage positive behaviors in the process of disease management, and strengthen their optimism.

5. Conclusion

The results showed that non-dialyzed CKD patients have low health literacy, and educational level, per capita monthly household income, number of comorbidities, social support, and positive psychological capital are the influencing factors of health literacy in CKD patients. Therefore, healthcare professionals should focus on identifying CKD patients with low literacy, low economic income, high number of comorbidities, insufficient social support, and negative psychological states to develop more targeted health literacy intervention programs.

In the study, the top three lowest-scoring items on the health literacy scale were "Often participate in healthful activities with patients", "Go to the hospital to see the doctor alone", and "Often discuss your health problems with other people besides the doctor". Therefore, healthcare professionals can build a platform for CKD patients to communicate and help each other, regularly organize online thematic discussions and offline activities for patients; provide patients with guidance on how to seek medical treatment, including how to make an appointment and register for a doctor's appointment, and choose the right doctor; encourage patients to actively discuss their health problems with their family members, friends, and community health workers, etc., in addition to communicating with their doctors in order to improve the quality of their health care.

There are some limitations in this study. On the one hand, the single-center study design may result in an under representative sample that does not cover the characteristics of a wider patient population; on the other hand, the specificity assessment tool was not used, which may be deficient in accurately measuring the health literacy of non-dialyzed CKD patients, affecting the comprehensiveness and accuracy of the results. In the future, it is recommended to develop specific assessment tools for health literacy of CKD patients that are suitable for national conditions, which is important for improving assessment accuracy and meeting individualized needs. It is recommended that a longitudinal study of health literacy among CKD patients be conducted to further explore the trajectory of changes in the study variables and to clarify the causal relationships among the variables.

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