RESEARCH ARTICLE

Correlations between uncertainty in illness and anxiety, depression and quality of life in patients receiving maintenance haemodialysis: A cross-sectional study

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Abstract

Aim: To investigate the uncertainty in illness, anxiety, depression and quality of life in patients receiving maintenance haemodialysis and confirm the correlations between these variables.

Design: A cross-sectional study was conducted among 396 patients receiving maintenance haemodialysis in four tertiary hospitals in China.

Methods: Uncertainty in illness was measured by Mishel's uncertainty in illness scale. The scores of self-rating anxiety scale, self-rating depression scale and medical outcomes study short form 36 were collected and compared with available norms. The Pearson correlation coefficient was calculated to investigate the correlation between uncertainties in illness with these vital variables.

Results: The mean score of uncertainty in illness was 78.16 out of 160. Compared with the norm, patients receiving maintenance haemodialysis had a statistically significantly lower score of depression and higher scores of most domains of quality of life. Uncertainty in illness is corrected with anxiety, depression positively and with quality of life negatively.

KEYWORDS
anxiety, depression, haemodialysis, quality of life, uncertainty

1 | INTRODUCTION

Chronic kidney disease (CKD) is a highly prevalent condition that contributes to a substantial proportion of disease burden globally and continues to rise in rank among leading causes of death (Bikbov et al., 2020). In 2017, almost 700 million cases of all-stage CKD were recorded, with a global prevalence of 9.1% (Bikbov et al., 2020). The prevalence of end-stage renal disease (ESRD), the final stage of CKD,

was also found to be increasing annually, especially in developing countries (Ghimire et al., 2021).

ESRD is a distressing disease characterized with irreversible impairments in kidney function and required long-term dialysis therapy. As the most commonly used and important renal replacement therapy (Robinson et al., 2016), maintenance haemodialysis (MHD) is vital for patients with ESRD to filter out excess hydrate and metabolic waste. However, due to the pressure of long-term therapy and

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complications of ESRD, patients receiving MHD often suffer from psychological distresses and socioeconomic constraints, which lead to the patient's bad health outcomes and poor quality of life (QoL).

On the other hand, due to the symptoms hidden of CKD, many patients ignored the health problems at early stages and know little about disease progression, treatment and prognosis (Khalil & Abdalrahim, 2014; Okoro et al., 2020). The lack of knowledge could give rise to patient's uncertainty in illness that could damage patients' physical, social, spiritual, mental, economic dimensions of life, thus reducing their compliance and coping abilities.

2 | BACKGROUND

1962s, Budner defined the "ambiguous situations" as one which cannot be adequately structured or categorized by the individual because of the lack of sufficient cues(Budner, 1962). Mishel proposed the theory of uncertainty in illness in 1988s to describe how patients "cognitively process" unpredictable aspects of their health, and four key factors forms to characterize it: ambiguity concerning the state of the illness; complexity about treatment and the healthcare system; lack of information about the diagnosis or severity of the illness; and the unpredictability of the disease course and prognosis (Mishel, 1988). Uncertainty in illness is a natural existence (Wright et al., 2009) and can be appraised as an opportunity for positive adaption or as a danger associated with psychological distress (Mishel, 1988). The reconceptualized theory of uncertainty in illness depicted four situations in which uncertainty is more likely to be appraised as dangerous: when the patient's supportive resources do not promote a probabilistic or conditional view of life; when the patient is the major caretaker that is statistically significant than others and delays their psychological response to their diagnosis and treatment; patients who are isolated from interaction with social resources; when the patient's healthcare givers maintain a persistent search for predictability and certainty (Mishel, 1990). If uncertainty in illness is appraised as a danger, patients are required to enact coping strategies to manage affect and increase control of positive adaption. Otherwise, psychological stress come into being.

Most studies indicated that patients receiving MHD have a moderate or high degree of uncertainty in illness in China, which was influenced by education level, job, duration of haemodialysis, social support, etc.(Hong et al., 2020; Sanmei et al., 2012). Studies conducted in Korea also indicated that the degree of uncertainty in haemodialysis patients was at or above the moderate level(B. Kim & Kim, 2019; O. Kim et al., 2020). While limited studies concerning the sub-concept of illness uncertainty. Kim made a standardized comparison between the four sub-concepts, including ambiguity, complexity, inconsistency, unpredictability, which shows that the uncertainty score is highest for ambiguity about the illness state(O. Kim et al., 2020). Jang's study showed that the score of ambiguity is the highest, followed by unpredictability, inconsistency and complexity. But there was still no consistent conclusion about which element was more impactful in China.

Previous studies indicated the negative impacts of uncertainty on the perception of and adjustment to ERSD or MHD, including reducing the patient's compliance (B. Kim & Kim, 2019) and inhabiting self-care behaviour (Jang et al., 2015). A study demonstrated statistically significant positive relationships between treatment belief and illness outcome in haemodialysis patients (Cha & Yi, 2014), which revealed the potential relationship between uncertainty in illness and quality of life (QoL) (Chae et al., 2020).

QoL is an important indicator of health outcome of patients with chronic disease and defined as the people's perception in situation, culture and values system they are in (Ercan & Demir, 2018). Patients receiving MHD were found to live with poor QoL (Ercan & Demir, 2018) on account of various problems such as reduction in physical functions, fatigue, sleep disturbances, sexual dysfunction and psychological stress, etc. (Yang et al., 2015).

Anxiety and depression were reported to be the most common psychological disorder among patients receiving MHD, with high prevalence ranges from 21.7% to 46% (Al-Shammari et al., 2021; Ganu et al., 2018; Gerogianni et al., 2018; Marthoenis et al., 2021; Mosleh et al., 2020; Najafi et al., 2016) and from 12% to 52% (Gerogianni et al., 2018; Goh & Griva, 2018; Mosleh et al., 2020; Najafi et al., 2016), respectively. Haemodialysis-associated anxiety and depression were attributed to various reasons, including demographical factors (gender, marital status, education level, economic status, financial situation), the duration of dialysis treatment, social support, the acceptance of the illness and limitation in daily activities (Ganu et al., 2018; Gerogianni et al., 2018; Marthoenis et al., 2021).

Though many studies concerning patients with cancer, heart disease and other chronic diseases widely reported the association between uncertainty in illness and anxiety, depression and QoL, there were limited studies specific to MHD confirm this relationship in China (Chen et al., 2018; Ozawa et al., 2021; Pahlevan Sharif, 2017). Thus, we hypothesize that patients receiving MHD suffered uncertainty in illness was related to anxiety, depression and QoL positively. In this study, we aimed to confirm this relationship and investigate the situation of uncertainty in illness, anxiety, depression and QoL in patients receiving MHD.

2.1 | Methods

2.2 | Study design

This study adopted a cross-sectional study design. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist for cross-sectional studies was followed (see Supplementary File S1).

2.3 | Participants

A convenience sample of 396 patients with MHD from four tertiary hospitals in Sichuan, China were recruited based on the following

inclusion criteria: 18 years old or older, being diagnosed with ESRD, having received MHD for more than 3 months and continuing to and consenting to participate in the study. Patients with a history of psychological illness, cognitive impairment, cancer or other serious diseases were excluded.

The sample size was calculated according to the Kendall sample estimation method, which should be more than 10 times the number of variables (Jialiang, 2014). There were 33 variables in this study. Consequently, the estimated minimum sample size was 396, with the consideration of 20% efficiency.

2.4 | Instruments

2.4.1 | *Demographical and disease-related characteristics*

Demographical and disease-related characteristics collected from participants included age, duration of haemodialysis, gender, marital status, region, nationality, education level, employment status, members living with, monthly family income, the form of payment for medical expenses, primary disease, haemodialysis vascular access, the times of haemodialysis per week, the duration of haemodialysis, the history of renal transplant and peritoneal dialysis, waiting for a donor or not, having received health education related to primary diseases or not and having received health education related to haemodialysis or not.

2.4.2 | *Mishel's Uncertainty in Illness Scales (MUIS)*

MUIS developed by Mishel (Mishel, 1981) and translated into Chinese by Xu Shulian (Shulian & Xiuli, 1996) was used to measure uncertainty. The Chinses version of MUIS was widely used and indicated to have good reliability and validity, with Cronbach's alpha of 0.86. This scale was constructed by four dimensions (ambiguity, unpredictability, inconsistency and complexity) and 33items (with item 15 being not scored), with Cronbach's alpha of 0.86 and used a 5-point Likert scale, ranging between 1 (strongly disagree) and 5 (strongly agree). Negative statements were coded in reverse. The higher the gross score is, the severer the uncertainty in illness is. A categorical algorithm could also assess the score of MUIS: 32 ~ 74.7 as mild, 74.8 ~ 117.4 as moderate and 117.5 ~ 160 as severe.

2.4.3 | *Self-rating Anxiety Scale (SAS)*

As a widely used instrument for anxiety disorders, SAS was compiled by William Zung in 1971(W. W. Zung, 1971). A modified and validated Chinese version of the SAS with a Cronbach's α of 0.931 was applied (Ming & Jingfang, 1994) in this study. The items were scored 1 (a little of the time), 2 (some of the time), 3 (good part of the time) or 4 (most of the time), and item 5, 9, 13, 17 and 19 were scored in

reverse. The total standard score was calculated by the total gross score multiplied by 1.25. The total standard scores were interpreted as follows: normal (total standard score <50), mild (50 ≤ total standard score <60), moderate (60 ≤ total standard score <70) and severe (total standard score ≥70).

2.4.4 | *Self-rating Depression Scale (SDS)*

The SDS compiled by William Zung (ZUNG W. W. K., 1965) was used to ascertain the patient's true situations about depression. The scale was indicated to be highly reliable and valid among Chinese (Lee et al., 1994), and its items were scored 1 (a little of the time), 2 (some of the time), 3 (good part of the time) or 4 (most of the time). The total standard score was calculated by the total gross score multiplied by 1.25. The total standard scores were interpreted as follows: normal (total standard score <53), mild (53 ≤ total standard score <62), moderate (60 ≤ total standard score <72) and severe (total standard score ≥72).

2.4.5 | *Medical Outcomes Study Short Form 36 (SF-36)*

SF-36, a self-administered questionnaire, was widely used to describe the health status of individuals and has good psychometric properties among Chinese (Jiang Minmin & Lu, 2003). It measured 8 specific dimensions of health, and the scores for each dimension range from 0 to 100, with higher scores that indicate better health status.

2.5 | Data collection

Data were collected by a self-reported survey in the haemodialysis centre of four tertiary hospitals. All the scales were filled out by patients, and if there were items they did not understand, the researchers would explain and clarify. When patients could not fill out the scales by themselves because of visual dysfunction, reading difficulties or inability to write led by arteriovenous fistula, the researchers would aid without interference.

2.6 | Statistical analysis

Frequency distributions were adopted to describe categorical variables of demographical and disease-related characteristics. After testing for skewness and kurtosis, means with standard deviations (*SD*) were used to describe age, the duration of haemodialysis, and scores of MUIS, SAS, SDS and SF-36. The *t* test was carried out to compare the scores of SAS and SDA, with national norms (Liyi & Deqin, 2018), so did the scores of SF-36 with the norm in Sichuan province (Li Ningxiu et al., 2001). The Pearson correlation coefficient was calculated to investigate the correlation between uncertainty in illness and anxiety, depression and QoL in patients experiencing

MHD. All p-values were calculated as two-tailed and all statistical tests used a statistically significance level of 0.5. All statistical analyses were conducted with SPSS 25.0.

2.7 | Ethics

Ethical clearance for the study was obtained from the Biomedical Ethics Committee of the relevant hospital (No. 2017 (10)). The purpose and procedure of the study were explained to participants before signing the informed consent form. Patients were informed that participation was voluntary, and they could withdraw at any time during the survey. All collected data does not contain information that could identify individual participants and are kept confidential and used for research purposes only.

3 | RESULTS

3.1 | Participant characteristics

This study involved 400 patients receiving MHD, of whom 396 (99%) returned complete and valid questionnaires. As illustrated in Table 1, the mean age of participants was 56.20 years (SD = 15.78), with 58.1% of male. Most participants married (78.8%), living with families (91.7%) and settling in urban areas (83.1%). Their educational level was evenly distributed between primary school and university. The proportion of unemployed participants was up to 80.8%, but most (72.3%) families earned a monthly income of more than 2,000 Yuan per person, and only few (0.5%) take medical care for self-paying.

At the time of this study, the mean of duration of haemodialysis was 49.99 months (SD = 35.22), with 83.8% of arteriovenous fistula and three times per week (91.7%). Very few patients had a history of renal transplantation (2.3%), peritoneal dialysis (5.1%) or waiting for donors (15.7%). Most participants have received health education related to primary disease (73.2%) or haemodialysis (91.2%).

3.2 | Uncertainty in illness in patients receiving MHD

As demonstrated in Table 2, the mean score of uncertainty in illness was 78.16 (SD = 15.68). The mean scores of items of the four subscales in descending order were: unpredictability (3.41 ± 0.57), ambiguity (2.48 ± 0.72), inconsistency (2.08 ± 0.56) and complexity (2.05 ± 0.45).

3.3 | Anxiety, depression, QoL in patients receiving MHD

The mean scores of anxiety and depression were 36.33 (SD = 7.17), and 45.88 (SD = 9.40), respectively. The score of SDS was statistically significantly higher than the Chinese national norm (t = 8.462, p < .001). The domains of QoL were scored between 44.25 and 81.38, and general health (mean = 44.25, SD = 23.43), social functioning (mean = 58.08, SD = 27.04) and vitality (mean = 69.92, SD = 15.15) got relatively lower scores. The scores of most domains of SF-36, including social functioning (t = −20.024, p < .001), general health (t = −19.578, p < .001), physical functioning (t = −14.498, p < .001), role physical (t = −2.392, p = .017), vitality (t = 1.991, p = .047), were obviously lower than the norm in Sichuan province. The results were depicted in Tables 3.

3.4 | The correlation between Uncertainty in illness and anxiety, depression, QoL in patients receiving MHD

Pearson's correlation analyses revealed a moderate positive correlation between the total score of uncertainty in illness and anxiety (r = 0.416, p < .001), and depression (r = 0.434, p < .001), and an inverse correlation between uncertainty in illness and domains of QoL (r = −0.231~-0.426, p < .001). Each dimension of uncertainty in illness was discovered to be positively correlated with anxiety and depression. The ambiguity was negatively correlated with the domains of SF-36, with the correlation coefficient being equal to or lower than −0.2. The results were depicted in Table 4.

4 | DISCUSSION

The present study revealed that the patients receiving MHD in southwest China had a moderated degree of uncertainty in illness, which was consistent with previous studies (Hong et al., 2020; Jang et al., 2015; B. Kim & Kim, 2019; Mun & Soon, 2017; Sanmei et al., 2012). The mean score of items of unpredictability was highest, which means the patients' uncertainty in illness mainly derives from their lack of ability to predict disease course and prognosis in this study. This finding was disagreed with other studies(B. Kim & Kim, 2019; O. Kim et al., 2020; Sanmei et al., 2012), which might be explained by the difference of demographical factors. Previous studies conducted in Korea found that ambiguity is the most general attribute of uncertainty in illness, which might due to patients were unclear their status of illness(Jang et al., 2015). Thus, Jang emphasized the education of management methods before and after dialysis(Jang et al., 2015). In this study, the average duration of haemodialysis is longer than 49 months, and a large proportion of patients had received health education related to primary diseases or haemodialysis, which is helpful to alleviate the ambiguity concerning. On the other hand, the timing and nature of symptoms onset, duration, intensity and location of the most critical diagnosis are unforeseeable, characterized by periods of stability, erratic flares of exacerbations or unpredictable recurrence resulting in uncertainty(Cypress, 2016). In this study, patients' uncertainties in illness were resulted from the erratic nature of CKD and the

TABLE 1 Demographical disease-related characteristics of maintenance haemodialysis patients (*N* = 396)

Variable		Range[a]	Mean (*SD*)
Age (Year)		18 ~ 85	56.20(15.78)
Duration of haemodialysis (Month)		3 ~ 180	49.99(35.22)
	Categories	Frequency	%
Gender	Male	230	58.1
	Female	166	41.9
Marital status	Married	312	78.8
	Unmarried	29	7.3
	Divorced	22	5.6
	Widowed	33	8.3
Region	Urban	329	83.1
	Town	47	11.9
	Rural	20	5.0
Nationality	Han nationality	382	96.5
	Ethnic minority	14	3.5
Education level	Primary school or below	87	22.0
	Secondary school	91	23.0
	High school	100	25.2
	Junior college	58	14.6
	Undergraduate or above	60	15.2
Employment status	Employed	76	19.2
	Unemployed	320	80.8
Members live with	Live alone	30	7.6
	Live with family	363	91.7
	Live with friends	3	0.7
Monthly family income (Yuan per person)	<1000	48	12.1
	1001 ~ 2000	62	15.6
	2001 ~ 3000	85	21.5
	3001 ~ 4000	64	16.2
	4001 ~ 5000	37	9.3
	>5000	100	25.3
The form of payment for medical expenses.	Free medical care	4	1.0
	Medical insurance	390	98.5%
	Self-paying	2	0.5
Primary diseases	Primary glomerular disease	198	50.0
	Diabetic nephropathy	87	22.0
	Hypertensive nephropathy	75	18.9
	Others	36	9.1
Haemodialysis vascular access	Arteriovenous fistula	332	83.8
	Central venous catheterization	64	16.2
Times of haemodialysis per week	2	29	7.3
	3	363	91.7
	5	4	1.0
History of renal transplant	Yes	9	2.3
	No	387	97.7

TABLE 1 (Continued)

Variable		Range[a]	Mean (SD)
History of peritoneal dialysis	Yes	20	5.1
	No	376	94.9
Waiting for a donor or not	Yes	62	15.7
	No	334	84.3
Having received health education related to primary diseases or not	Yes	290	73.2
	No	106	26.8
Having received health education related to haemodialysis or not	Yes	361	91.2
	No	35	8.8

[a]Maximum range of scores for participants

TABLE 2 Uncertainty in illness in patients receiving maintenance haemodialysis (N = 396)

Variable	Range[a]	Total score (Mean (SD))	Mean cores of items (Mean (SD))
Uncertainty in illness	32 ~ 160	78.16(15.68)	2.23(0.45)
Ambiguity	13 ~ 65	32.21(9.30)	2.48(0.72)
Complexity	7 ~ 35	14.33(3.15)	2.05(0.45)
Inconsistency	7 ~ 35	14.58(3.93)	2.08(0.56)
Unpredictability	5 ~ 25	17.04(2.85)	3.41(0.57)

unpredictability of symptoms, outcome and chance of access to kidney transplant could increase along with the age and duration of MHD. It is suggested that symptoms management, to postpone the development of disease may be useful measures to alleviate the uncertainty of the patient's disease.

The long duration of haemodialysis and a large proportion of patients who received health education could not only alleviate the ambiguity, but also reduce patients' anxiety by improve their ability of self-management and coping with disease-related events. Meanwhile, most of patients in this study had substantial family incomes and medical insurance that lessen their financial burden. Thus, although the score of anxiety in this study was higher that the norm, it was not statistically significant. Anxiety was a common psychiatric disorder among patients receiving MHD. Existing literature points to increased levels of anxiety in patients with CKD(Goh & Griva, 2018). But limited studies compared the anxiety of patients receiving MHD with healthy individuals and this finding warrant further exploration.

The severe depressive symptoms and poor QoL of the patients shown in this study should be noticed. Many studies had reported the high prevalence of depression and its damage to patients with MHD, including strengthening the suicidal ideation, weakening coping ability, hampering the compliance of self-care, and decreasing self-deterministic health behaviour(Goh & Griva, 2018; B. Kim & Kim, 2019; Mun & Soon, 2017). Depression indicated patients' severe psychosocial stress which was caused by the loss of physical abilities, renal function, sexual function, cognitive ability, role in their family and employment(Wang et al., 2015). Body impairment

and social restriction always made MHD patients stressed, and they had to rely on their relatives and friends to assist them with routine daily living. Thus, symptom management and a supportive family and social environment would contribute to patients' depression.

The loss of patients with MHD might also explain their poor QoL, and that their social functioning, general health, and physical functioning are statistically significantly worse than healthy individuals. The poor QoL of patients receiving MHD was widely known, while it seemed to have no unified conclusion on which domain of SF-36 was worse. Yarlas (Yarlas et al., 2011) synthesized findings from twenty-six published studies to compare SF-36 scores of HD patients with those of control or general population samples, with a conclusion that physical functioning, general health and role physical capture the largest burden in patients receiving haemodialysis, and the disease burden negatively impacts physical QoL more strongly than mental QoL. However, the studies being recruited to analyses were conducted before 2010(Yarlas et al., 2011), and the improvement of haemodialysis technology over the decade might explain the change in domains of QoL. Overall, patients evaluated their health negatively, with limited physical function due to complications and disease progression. The developed haemodialysis technology has helped to improve their physical condition. However, greater attention needs to be given to their psychosocial stress.

In this study, patients' anxiety, depression and impaired QoL were correlated with uncertainty in illness, as is exhibited in studies related to other diseases (Chen et al., 2018; Ozawa et al., 2021; Pahlevan Sharif, 2017; Parker et al., 2016). Patients receiving MHD tended to appraise uncertainty in illness as a threat giving rise to psychological stress rather than an opportunity (Ahn et al., 2017; Chen et al., 2018; Parker et al., 2016). According to the reconceptualized theory of uncertainty in illness, the supportive resources and nurse's views have great impacts of patients' appraise of uncertainty in illness (Mishel, 1990). This shed light on how to deal with uncertainty in illness. Nurses were supposed to acknowledge the natural existence of uncertainty and help patients integrate the experience of chronic uncertainty into their self-structure and use uncertainty as a force for evolution by promoting supportive resources of patients (Mishel, 1990).

In terms of the scale dimensions, ambiguity had the greatest correlation with anxiety, depression and SF-36 domains. Ambiguity was

Variable	Range[a]	This study (Mean (SD))	Norms (Mean (SD))	t	P
Anxiety	20 ~ 80	36.33(7.17)	29.7(10.07)[b]	−1.565	.118
Depression	25 ~ 100	45.88(9.40)	41.8(10.57)	8.462	<0.001
Quality of Life					
Social functioning	0 ~ 100	58.08(27.04)	85.29(18.06)	−20.024	<.001
General health	0 ~ 100	44.25(23.43)	67.30(21.97)	−19.578	<.001
Physical functioning	0 ~ 100	75.91(20.44)	90.8(15.07)	−14.498	<.001
Role physical	0 ~ 100	74.94(38.05)	79.51(34.70)	−2.392	.017*
Vitality	0 ~ 100	69.92(15.15)	71.44(15.81)	−1.991	.047*
Mental health	0 ~ 100	73.92(14.60)	73.52(15.68)	0.544	.587
Role emotional	0 ~ 100	76.60(34.41)	76.45(38.47)	0.086	.931
Bodily pain	0 ~ 100	81.38(25.46)	82.41(21.25)	−0.802	.423

[a]Maximum range of scores for scales

[b]The gross score of SDS between this study (29.33(5.68)) and Chinese national norm (29.7(10.07)) was compared due to the lack of standard score of Chinese national norm.

TABLE 4 The correlations between uncertainty in illness and anxiety, depression, quality of life in patients receiving maintenance haemodialysis (N = 396)

Variable	Uncertainty in illness	Ambiguity	Complexity	Inconsistency	Unpredictability
Anxiety	0.416***	0.398***	0.304***	0.352***	0.168***
Depression	0.434***	0.408***	0.393***	0.297***	0.213***
Quality of Life					
Social functioning	−0.350***	−0.343***	−0.181***	−0.303***	−0.187***
General health	−0.426***	−0.390***	−0.327***	−0.339***	−0.239***
Physical functioning	−0.231***	−0.236***	−0.188***	−0.124*	−0.124*
Role physical	−0.348***	−0.348***	−0.148***	−0.337***	−0.113*
Vitality	−0.386***	−0.348***	−0.335***	−0.254***	−0.267***
Mental health	−0.229***	−0.198***	−0.267***	−0.105*	−0.171**
Role emotional	−0.290***	−0.299***	−0.182***	−0.249***	−0.077
Bodily pain	−0.278***	−0.258***	−0.161**	−0.267***	−0.143**

Note: *p < .05, **p < .01, ***p < .001

commonly created by symptoms with multiple causes or difficult to distinguish(McCormick, 2002). As a stimulation pattern, symptoms will lead patients to evaluate the nature, intensity, frequency, duration and results of symptoms. When patients' evaluation or expectation was inconsistent with their actual experience, uncertainty arose, which made the patients unable to determine the impact of diseases and dialysis related complications and symptoms those therapy targeted, worried about the treatment effect and prognosis, and lead to anxiety and depression(Yan et al., 2012). MHD patients often experience various symptoms and these ambiguous symptoms were severe, erratic, but often were underestimated and without adequate treatment(Song et al., 2020). Besides, the variety of symptoms among patients with ESRD made patients hard to build correct perceptions of illness which increased patients' negative feelings and decline in QoL. In this perspective, it is necessary to

give patients with better clinical integrated treatments and clearer and consistent pieces of information, especially information related to status and symptoms of CKD and MHD, to reduce the ambiguity and inconsistency and improve QoL.

To the best of our knowledge, this study is the first to explore the relationship between uncertainty in illness and anxiety, depression and QoL in China. Actually, due to the development of technology that is parallel to important advancements made in health field, life expectancy prolongs in long-term illness and the QoL of patients is becoming more important(Ercan & Demir, 2018). The improvement of patient's QoL of has become the essential goal of medical care. The close correlation between uncertainty in illness and anxiety, depression, QoL suggested nurses play a greater role in enhancing the QoL of patients receiving MHD by providing adequate disease-related information and psychosocial

support. More tight interactions among patients, health-workers and better communication strategies were supposed to encourage patients to manifest their doubts and concerns (Giammanco et al., 2015).

5 | LIMITATIONS

Despite the statistically significant findings, some limitations exist. First, we conducted a cross-sectional study that only gives the information at one point of time and could not measure the changes of uncertainty in illness, anxiety, depression and QoL from time to time. Second, a convenient sampling might reduce the representativeness of the sample. Third, our study did not include a qualitative design that could delineate some of the pertinent issues. Finally, although well-validated scales were used, the anxiety and depression among the patients were not confirmed by formal psychiatric assessment.

6 | CONCLUSION

This study indicated that uncertainty in illness in patients with MHD was at a moderated degree and mainly derives from unpredictability. Uncertainty in illness was related to anxiety, depressive symptoms and impaired QoL positively. Nurses were recommended to acknowledge the natural existence of uncertainty and help patients optimize the usage of supportive resources, and attach more importance to symptom management. Providing emotional support, clearer and consistent pieces of information, especially information related to status and symptoms of CKD and MHD, and opportunities to discuss their concerns might be worthwhile.

CONFLICT OF INTEREST

We declare that we have no competing or potential conflicts of interest.

AUTHORS CONTRIBUTIONS

Jingxia Cheng: Involved in methodology, formal analysis, writing–original draft. Dongju Yang: Involved in investigation, formal analysis and project administration. Qiantao Zuo: Involved in investigation, data input and data Curation. Weixu Peng: Involved in investigation and data curation. Longling Zhu: Involved in investigation. Xiaolian Jiang: Involved in study design, supervision, reviewing and editing.

ETHICS APPROVAL

Ethical clearance for the study was obtained from the Biomedical Ethics Committee, West China Hospital, Sichuan University (No. 2020 (981)).

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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