

Trajectories of Learned Helplessness in Maintenance Haemodialysis Patients and Their Predictive Effects on Self-Management: A Latent Growth Mixture Modeling Approach

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Background: Learned helplessness (LH) is an essential psychological factor influencing maintenance haemodialysis (MHD) patients' health behaviour and is closely related to prognosis of the disease. This study aimed to identify potential trajectories of LH in MHD patients and assess their predictive role in self-management.

Methods: This study was conducted in strict compliance with national laws, the Declaration of Istanbul, and the Declaration of Helsinki. A total of 347 MHD patients at a blood purification centre in Hunan Province, China, were selected as the study population. Four longitudinal surveys (baseline and second/fourth/sixth month after baseline) were conducted using the General Information Questionnaire for MHD patients, the Chinese version of the Learned Helplessness Scale for MHD patients, and the Self-Management Scale for Haemodialysis. Latent growth mixture model (LGMM) analysis was used to identify LH trajectories, and their predictors were analysed using multinomial logistic regression. The predictive role of LH trajectory on self-management was analysed using linear regression.

Results: This study identified three LH trajectories in MHD patients, named the "high-decreasing group" (57.9%), "low-increasing group" (21.3%), and "low-stability group" (20.7%). The results of the univariate analysis showed that sex ($\chi^2=33.777$, $P < 0.001$), age ($\chi^2=10.605$, $P < 0.05$), and subjective social status (SSS) ($\chi^2=12.43$, $P < 0.01$) were associated with LH trajectory classes. Multinomial logistic regression further demonstrated that gender, age, and SSS were predictors of different LH trajectories. The intercept and slope of the overall LH trajectory were negatively correlated with self-management ($\beta=-0.273$, $P < 0.001$; $\beta=-0.234$, $P < 0.01$).

Conclusion: MHD patients show three different LH trajectories. The initial level and developmental rate of LH can negatively predict future self-management. It is necessary to screen MHD patients' LH and develop targeted interventions for them with different LH trajectories at specific stages.

Keywords: learned helplessness, maintenance haemodialysis, self-management, trajectories, longitudinal research

Introduction

Haemodialysis (HD) is the primary renal replacement therapy for end-stage renal disease (ESRD) patients.¹ HD removes metabolic wastes and maintains electrolyte and acid-base balance by diverting the blood into the extracorporeal circulation and exchanging substances with dialysis fluid.² Patients receiving HD for over three months are defined as maintenance haemodialysis (MHD) patients.³ More than 90% of ESRD patients in China are treated with MHD, with an annual growth rate of 20%. By 2021, there will be approximately 750,000 MHD patients in China.

MHD significantly improves patient survival but cannot completely replace renal function. Patients' HD effects, prognosis, and quality of life are largely related to their self-management behaviours.⁴ Psychological factors are the most common risk factors for MHD patients' self-management behaviours.⁵ Due to the severity and irreversibility of ESRD,

the high medical charges, complications, and dietary and fluid restrictions, many patients suffer from learned helplessness (LH), such as hopelessness, depression, abandonment, and even self-destruction. LH refers to the psychological state of powerlessness or loss of confidence that occurs when an individual experiences long-term or repeated uncontrollable outcomes.⁶ The essence of LH is a learned negative motivation.⁷ It has been demonstrated that LH significantly impacts self-management and adherence in MHD patients.^{8,9} Patients with high LH are not confident in their ability to control disease and manage their lives and are prone to negative expectations. Thus, they tend to give up efforts or persist for a shorter time. In addition, patients who fall into helplessness may experience various negative consequences, such as mental distress, depression, and suicide, placing a heavy burden on society.^{10–13}

Seligman proposes that LH is not a direct result of a traumatic event but rather is learned by the individual in response to a traumatic event.¹⁴ LH interacts with various variables. When individuals experience a stressful event (eg, dialysis), LH can be dynamic, which increases the complexity of their self-management interventions.¹⁴ Therefore, a longitudinal study of LH in MHD patients can inform the allocation of mental health resources and health-related behavioural interventions. Given that the current studies have been conducted based on variable-centred analysis, they are not conducive to clarifying the characteristics of individual LH growth. Using a person-centred approach, this study aimed to identify heterogeneous trajectories and examine the relationship between MHD patients' self-management and heterogeneous trajectories. Specifically, we hypothesized that (a) different trajectories of LH in MHD patients would be found, (b) demographic variables and subjective social status (SSS) of MHD patients related to LH trajectories, and (c) the initial level and developmental rate of LH can be used to predict future self-management.

Materials and Methods

Participants

The MHD patients were selected using a convenience sampling method in May 2022 at the blood purification centre of a comprehensive hospital in Hunan Province, China. The inclusion criteria were as follows: (i) received HD treatment for \geq three months and (ii) provided informed consent. Patients who did not complete baseline measurements were excluded.

Procedures

We clarified the purpose and significance of this study at the beginning to obtain informed consent from the participants. For the illiterate group, we explained the items' content and helped them fill out questionnaires based on their real desires. The researchers confirmed the accuracy of the content with the participants to ensure that no omissions or mistakes were made. The investigation occurred one hour after the start of dialysis or 1 hour before the end when the patient's blood circulation was stable. Each participant took approximately 10–15 minutes to complete the questionnaire. The first measurement's time was considered the baseline (T1). The follow-up occurred in the second (T2), fourth (T3), and sixth (T4) months after baseline. In the T1 stage, 400 questionnaires were distributed, and 369 valid questionnaires were returned, with a valid return rate of 92.25%. During the follow-up, 17 samples were lost due to moving, transplantation, and death, and another five incomplete questionnaires were also excluded. A final sample of 347 with no missing values was obtained to enter the analysis. The independent samples *t* test indicated no significant difference between the attrited sample and the final sample regarding the mean value of LH at baseline, indicating that the sample attrition was random.

Measures

General Information Questionnaire for MHD Patients

The research team designed a General Information Questionnaire for collecting MHD patients' demographic information: gender, age, education, working status, monthly income and duration of the MHD/kidney transplant.

The Chinese Version of the Subjective Socioeconomic Status Scale (CSSS)

Subjective social status (SSS), a crucial psychological concept in social class psychology research, reflects how individuals perceive their position in the socioeconomic structure.¹⁵ The relationship between SSS and mental health has attracted much attention.

In this study, the CSSS scale was selected to validate the predictive role of SSS on LH trajectories. The CSSS was adapted from the MacArthur Scale of Subjective Social Status (SSS) developed by Adler et al.¹⁶ The scale consists of two items. Item 1 (social status) is linked to socioeconomic status (SES) and is used to assess an individual's position in the social environment. Item 2 (community status) is related to the individual's living environment, and the individual assesses his or her position in the community.¹⁷ Each item is scored from 1 to 10. The lower the score is, the lower the SSS of the individual. The scale is widely used in China, with a Cronbach's α value of 0.82.¹⁸

The Learned Helplessness Scale for Maintenance Haemodialysis Patients in China (LHS-MHD-C)

There is no specific scale for MHD patients' LH. Considering this limitation, we adapted a Chinese version of the learned helplessness scale for maintenance haemodialysis patients (LHS-MHD-C) based on Nicassio's AHI scale.¹⁹ With his authorization, we conducted cross-cultural adaptation, psychological measurement, and evaluation. The LHS-MHD-C has 11 items classified into two dimensions (helplessness and internality) based on the results of exploratory factor analysis and confirmatory factor analysis. Responses were measured on a five-point Likert scale with options ranging from 1=strongly disagree to 5=strongly agree. Six items in the dimension of internality are reverse scored. The higher the total score was, the more severe the LH.²⁰ In our previous study, the scale showed good internal consistency (Cronbach's α value of 0.759), retest reliability ($n=30$, intragroup correlation=0.772, $P<0.01$), and split-half reliability (0.774).

Self-Management Scale for Haemodialysis (SMSH)

SMSH, developed by Song in 2009,²¹ was used to measure MHD patients' self-management in this study. It has 20 items and is divided into four dimensions: problem solving, performing self-care, partnership, and emotional processing. Responses were measured on a 4-point Likert scale, with scores 1–4 representing the frequency of the behaviour: never, occasionally, often, and always, respectively. Total scores were 20–80. The higher the score was, the better the patient's self-management behaviour.²² SMSH was adapted by Li,²³ and its Cronbach's α value was 0.813.

Data Analysis

Descriptive statistical analysis, univariate analysis, and multinomial logistic regression were performed using SPSS 25.0 software. Latent growth mixture modeling (LGMM) was performed using Mplus 7.0 software, which assumes that a class has similar but not identical trajectories, ie, variance variation is allowed for individuals within the same class.²⁴ Therefore, LGMM helps examine LH's dynamic pattern. The indicators of model fitness are the log-likelihood test, Akaike information criterion (AIC), Bayesian information criterion (BIC), and adjusted BIC (aBIC), and their smaller values indicate better model fit.²⁵ The entropy index was used to assess the classification accuracy. The value of entropy ranged from 0 to 1, and when it was 0.8, it indicated that the classification accuracy was more than 90%.²⁶ Lo-Mendell-Rubin (LMR) and Bootstrapped Likelihood Ratio Test (BLRT) were used to compare the difference in fit between the models. If both P values reached a significant level, the model with k classes was significantly better than that with $k-1$ classes.²⁷ Models containing less than 5% of the samples in any class could be excluded.²⁸

Ethical Considerations

The Ethics Committee of Xiangya Nursing School of Central South University approved this study on April 20, 2022 (No. E202255). Informed consent was obtained from all participants. This study was conducted strictly with national laws and the Declaration of Helsinki. All kidneys were donated voluntarily with written informed consent, and this process was conducted in accordance with the Declaration of Istanbul.

Results

General Characteristics

Of the 347 samples, 60.2% of the participants were male, 32.3% were 18–44 years old, and 43.5% had secondary education. Other characteristics of the participants are shown in Table 1.

Table 1 Participant Characteristics (n=347)

Characteristics	n	%
Sex		
Male	209	60.2
Female	138	39.8
Age		
18–44	112	32.3
45–59	114	32.9
≥60	121	34.9
Education		
Elementary school	87	25.1
Middle school	151	43.5
University and above	109	31.4
Working state		
On duty	18	5.2
Part-time job	45	13
Off duty	284	81.8
Monthly income (RMB)		
≤2999	99	28.5
3000–4999	116	33.4
≥5000	132	38
Duration Of the MHD (years)		
<1	80	23.1
(1,3)	74	21.3
(3,7)	97	28
≥7	96	27.7
Kidney transplant		
No	319	91.9
Yes	28	8.1

Abbreviation: RMB, Renminbi.

Descriptive Statistics of Key Variables

Descriptive statistical analysis of LH and self-management scores of MHD patients revealed that patients had the highest LH and self-management scores at time point T4, 36.12 ± 10.69 and 60.47 ± 12.85 , respectively. Table 2 shows the means and standard deviations of key variables.

Identification Trajectory Classes

In the initial GMM model, there was significant variance in the intercept and slope ($P < 0.001$), indicating significant variability in both the mean LH and the linear growth trajectory over six months. Based on the initial model, the number of classes in the model gradually increases until the best model fits the data. The results showed that the AIC, BIC, and aBIC indicators were higher in the 5-classes model than in the other models. The entropy of the 5-classes model was less than 0.8, and the probability of one of its classes was less than 5%, so it was not considered. The BIC of the 4-classes

Table 2 Means and Standard Deviations for Main Variables (n=347)

Variables	T1		T2		T3		T4	
	M	SD	M	SD	M	SD	M	SD
Learned helplessness	35.58	13.42	35.93	11.89	35.7	11.44	36.12	10.67
Self-management	49.72	17.49	49.39	12.31	49.59	10.66	60.47	12.85

Notes: T1, baseline, T2, the second month, T3, the fourth month, T4, the sixth month.

Abbreviations: M, means, SD, standard deviations.

Table 3 Fit Indices of the Grow Mixture Models for Different Numbers of Latent Classes

Number of Classes	k	AIC	BIC	aBIC	Entropy	p for LMR	p for BLRT	Class Frequency	Class Probability
C1	9	8438.299	8472.943	8444.392	N/A	N/A	N/A	N/A	1.000
C2	12	8066.178	8112.370	8074.302	0.998	<0.001***	<0.001***	201/146	0.579/0.421
C3	15	8049.273	8107.013	8059.428	0.860	<0.01**	<0.001***	72/201/74	0.207/0.579/0.213
C4	18	8046.470	8115.758	8058.656	0.856	>0.05	>0.05	115/122/79/31	0.331/0.352/0.228/0.089
C5	21	8054.992	8135.827	8069.209	0.692	>0.05	>0.05	64/100/82/3/98	0.184/0.289/0.236/0.009/0.282

Note: ** $p < 0.01$, *** $p < 0.001$.

Abbreviations: k, Number of free parameters; AIC, Akaike information criterion; BIC, Bayesian information criterion; aBIC, Adjusted BIC; LMR, Lo-Mendell-Rubin; BLRT, Bootstrapped likelihood ratio test; N/A, Not applicable.

model was higher than that of the 3-classes model. The entropy value of the 4-classes model was smaller than that of the 3-classes model. Moreover, the LMR and BLRT of the 4-classes model were insignificant, indicating no difference between the 4-classes model and 3-classes models. Therefore, the 4-classes model was not considered. The AIC, BIC, and aBIC values were smaller in the 3-classes model than in the 2-classes model. Moreover, when three classes were retained, LMR and BLRT reached significant levels ($P < 0.001$), entropy values were more desirable (> 0.8), and the class probability was reasonable (all $> 5\%$). Combining the above information with LH theory, the three-classes model was finally identified as the optimal model. The fitting index results are shown in Table 3.

The latent classes were named according to their characteristics. In Class 1, the intercept of the LH trajectory model was low, and the slope was not significant ($P > 0.05$). Therefore, Class 1 was named the low-stability group, accounting for 20.7% of the overall model. Class 2 had a high initial level of LH with a negative slope ($P < 0.01$) and was named the high-decreasing group, accounting for 57.9% of the model. Class 3 had a low intercept of LH with a positive slope ($P < 0.01$), indicating that MHD patients started with low LH but deteriorated significantly over time. Therefore, Class 3 was named the low-increasing group, accounting for 21.3% of the model. Three trajectories are shown in Figure 1.

Predicting the Membership of Trajectory Classes

The univariate analysis explored the factors affecting LH trajectories. The results showed significant differences in the distribution of patients on gender, age, and SSS for the three trajectories ($P < 0.05$). The results are detailed in Table 4.

Next, those variables were included in the multinomial logistic regression, with the three trajectories as dependent variables. The results showed that the predictors of MHD patients' LH that were prone to develop into the high-decreasing group (Class 2) or low-increasing group (Class 3) compared to the low-stability group (Class 1) were male, 45–59 years old with low SSS. The results are detailed in Table 5.

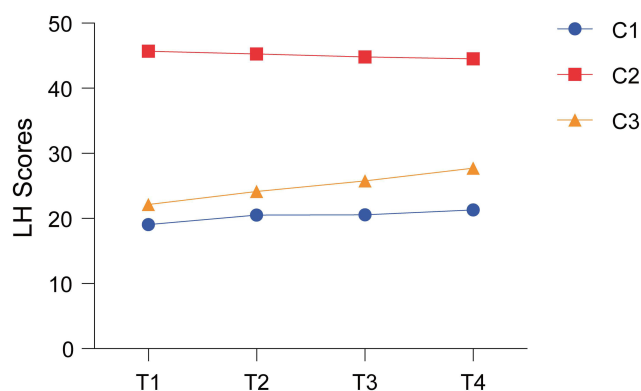


Figure 1 Three classes trajectory model for LH from baseline to six months ($n=347$).

Table 4 Demographic, Disease, and SSS Characteristics by Trajectory Classes (n=347)

Characteristics	C1 n(%)	C2 n(%)	C3 n(%)	χ^2	p
Sex					
Male	18(0.28)	55(0.67)	136(0.68)	33.777	0***
Female	46(0.72)	27(0.33)	65(0.32)		
Age					
18–44	23(0.36)	22(0.27)	67(0.33)	10.605	0.031*
45–59	11(0.17)	31(0.38)	72(0.36)		
≥60	30(0.47)	29(0.35)	62(0.31)		
Education					
Elementary school	15(0.24)	22(0.27)	50(0.25)	1.245	0.871
Middle school	31(0.48)	36(0.44)	84(0.42)		
University and above	18(0.28)	24(0.29)	67(0.33)		
Working State					
On duty	2(0.03)	3(0.04)	13(0.07)	4.555	0.336
Part-time job	9(0.14)	15(0.18)	21(0.10)		
Off duty	53(0.83)	64(0.78)	167(0.83)		
Monthly income (RMB)					
≤2999	11(0.17)	27(0.33)	61(0.30)	5.297	0.258
3000–4999	24(0.38)	25(0.30)	67(0.33)		
≥5000	29(0.45)	30(0.37)	73(0.37)		
Duration Of the MHD (years)					
<1	16(0.25)	23(0.28)	41(0.20)	11.710	0.069
<3	12(0.19)	21(0.26)	41(0.20)		
<7	15(0.23)	27(0.33)	55(0.28)		
≥7	21(0.33)	11(0.13)	64(0.32)		
SSS					
Low	24(0.38)	52(0.63)	122(0.61)	12.430	0.002**
High	40(0.62)	30(0.37)	79(0.39)		
Kindy transplant					
No	60(0.94)	78(0.95)	181(0.90)	2.370	0.306
Yes	4(0.06)	4(0.05)	20(0.10)		

Notes: *p< 0.05, **p< 0.01, ***p< 0.001. RMB=Renminbi, SSS=Subjective social status. C1, Class 1, C2, Class 2, C3, Class 3. χ^2 , chi-square.

Table 5 Results of the Multinomial Logistic Regression (n=347)

	Class 2 VS Class 1			Class 3 VS Class 1		
	OR	p	95% CI	OR	p	95% CI
Sex						
Male	5.520	0	2.521–10.933	5.337	0	2.817–10.112
Female	/	/	/	/	/	/
Age						
18–44	0.914	0.83	0.402–2.077	1.308	0.448	0.654–2.618
45–59	3.157	0.012*	1.282–7.773	3.426	0.003**	1.514–7.755
≥60	/	/	/	/	/	/
SSS						
Low	2.929	0.003**	1.437–5.969	2.576	0.003**	1.386–4.789
High	/	/	/	/	/	/

Notes: *p<0.05, **p<0.01. VS, versus; SSS, Subjective social status; OR, Odds ratios based on two multinomial logistic regression models; 95% CI=95% confidence interval; In all the models, Class 1 was the reference. For the predictors, female is the reference for sex; ≥60 is the reference for ages, and high level is the reference for SSS. / =Not applicable.

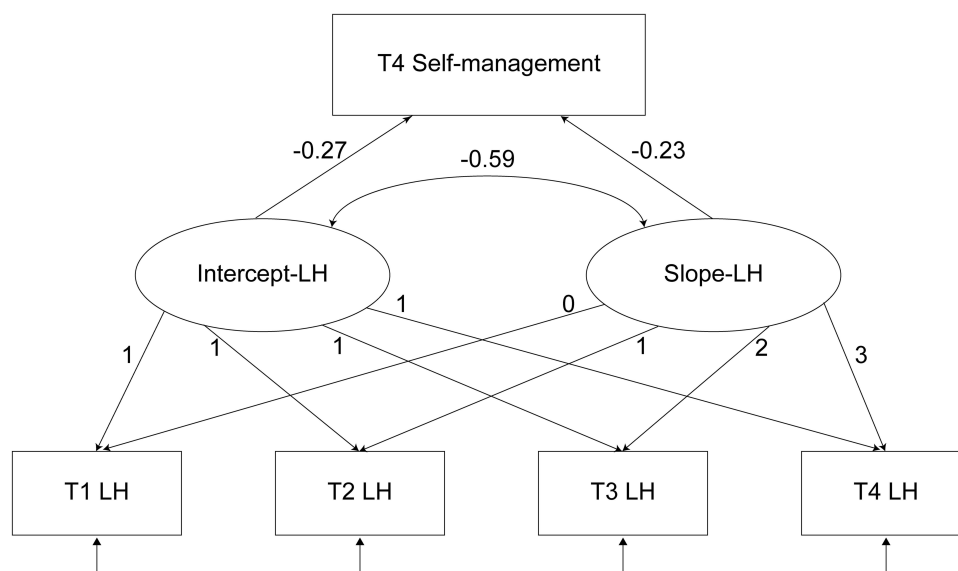


Figure 2 Predictive effects of the initial level and slope of LH on self-management. Data in the figure are standardized path coefficients. The *P* values of all path coefficients were <0.05 .

Predictive Effects of the Initial Level and Developmental Rate of LH on Self-Management

A linear regression model was constructed. The scores of self-management at the T4 stage were considered the dependent variable, and the intercept and slope of the LH trajectory were the independent variables. The results showed good model fit [$\chi^2=26.54$, degrees of freedom=7, $P<0.001$, $\chi^2/df=3.79$, comparative fit index (CFI)=0.992, Tucker–Lewis index (TLI)=0.988, root mean square error of approximation (RMSEA) =0.09 (90% CI: 0.055 0.127), and standardized root mean square residual (SRMR)= 0.02]. The intercept and slope of LH were significant negative predictors of self-management scores ($\beta=-0.273$, $P<0.001$; $\beta=-0.234$, $P<0.01$). The prediction model is shown in Figure 2.

Discussion

LH Trajectories in MHD Patients

In this study, we found that the LH trajectories of MHD patients had distinct characteristics and identified a three-classes trajectory model. The LH of all three subgroups in stage T1 was significantly different ($P<0.001$). The high-decreasing group had the highest percentage (57.9%), indicating that more than half of the participants were at a high level of LH. As the treatment progressed, the LH of this group showed a slowly decreasing trend. Notably, this group's lowest LH level remained higher than the highest in the other two groups during the follow-up period. This suggests that despite MHD being a traumatic event, most patients could gradually adjust and show resilient changes in their helplessness, consistent with Bonanno's trajectory theory of psychological change²⁹ and Seligman's LH theory.³⁰ This may be because patients in this class are good at using psychological resources (eg, social support, family support, peer support) to cope with helplessness. The measures that should be taken for this class of patients are maintaining attention and using positive interventions to facilitate the accelerated remission of their helplessness symptoms to normal levels.

Meanwhile, the results of this study showed that the low-stability group accounted for 20.7% of the overall participants, indicating that a small proportion of patients maintained a stable low level during the six-month follow-up period. This may be because patients in this group have a more rational cognition of ESRD and MHD. They regard MHD as an opportunity to prolong their lives and can adapt more quickly to changes.³¹ These characteristics can help them maintain lower LH levels. In addition, the low-increasing group accounted for 21.3%. This group had a low initial level of LH, but during the six-month follow-up period, the LH scores increased significantly. This may be because this

group of patients had no in-depth knowledge at the beginning of MHD treatment and did not feel great psychological stress. However, with the duration of treatment, patients gradually become aware of the disease's uncontrollability and the MHD's chronicity. They need more family attention, support, and care, making them feel guilty about their needs.⁹ In addition, resuscitation and death of ward mates, dialysis complications, lifestyle restrictions, medical costs, and low social status are easy triggers for their helplessness.³²

It can be seen that MHD patients experience different LH trajectories. Although most patients showed a gradual declining trend in this study, they remained above normal during the follow-up period. In addition, some patients were at low LH levels but had a risk for growth. Health care staff should prioritize these two classes of patients, provide early identification and dynamic assessment of their LH and offer psychological support at the right time to prevent more serious consequences.

Predictors of the Different LH Trajectories

First, this study found a significant gender difference between the three trajectories. The proportion of males in the high-decreasing and low-increasing groups was significantly higher than that of females compared to the low-stability groups. It reveals that males are more likely to experience high levels of LH and persistently rising LH than females in MHD patients. This distribution is similar to the results reported in other fields.³³ In China, the family model of "men outside the home, women inside" dictates that men have more important financial responsibilities. Men experience more life stress and cumulative negative events than women. The loss of income due to the inability to work has dealt a fatal blow to male family status and self-esteem, which may be why males are more likely to experience high LH or increasing LH. In addition, middle-aged patients (45–59 years old) were 3.157 and 3.426 times more likely to be in the high-decreasing and low-increasing groups, respectively, than in the low-stability group. A Chinese proverb describes the survival status of middle-aged people: "There are old and young at home." Middle-aged patients bear the double responsibility of family and society. However, MHD greatly limits their careers, marriage, and family. Loss of job, postdialysis fatigue, high medical costs, dietary and water restrictions, and poor health status greatly increase the sense of loss of control and helplessness of middle-aged patients regarding disease prognosis and their future life.

SSS may be another factor in predicting LH trajectories in MHD patients. The results showed that patients with low SSS were more likely to be in the high-decreasing and low-increasing groups than in the low-stability group. This is similar to the results of another study.³⁴ Many previous studies have reported the relationship between SSS and mental health problems, especially with regard to negative psychological aspects such as helplessness and depression. This can be explained by the fact that people with higher SSS have more access to health care resources, health literacy, and disease management skills to cope with helplessness.³⁵ On the other hand, individuals with low SSS may excessively adopt emotional dysregulation strategies accompanied by strong negative emotions to deal with various stresses or challenges in life, which increases their susceptibility to LH.³⁶ Therefore, SSS may play an essential role in the LH status of MHD patients and influence their trajectories.

Predictive Effects of the Initial Level and Developmental Rate of LH on Self-Management

This study showed that MHD patients with higher initial LH scores and a faster developmental rate of LH had a lower level of future self-management, which verified that LH is a hindering factor for self-management behaviour. According to Seligman's LH theory, this may be because helpless individuals have had uncontrollable experiences contributing to their negative attributions and cognitive biases.³⁷ They tend to believe that their self-management behaviours do not correlate with disease outcomes and that their efforts will not change disease progression and death.³⁸ At this point, helpless patients lack self-confidence, passivity, and self-abandonment in health-related behaviours and develop low motivation and self-efficacy when faced with disease management.³⁹ Helplessness can negatively affect the individual's self-management and complicate their health interventions.³⁸ MHD patients who fall into persistent helplessness may believe that no one or treatment can change the outcome of their kidney failure.⁴⁰ Unless patients change this belief, high

levels and growing LH will hinder their treatment adherence and self-management behaviour. Therefore, future interventions focusing on LH to improve patients' self-management behaviours may have better outcomes.

Limitations and Strengths

First, the study population was from a single blood purification centre in a southern Chinese city. The convenience sampling method limits the generalizability of the findings to some extent. Second, this study used patients' self-report questionnaires, which may be subject to recall bias. Third, the follow-up period of this study was short, and the dynamic changes after six months need to be further observed in our future studies.

Despite these limitations, the current study contributes to existing research and has important implications for future clinical practice. First, to our knowledge, this is the first study to investigate the heterogeneous trajectories of LH in MHD patients. Second, the present study is based on a person-centred philosophy and focuses on a group more likely to feel helpless in response to illness-related events and HD treatment. This provides valuable information for developing targeted intervention programs for vulnerable groups.

Conclusion

This study confirmed the existence of heterogeneous trajectories by longitudinally assessing LH levels in MHD patients. This study confirmed the theory of psychological trajectories in patients with chronic diseases.⁴¹ That is, most patients will have a gradual remission of LH. A small number of patients will have a continuous increase in LH, which needs to be noted. Age, sex, and SSS can predict LH trajectories in MHD patients. In addition, the initial level and developmental rate of the LH trajectory were negative predictors of patients' self-management. In future clinical practice, medical professionals should pay attention to assessing and predicting patients' LH, focusing on patients with high LH levels and potential growth and adapting targeted interventions to improve their adherence and health behaviours.

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Disclosure

All authors declare that they have no conflicts of interest for this work.

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