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Latent Categories of Mental Health Literacy in Patients with Coronary Artery Disease and Their Relationship with Quality of Life

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Abstract

Objectives: This study aims to explore the latent categories of mental health literacy among patients with coronary artery disease and examine their associations with quality of life. **Design:** A cross-sectional quantitative design was used. **Methods:** The study sample consisted of 208 patients with coronary artery disease from five wards in the Department of Cardiology at a tertiary hospital. Data were collected using a general information questionnaire, the Chinese version of the Multiple Mental Health Literacy Scale and the Chinese Cardiovascular Patient Quality of Life Assessment Questionnaire. The data were analysed with Mplus (v.8.3) and SPSS (v.25.0). **Results:** The mental health literacy of the 208 patients was categorised into four latent categories: low literacy (n = 28, 13.5%), high knowledge-low resources (n = 53, 25.5%), low knowledge-high resources (n = 63, 30.2%) and high literacy (n = 64, 30.8%). A significant difference in quality of life was observed according to mental health literacy category ($P < 0.05$). **Conclusion:** The quality of life of patients with coronary artery disease is significantly influenced by their levels of mental health literacy. Targeted interventions addressing the various profiles of mental health literacy should be implemented to improve the quality of life for patients with coronary artery disease.

Keywords

Coronary Artery Disease, Latent Categories, Mental Health Literacy

1. Introduction

Coronary artery disease, which is characterised by high morbidity, mortality and recurrence rates and multiple complications, is one of the most prevalent chronic diseases and the leading cause of death from chronic non-communicable diseases worldwide, with its incidence, recurrence, mortality and disability-adjusted life year rates only increasing every year [1]. Estimates by the American Heart Association have shown that around 19.1 million people die of cardiovascular disease annually, the most common of which is coronary artery disease, which has a global incidence of approximately 240 million, as well as a high recurrence rate [2]. The prevalence of coronary artery disease has continued to increase every year. Estimates show that the number of current patients with cardiovascular disease in China is around 330 million, 11.39 million of whom have coronary artery disease [3], and that mortality rates have been on the rise since 2012.

Patients with coronary artery disease commonly suffer from psychological problems, which may negatively affect their quality of life and treatment outcomes [4]. Mental health literacy (MHL), which refers to the knowledge and beliefs related to helping people recognise, address and prevent mental illnesses [5], is an important component in the construction of a healthy China [6]. Previous studies have shown that patients with coronary artery disease generally have low MHL [7]-[9]. Moreover, given that most of the current studies have been based on total scores, analysis of individual heterogeneity has been lacking. Latent category analysis explains the associations between exogenous indicators through latent classes, thereby maintaining local independence and better explaining the nature of the problem from an individual perspective [10]. Therefore, to provide a reference for the implementation of precise interventions for MHL in patients with coronary artery disease, the current study used Latent Class Analysis (LCA) to categorise patients with coronary artery disease according to their MHL characteristics, explored factors influencing MHL and examined the relationship between the various MHL categories and quality of life.

2. Methods

2.1. Design and Participants

This was a descriptive, cross-sectional study. A total of 208 patients with coronary artery disease were selected from five wards at the Department of Cardiology of a tertiary hospital in Henan Province from June to September 2021 using the convenience sampling method. The inclusion criteria were as follows: those who satisfied the diagnostic criteria for coronary heart disease [11]; were ≥18 years of age; were conscious and able to cooperate, had no communication or understanding barriers; and provided informed consent. The exclusion criteria were as follows: those who had severe heart failure, other serious physical diseases and mental disorders. Among the 215 patients with coronary artery disease initially identified for analysis, 7 were excluded due to careless completion of the questionnaire (taking <5 min to fill out the form or providing similar answers), bringing the total number

of enrolled patients to 208, with a valid questionnaire return rate of 97%.

2.2. Data Collection

The inclusion and exclusion criteria were strictly followed in the identification of the study subjects, subsequently including those who were eligible for this study. With the help of the charge nurse, the study subjects were provided an explanation regarding the purpose and significance of this study. They were also informed of the voluntary nature of this study and were assured that the relevant information would be kept strictly confidential. After obtaining informed consent, the questionnaires were distributed to the study subjects, who were then provided an explanation about the method for completing the questionnaires and necessary the precautions. Those who were unable to fill out the questionnaire independently were provided assistance by investigators through dictation. All questionnaires were collected on-site and carefully checked to complete missing entries in a timely manner, with each questionnaire taking around 15 min to complete. At the end of the study, all data were double-checked and entered into a computer.

2.3. Instruments

2.3.1. The Demographic Questionnaire

The General Demographic Information form was used to collect the demographic and disease-related data of the patients, such as gender, age, education, number of stents implanted and cardiac function classifications.

2.3.2. Multiple Mental Health Literacy Scale

The Multicomponent Mental Health Literacy Scale (MMHL), developed by Jung [12] and revised by Ming Zhijun [7] in Chinese, is a widely used tool for assessing the level of MHL in adult populations. This study used the Chinese version of the revised version of Ming Zhijun. The scale consists of three dimensions, namely mental health knowledge (10 items), beliefs (8 items) and resources (4 items), for a total of 22 items. The mental health dimension was scored on a 5-point Likert scale, with "strongly agree" to "strongly disagree" scoring 0 - 4 and "don't know" scoring 5. The knowledge and belief dimensions were assessed based on a positive and negative question, respectively, using a dichotomous method of scoring wherein the positive question is provided a score of 1 when "strongly agree" and "agree" are selected and the negative question is provided a score of 5 when "strongly disagree" and "disagree" are selected. The total score ranges from 0 to 22 points, with higher scores indicating better MHL. The Cronbach's alpha coefficient of this scale was 0.909 in the current study.

2.3.3. China Questionnaire of Quality of Life in Patients with Cardiovascular Diseases

The China Questionnaire of Quality of Life in Patients with Cardiovascular Diseases (CQQC) was developed by the Cardiovascular Disease Committee of the Chinese Society of Rehabilitation Medicine and the Editorial Committee of the Cardiovascular Rehabilitation Medicine Journal [13]. The questionnaire consists

of 24 items under 6 dimensions (physical strength, medical condition, medical status, general life, psychosocial status and work interpersonal status). Each dimension could be used independently. The total score ranges from 0 to 154, with higher scores indicating higher levels of quality of life. The Cronbach's alpha coefficient of this scale was 0.862 in the current study.

2.4. Data Analyses

Latent category analyses were conducted using Mplus 8.3. From the initial one-category model to the final four-category model, all parameters were estimated by gradually increasing the number of categories until the best-fit index emerged. The Akaike information criterion (AIC), Bayesian information criterion (BIC) and sample-corrected BIC (adjusted Bayesian information criterion [aBIC]) are the most common methods currently used. The likelihood ratio test (LRT) and bootstrap-based likelihood ratio test (BLRT) were used to compare differences in model fit. The specific criteria were as follows: Smaller AIC and BIC values implied a better model fit. LMR (P) and BLRT (P) values were <0.05, implying that the previous profile was the best-fitting model. In addition, entropy values greater than 0.8 indicated that the latent categories were well separated [14].

Descriptive statistics analyses were performed using the IBM SPSS software (v25.0). Categorical variables were described as frequencies and percentages, continuous variables were described as means ± standard deviations and non-normally distributed variables were expressed as M (P25, P75). The LCA categorisation results were set as the dependent variable. Comparisons between groups for categorical variables were performed using χ^2 tests. Multiple linear regression analysis was used to examine the relationship between latent categories of MHL and quality of life. A P-value of <0.05 was considered as a statistically significant difference.

3. Results

3.1. Latent Categories of Mental Health Literacy

This study analysed models with different numbers of categories and compared five models. When the number of categories was between 1 and 5, AIC, BIC and aBIC gradually decreased. When the number of categories was 2, 3 and 4, LMR and BLRT remained statistically significant ($P < 0.005$). When the number of categories was 4, BIC values gradually slow down and entropy was >0.80, which indicated that the accuracy of this classification reached 90% (*i.e.*, the highest value). When the number of categories was 5, the entropy value decreased, and the LMR did not reach significance ($P = 0.8185$). According to the practical significance of the model and the number of samples included in the latent categories, four latent categories were selected as the best model after comprehensive consideration. **Table 1** presents the model fit statistics for the latent category estimates.

Figure 1 shows the distribution of the four categories of MHL in patients with coronary heart disease according to each entry. 1) Group C1 (13.5%) had a low probability of scoring on all items and was therefore named "low literacy". 2)

Group C2 (25.2%) scored high for both entry 8 (a person who becomes dirty and unkempt may be a sign of depression) and entry 12 (a person with depression has a weak personality) and low for entries 19 - 21, reflecting the fact that this group of patients scored high on the knowledge dimension and low on the beliefs and resources dimensions. Hence, this group was named "high knowledge-low resource type". 3) Group C3 (30.2%) had the highest scores for entries 19 - 22, with low knowledge, low beliefs and high resources; thus, it was named "low knowledge-high resources type". 4) Group C4 (30.8%) scored high on all items, with high knowledge, high beliefs and high resources, reflecting the high MHL of this group. Hence, it was named "high literacy type".

Table 1. Model fit indices of different latent categories (N = 208).

categories	L	AIC	BIC	aBIC	Entropy	LMR(*P*)	BLRT(*P*)	categorical probability
1	-2961.368	5966.736	6040.162	5970.455	—	—	—	—
2	-2470.804	5031.607	5181.797	5039.215	0.946	<0.001	<0.001	33.7/66.3
3	-2336.595	4809.19	5036.142	4820.686	0.947	0.003	<0.001	38.5/29.3/32.2
4	-2263.252	4708.504	5012.22	4723.887	0.956	0.001	<0.001	13.5/25.5/30.3/30.7
5	-2207.473	4642.946	5023.426	4662.218	0.947	0.819	<0.001	25.5/16.8/24.5/13.5/19.7

Abbreviations: AIC, Akaike information criterion; BIC, Bayesian information criterion; aBIC, adjusted Bayesian information criterion; LMR, Lo-Mendell-Rubin adjusted likelihood ratio test; BLRT, bootstrapped likelihood ratio test. $P < 0.05$.

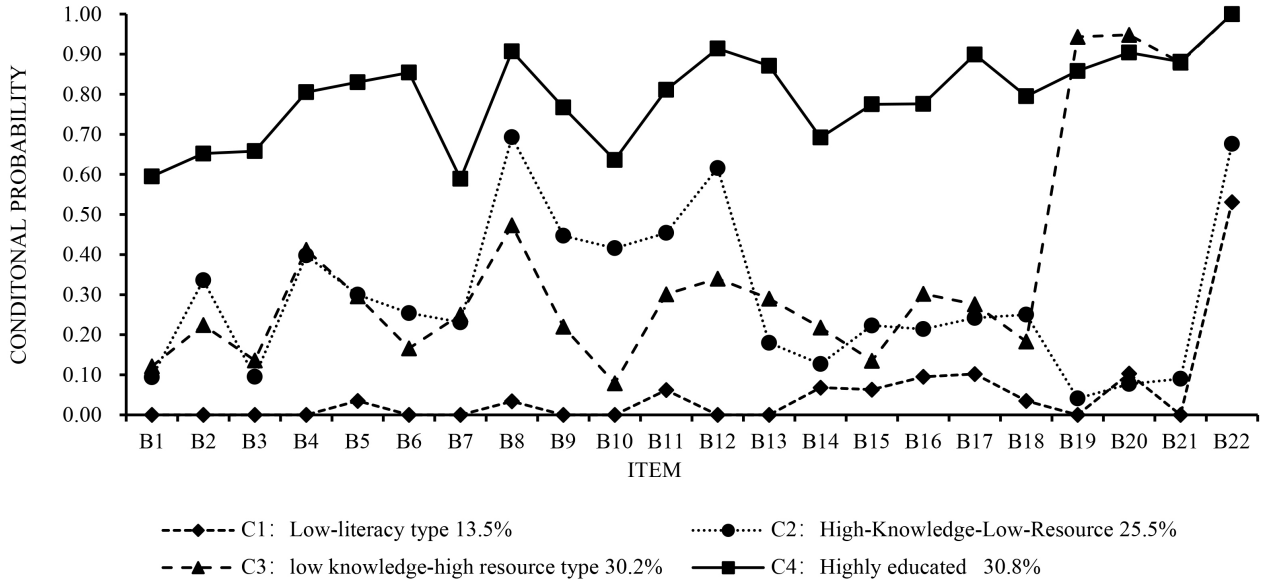

Figure 1. Conditional probability distribution on each item of the Mental Health Literacy Scale for coronary artery disease patients in model 4.

3.2. Descriptive Statistics

A total of 208 patients with coronary artery disease (average age, 68.85 ± 12.45 years) were included in this study, among whom 123 (59.1%) were male and 85 (40.9%) were female. Patients with coronary artery disease had a MHL score, knowledge dimension score, belief dimension score and resource dimension score

of 12 (7, 17), 6 (4, 9), 5 (3, 7) and 1 (0, 3), respectively. Quality of life scores ranged from 0 to 154, with a total score of 80.48 ± 22.831. **Table 2** summarises the rest of the general information.

Table 2. Univariate analysis of the characteristics of the patients in different latent categories.

Item	Low literacy (n28)	High knowledge-low resource (n53)	Low knowledge-high resource (n63)	High literacy (n64)	c^2/k	*P*
genders					5.70[a]	0.127
Male	22 (78.6)	32 (60.4)	35 (55.6)	34 (53.1)		
Female	6 (21.4)	21 (39.6)	28 (44.4)	30 (46.9)		
Age (years)					13.88[a]	0.031
18 - 59	9 (32.1)	12 (22.6)	20 (31.7)	18 (28.1)		
60 - 79	14 (50)	22 (41.5)	31 (49.2)	40 (62.5)		
≥80	5 (17.9)	19 (35.8)	12 (19.0)	6 (9.4)		
Education level					3.74[b]	0.291
Elementary school or below	10 (35.7)	16 (30.2)	20 (31.7)	20 (31.3)		
High school or technical secondary schoo	10 (35.7)	23 (43.4)	28 (44.4)	35 (54.7)		
College degree or above	8 (28.6)	14 (26.4)	15 (23.8)	9 (14.1)		
Marriage					4.82[a]	0.186
Married	25 (89.3)	39 (73.6)	52 (82.5)	56 (87.5)		
Unmarried/divorced/widowed	3 (10.7)	14 (26.4)	11 (17.5)	8 (12.5)		
Medical Payment Method					5.35[a]	0.148
Urban and rural residents	7 (25.0)	21 (39.6)	15 (23.8)	25 (39.1)		
Other	21 (75.0)	32 (60.4)	48 (76.2)	39 (60.9)		
Average Monthly Personal Income level (Yuan/month/person)					17.04[a]	0.048
<1000	8 (28.6)	17 (32.1)	13 (20.6)	5 (7.8)		
1001 - 3000	9 (32.1)	10 (18.9)	19 (30.2)	21 (32.8)		
3001 - 5000	6 (21.4)	17 (32.1)	17 (27.0)	16 (25.0)		
>5000	5 (17.9)	9 (17.0)	14 (22.2)	22 (34.4)		
Cardiac Function Classification					1.55[b]	0.67
Grade I	10 (35.7)	13 (26.4)	15 (23.8)	17 (28.2)		
Grade II	10 (35.7)	19 (35.8)	26 (41.2)	26 (40.6)		
Grade III	5 (17.9)	9 (17.0)	11 (17.5)	10 (15.6)		
Class IV	3 (10.7)	11 (20.8)	11 (17.5)	10 (15.6)		

[a]chi-square test; [b]K-WH rank sum test.

Significant differences between the four latent categories of MHL in patients with coronary artery disease were observed statistically according to the patients' age and monthly income (all $P < 0.05$; **Table 2**).

The four latent categories were used as the dependent variables, whereas indicators determined to be significant during univariate analysis were used as the independent variables. Multicategorical logistic regression analysis was performed with the C4 high literacy type as the reference group. Our results showed that age and monthly income were predictors of the latent categories of MHL, as shown in **Table 3**.

Table 3. Multiple logistic regression analysis of 4 latent mental health literacy classes.

Item	Regression coefficient	Standard error	Wald χ^2	P	OR 值	Lower limit of 95% *CI*	Upper limit of 95% *CI*
Comparison of C1 and C4							
constant term	0.668	0.738	0.819	0.365	—	—	—
Age							
18 - 59	−0.174	0.773	0.051	0.822	0.84	0.185	3.82
60 - 79	−0.417	0.723	0.334	0.563	0.659	0.16	2.715
Average monthly income							
<1000	−1.836	0.777	5.587	0.018	0.159	0.035	0.731
1001 - 3000	−1.367	0.773	3.131	0.077	0.255	0.056	1.159
3001 - 5000	−1.192	0.722	2.729	0.099	0.304	0.074	1.249
Comparison of C2 and C4							
Constant term	2.004	0.625	10.278	0.001	—	—	—
Age							
18 - 59	−1.544	0.646	5.719	0.017	0.214	0.06	0.757
60 - 79	−1.414	0.576	6.018	0.014	0.243	0.079	0.753
Average monthly income							
<1000	−1.692	0.676	6.273	0.012	0.184	0.049	0.692
1001 - 3000	−0.575	0.659	0.76	0.383	0.563	0.155	2.048
3001 - 5000	−1.591	0.669	5.658	0.017	0.204	0.055	0.756
Comparison of C3 and C4							
Constant term	1.323	0.648	4.175	0.041	—	—	—
Age							
18 - 59	−0.455	0.627	0.528	0.468	0.634	0.186	2.166
60 - 79	−0.7	0.58	1.457	0.227	0.497	0.159	1.547
Average monthly income							
<1000	−1.217	0.646	3.55	0.06	0.296	0.083	1.05
1001 - 3000	−0.714	0.656	1.187	0.276	0.49	0.135	1.769
3001 - 5000	−0.863	0.634	1.851	0.174	0.422	0.122	1.463

Abbreviations: OR, odds ratio; CI, confidence interval. $P < 0.05$.

3.3. Relationship between Mental Health Literacy and Quality of Life

Multiple linear regression analyses were conducted with quality of life scores as the dependent variable and latent categories as the independent variable (dummy variables were set up and the high literacy type was used as the reference group) after controlling for confounding factors, such as age and monthly income. Our results showed that the low literacy, high knowledge-low resources and low knowledge-high resources types all positively predicted quality of life when compared to the high literacy type (all $P < 0.05$), explaining 22.4% of the total variance (**Table 4**).

Table 4. Multiple linear regression analysis of Latent categories and quality of life.

categories	*B*	*SB*	*t*	*P*	Lower limit of 95% *CI*	Upper limit of 95% *CI*
(Constant)	52.250	-	15.139	<0.001	45.445	59.055
Low literacy type	46.536	0.508	7.438	<0.001	34.201	58.871
High knowledge-low resource type	26.882	0.375	5.242	<0.001	16.771	36.993
Low knowledge-high resource type	20.925	0.308	4.27	<0.001	11.263	30.586

Note: $R^2 = 0.235$, adjusted $R^2 = 0.224$, $F = 20.907$, $P < 0.05$.

4. Discussion

The current study categorised the MHL of patients with coronary artery disease into four latent categories, namely low literacy (13.5%), high knowledge-low resources (25.5%), low knowledge-high resources (30.2%) and high literacy (30.8%). Notably, our findings showed that patients in the "low literacy" category were more likely to develop negative emotions and experience psychological difficulties, have difficulty coping with the psychological stress of the disease and have a twofold higher risk of complications than did those in the high literacy category [15]. Patients with low literacy may lack the necessary health knowledge and skills to effectively manage their health conditions and make full use of available healthcare resources, suggesting that health knowledge and skills training provided by healthcare professionals through health education activities can help them better understand their disease and treatment options, improve self-management skills and enhance their personal coping abilities. Moreover, 25.5% of our patients were in the "high knowledge-low resources type", who had considerable knowledge regarding coronary artery disease but lacked practical resources (financial support, social support etc.), which made it difficult for them to prevent, manage and control the disease. Healthcare professionals can therefore suggest relevant policies that provide appropriate resource support, such as financial assistance or access to exercise facilities, to help patients overcome practical difficulties, better implement self-management and strengthen their perceived control over their disease, thereby creating an effective virtuous circle [16]. Besides, 30.2% were in the "low

knowledge-high resource type". Although these patients lacked in-depth knowledge of coronary artery disease, they may have possessed sufficient financial and social support, which facilitates disease prevention and management. However, they may be unaware of how to fully utilise these resources to improve their health. Studies have suggested that healthcare professionals targeting such patients can provide health education to help them understand coronary artery disease and its management and better utilise available resources.

Evidence has shown an association between the level of MHL and age, such that the low literacy, high literacy and high knowledge-low resource groups are more likely to comprise middle age and young patients, old age patients and very old age patients, respectively. According to the actual situation in China, patients in their middle age, old age and very old age have been described as those aged 18 - 59, 60 - 79, and 80 years and older, respectively [17]. Young and middle-aged patients have low levels of MHL given their need to assume multiple social roles, high social and work pressures, lack of effective psychological adjustment, inability to promptly resolve negative emotions and insufficient attention to their own mental health [18]. Conversely, elderly patients are socially experienced and have the time and energy to acquire health information through diverse channels and methods, and therefore have a fuller knowledge of mental health [19]. Very old age patients are older and have a weakened ability and willingness to accumulate new knowledge, as well as a decreased ability to obtain mental health information from outside sources [17], which hinders access to mental health resources, thereby lowering their level of MHL. Therefore, other health management organisations should expand the channels of mental health education and enrich the content of mental health education. Moreover, healthcare professionals should develop appropriate mental health education programs according to the age and mental health needs of the patients and guide them in acquiring more comprehensive mental health knowledge to improve their MHL level.

Monthly income has been directly associated with the level of MHL, such that low-income patients were more likely to be included in the low-literacy group, consistent with the findings of Song [20] and Laoise [21]. Patients with belonging to lower-income families are more concerned about meeting basic needs, pay less attention to mental health knowledge, have fewer available resources and are prone to neglecting mental health problems [22]. In contrast, patients from higher-income families are more likely to seek resources to enhance their spiritual and cultural needs [20] and pay more attention to their own mental health after meeting their material needs. Therefore, healthcare professionals should have a comprehensive understanding of the basic needs of each patient, improve patient communication and interaction, identify the psychological problems of each patient as early as possible and provide guidance and help patients expand their mental health knowledge to correctly understand the disease. Simultaneously, we recommend that the relevant departments provide medical assistance, such as medical subsidies, to low-income families and appropriately increase the reimbursement

rate.

The results of the current study showed that after controlling for confounders, low literacy, high knowledge-low resources and low knowledge-high resources positively predicted quality of life ($P < 0.05$). This finding indicates that an individual's quality of life is affected by not only their level of knowledge and resources but also their level of MHL. Increasing the level of MHL can help improve mental health, reduce burden and enhance quality of life [23]. Previous studies have shown that certain psychological interventions, such as positive thinking therapy [24], mental resilience training [25] and focused solution short-course psychological intervention [26], can effectively improve patients' quality of life. Therefore, we recommended that healthcare professionals emphasise the positive impact of MHL on quality of life and that factors such as individual literacy, knowledge and resources be comprehensively considered in the pursuit of better quality of life.

The current study has some limitations worth noting. First, this study was conducted in only one tertiary hospital and did not cover other hospital levels. Future studies may consider launching a large-scale study involving hospitals from different regions to obtain more comprehensive data. Second, our sample size was quite small. As such, future studies should include a larger sample size to improve data representativeness.

5. Conclusion

Improving MHL is important for the prevention and treatment of coronary artery disease. According to the results of our latent category analysis, the MHL of patients with coronary artery disease can be categorised into four types: low literacy, high knowledge-low resources, low knowledge-high resources and high literacy, highlighting the need for healthcare professionals to adopt different intervention and support strategies according to patient type. For different types of patients, appropriate health knowledge and skills training, practical resource support, disease awareness and resource utilisation ability assistance should be provided. This categorisation and management will help patients meet their needs and improve their MHL and quality of life.

Relevance for Clinical Practice

Mental health literacy in patients with CAD is crucial for improving psychological adaptability and quality of life. First, by detecting differences in mental health literacy traits, healthcare providers can gain a better understanding of their patients' particular knowledge, beliefs, and resources. Second, the study discovered a correlation between mental health literacy and quality of life, emphasizing the necessity of psychological interventions in improving the well-being of patients. Consequently, healthcare practitioners can devise more individualized mental health intervention techniques to effectively improve the quality of life and psychological adaptability of patients with CAD.

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Authors' Contributions

Qiuju Shan and Panpan Wang were responsible for the formulation of the article framework; Jing Zhao, Zhenzhen Wang, Miaoliu Lian and Yikai Liu were responsible for the data collection and process; Panpan Wang and Yongxia Mei were responsible for the content supplement; Zhiguang Ping was responsible for the data analysis and improvement of the article. All authors read and approved the final manuscript.

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Data Availability Statement

The data are not publicly available due to privacy or ethical restrictions.

Ethics Statement

This study protocol was approved by the Second Clinical Medical School of Zhengzhou University (Date: 14.04.2021 & No: 2021281). All the patients included in the study were informed in advance of the study content and that they had the right to withdraw from the research at any time.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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