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ORIGINAL RESEARCH

Health Belief Clusters Among Stroke Patients: Insights for Tailored Interventions Using Latent Profile Analysis

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Aim: To determine the latent profiles of health beliefs for stroke patients and analyze the differences among different clusters of stroke patients.

Methods: 1358 stroke patients were recruited by a stratified cluster random sampling approach in Henan Province, China, from March to April 2023. The instruments used were the general situation questionnaire, Stroke Knowledge Questionnaire, National Institute of Health Stroke Scale, modified Rankin Scale, Health Behavior Scale for Stroke Patients, and Short Form Health Belief Model Scale. Questionnaires were distributed through the Questionnaire Star Platform. The health belief clusters were determined by Mplus8.3. Pearson's chi-square test and one-way ANOVA in SPSS 26.0 were applied to examine the profiles' differences.

Results: A total of 1358 questionnaires were returned, resulting in an effective response rate of 87.33%. Model fitting indicators supported the three-class model of health beliefs. Latent profile analysis identified three distinct clusters, labeled Class 1 (health belief absence cluster totally), Class 2 (self-deficiency deprivation cluster), and Class 3 (higher perception behavior disorder cluster). Total Short Form Health Belief Model Scale scores among Class 1–3 differed significantly. Single-factor analysis showed statistical significance in the modified Rankin Scale, health behavior, health knowledge, education, residence, profession, medical insurance mode, and hypertension.

Conclusion: Individual heterogeneity is evident in health beliefs among stroke patients. The belief can be divided into three potential clusters. The study provides reference for the developing regular health belief and provide methodological guidance for other clinical studies. Clinicians are able to offer tailored guidance according to the different health beliefs of patients.

Keywords: stroke, latent profile analysis, health belief, nursing, health behavior, health knowledge

Introduction

An acute attack of cerebral blood circulation disorders is a stroke, also known as a cerebrovascular accident.[1] Stroke is caused by various circumstances, especially cerebral vascular stenosis, obstruction, or sudden rupture, which generates brain tissue damage and clinical symptoms.[2] In addition to high morbidity and disability rates, stroke also has a high mortality, economic burden, and recurrence.[3] It has become the second leading cause of mortality among adults and the third leading cause of long-term disability, which poses a severe threat to human health.[4] The Lancet revealed that China had the highest incidence of stroke in the world. The lifetime risk of stroke was calculated at 39.9%, which meant that about two of every five individuals would suffer a stroke.[5,6] A survey of 14244 stroke patients obtained through the China National Stroke Registry (CNSR) found that the recurrence rate was 8%.[7,8] Stroke is still a significant public health issue.[9] The prevalence and incidence rates show an upward trend, and the outlook does not appear bright.

It is gratifying that 94.3% of stroke occurrences are closely related to modifiable risk factors, and health behavior is crucial for preventing and improving risk factors.[10,11] Health beliefs are the driving force for behavior change, which can

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directly affect patients' health behaviors and improve their behavior levels through multiple indirect pathways. They help patients establish positive health beliefs and are the key to enhancing their health behavior intentions. However, the health beliefs of stroke patients need to be improved. Accordingly, health belief can be defined as one's attitude towards disease, knowing the severity and susceptibility of disease, and perception of health behavior disorders and benefits.[12] Patients who are aware of their own risk factors, recurrence risk, and perceive their own health threats are more likely to take proactive response measures, verifying the correlation between disease threats and health behavior in HBM. Related studies have shown that young, middle-aged, and elderly patients all have certain misconceptions about disease risk awareness, and there is a general lack of awareness of recurrence risk. Research data shows that up to 61.5% of stroke patients do not understand the risk of stroke recurrence, indicating that stroke patients currently have insufficient awareness of their own disease risk, difficulty in identifying their own recurrence risk factors, or difficulty in effectively combining their own risk factors with the risk of onset, that is, insufficient perception of health threats by patients, which affects their health behavior level.

Numerous studies[13–15] have shown that people with better health beliefs may have an enhanced quality of life following a stroke. In the early days, the health belief model (HBM) was used for disease prevention and asymptomatic disease screening tests. Gradually, Becker et al refined and developed it to serve as a basic mode of health behavior intervention.[16] Now, as a cognitive model, it consists of six dimensions: perception of disease susceptibility, perception severity, perception benefits, perception disorder, health motivation, and self-efficacy.[11,17] The HBM advocates the change of health behavior through the transformation of health belief, emphasizing that changing an individual's perception is fundamental to changing unhealthy behavior. Furthermore, in most cases, the scales are used as an indicator to evaluate the level of health belief without considering the heterogeneity of different patient groups.[18–20] Latent profile analysis (LPA) is a technique for posterior probability classification. This approach focuses on distinguishing subpopulations based on individual-centered features and depicting the heterogeneity between populations intuitively compared to traditional clustering.[21]

Consequently, the study utilized LPA to evaluate the health belief level of stroke patients, classify the corresponding health belief, and obtain the specific explicit characteristics of potential classes. Via it, researchers can understand the proportion of various clusters and identify the categories and characteristics of health beliefs among stroke survivors to guide the development and implementation of clinically targeted interventions for stroke survivors.

Methods

Design and Setting

A descriptive cross-sectional design on stroke survivors was employed. A stratified cluster random sampling method was used to collect participants in Henan Province, China, from March to April 2023. All of the participants obtained informed consent.

Participants

Inclusion criteria (a) who met the diagnostic criteria of Chinese Guidelines for the Diagnosis and Treatment of Cerebral Hemorrhage (2019)[22] and Chinese Guidelines for the Diagnosis and Treatment of Acute Ischemic Stroke (2018);[23] (b) who were in a stable condition; (c) who were informed consent and voluntary participation; (d) who had a particular language communication ability. Exclusion criteria (a) participating in other studies; (b) unable to live with other serious illnesses; (c) suffering from mental illness.

There is no definite calculation method for the sample size of LPA. However, this method has its criteria for selecting a sample size. A model with more samples and indexes produced better classification results.[24,25] Meyer et al[26] found that LPA generally required at least 500 samples. Yang et al[27] pointed out that to obtain more robust statistical analysis results, the average sample size of each section needed to reach more than 50. What's more, in cross-sectional survey studies, the sample size should be at least 10 times that of the observed variable, and then add 20% sample loss. The total number of entries is 81 and the calculated sample size is at least 1013. Finally, 1186 stroke patients were enrolled in this study finally.

Measurements

The general information questionnaire was designed according to the research purpose and characteristics of stroke survivors, including general demographic characteristics (gender, age, BMI, education, residence, profession, household income monthly, etc) and clinical characteristics (family history of stroke, type of stroke, number of stroke episodes and complications).

Stroke Knowledge Questionnaire (SKQ)[28] was prepared to assess the health knowledge of stroke patients. The questionnaire includes 36 items covering 8 dimensions: daily living, exercise, diet, stroke risk factors, taking medicine, regular monitoring, stroke precursors, and stroke management. Items are assigned 1 and 0 points, respectively, in terms of whether they know. The total scores range from 0 to 36 points. A higher score equals higher health knowledge. The Cronbach' s α was 0.87.

Health Behavior Scale for Stroke Patients (HBS-SP)[29] is mainly used to measure health behaviors and includes 25 items and 7 dimensions. The dimensions are exercise, nutrition, low-salt diet, blood pressure monitoring, smoking cessation, alcohol restriction, and medication. The Cronbach's α was 0.853.

Short Form Health Belief Model Scale (SF-HBMS)[30] was developed by Wan and used to measure health belief. With 20 items in total, the scale includes 6 dimensions: susceptibility, severity, health motivation, self-efficacy, health behavior benefits, and health behavior disorder. Health behavior disorder is the reverse score. Higher scores indicate higher health beliefs. The Cronbach's α was 0.835.

Ethics

The Ethical Committee of the First Affiliated Hospital of zhengzhou university (2020-KY-459) approved the study. In addition, before the beginning of the study, participants were informed of the purpose and content of the research. They had the right to participate voluntarily and withdraw at any time. Furthermore, the questionnaires were saved to an encrypted computer, and the contents were only used for scientific purposes. This study was conducted following the Declaration of Helsinki.

Data Collection

Stroke patients in hospitals in Henan Province were selected by stratified cluster random sampling, and the questionnaires were gathered via the Questionnaire Star Platform. A stratified cluster random sampling was used to determine patients. Henan Province was divided into five parts by region. The tertiary hospitals in each region were numbered. Finally, 5 tertiary hospitals were selected. We obtained the consent of the hospital managers and their cooperation. The researchers sent the questionnaire link to the nurses in charge of the relevant hospitals through WeChat. The nurses received our unified training and guidance to investigate and select designated patients. This questionnaire adopted unified instructions explaining the purpose, content, and method. Patients can complete the questionnaire on their or their minders' mobile phones. All questionnaires can only be submitted once all information has been entered to ensure integrity. After that, data were exported to Excel through the Questionnaire Star Platform, with 1358 questionnaires collected. Then, two investigators examined the questionnaires. Afterwards, any questionnaire with incomplete information or obvious errors will be discarded. Eventually, an effective recovery rate of 87.33% was achieved for the 1186 valid questionnaires recovered.

Data Validity and Reliability

Previous studies have demonstrated good reliability and validity of the scale used in this study. In addition, Cronbach's α of SKQ, HSB-SP, and SF-HBMS was 0.940, 0.888, and 0.858, respectively, indicating high reliability and validity. Before the survey, nurses were given special training, and then investigators explained each item of the questionnaire so that nurses guided the subjects to complete it with uniform instructions. When collecting the data, the questionnaires were designed for each item as a required response and filling restrictions to ensure the integrity and response rate of the data collection process.

Data Analysis

The data were preliminarily collated on the Questionnaire Star Platform. SPSS 26.0 and Mplus 8.3 were used to analyze the data. Following a normal distribution, measurement data were represented by the mean and standard deviation. One-way analysis of variance was used for comparisons among multiple groups. Count data were expressed as frequency and percentage, and comparisons between groups were performed using the chi-square test or Fisher's exact probability method. The difference was statistically significant when $P < 0.05$. Mplus8.3 was used to analyze the latent profile of about 20 items related to health beliefs in stroke patients. Starting with a single-category model, the number of models gradually increased. The model fitting index and its theoretical significance were considered comprehensively until the most optimal fit of the data model was found. LPA statistical indicators include likelihood ratio (Log), Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), Sample Size Adjusted BIC (SABIC), classification accuracy index Entropy, Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (LMRT) and Bootstrap Likelihood Ratio Test (BLRT). The smaller AIC, BIC, and SABIC signs, the better fitting. Entropy ranges from 0 to 1. A larger figure indicates a higher classification accuracy. Entropy≥0.80 means that over 90% of the classification is correct.[31] LMRT and BLRT both reached significant levels ($P< 0.05$), indicating that the model of k categories was better than that of k-1 categories.[32] Finally, the latent categories were grouped as a new classification variable to analyze the influence of various factors (gender, health behavior, health knowledge, education, profession, etc) on different clusters of health beliefs among stroke patients. $P < 0.05$ shows that the difference was statistically significant in this case.

Results

General Information of the Sample

A total of 1186 stroke patients were investigated in this study, aged 19 to 95, with an average age of 62.08 ± 13.30. BMI was (23.96 ± 3.15) kg/m^2, mRS score was 1.65 ±1.58, and NIHSS score was 3.93 ± 5.22. The average health knowledge, behavior, and belief scores were 30.65 ±7.08, 63.66±10.95, and 74.75±10.21, respectively. Table 1 provides further general information.

Table 1 General Information on Stroke Patients (n=1186)

Variables	N (%)	Variables	N (%)
Gender		Primary caregivers	
Male	672 (56.7)	Spouse	656 (55.3)
Female	514 (43.3)	Child	405 (34.1)
Education		Nanny or nurse	15 (1.3)
Elementary school or below	503 (42.4)	The other	110 (9.3)
Junior school	357 (30.1)	Medical insurance mode	
High school	181 (15.3)	Urban residents/workers' medical insurance	451 (38.0)
Undergraduate and above	145 (12.2)	New rural cooperative medical insurance	705 (59.4)
Profession		No health insurance	9 (0.8)
No	784 (66.1)	The other	21 (1.8)
Full-time employee	156 (13.2)	Type of stroke	
Part-time employee	43 (3.6)	Hemorrhagic	218 (18.4)
Retire	203 (17.1)	Ischemic	968 (81.6)
Household income/month (RMB)		Number of stroke episodes	
<3000	641 (54.0)	The first	810 (68.3)
3000-5000	431 (36.3)	Recurrence	376 (31.7)
5000-10,000	100 (8.4)	Family history of stroke	
>10,000	14 (1.2)	Yes	235 (19.8)
Marital status		No	951 (80.2)

(*Continued*)

Table 1 (Continued).

Variables	N (%)	Variables	N (%)
Nonmarried	36 (3.0)	Complication	
Married	1045 (88.1)	Hypertension	776 (65.4)
Divorced	12 (1.0)	Diabetes	313 (26.4)
Widowed	93 (7.8)	Hyperlipidemia	236 (19.9)
Residence		Heart disease	174 (14.7)
Rural	807 (68.0)	No	273 (23.0)
Urban	379 (32.0)		

Description of Three Clusters

The latent profile analysis model was fitted by performing LPA and gradually increasing the number of categories from one category to 20 items in 6 dimensions: susceptibility, severity, health motivation, self-efficacy, health behavior benefit, and health behavior problem. The latent class model was set as 5. The fitting results of the model are shown in Table 2. AIC, BIC, and SABIC gradually decreased with an increase in profiles. However, there was a slight drop from category 3 into category 5. The Entropy increased as the number of profiles increased. Upon reaching four profiles, the probability of one class was too low. The study found that each profile needed sufficient individuals. Makikangas[33] recommended that the profile ratio be increased by at least 2%; moreover, it should be carefully considered whether to keep it. Previous studies[34] revealed that the selection of models relied heavily on sampling results, so suboptimal models with data results were often selected. Class 1 to Class 3 had average attribution probabilities of 0.982, 0.975, and 0.984, respectively. It demonstrated that the potential category model results were credible. After comprehensively considering the models' fitting indexes and clinical significance, the three models' categories were finally selected as the optimal classification results for stroke patients' health beliefs.

Identification of Latent Clusters in Health Belief

The scores of each item in SF-HBMS for the three clusters in this study are shown in Figure 1. The total average the score of health belief was 3.74±0.51. Three clusters are further labeled based on mean scores for SF-HBMS, health belief definition, and some clinical symptom characteristics. As revealed in Figure 1, Class 1 had lower health belief scores than the other two clusters. Patients had not yet realized the benefits of healthy behavior to reduce the risk of stroke recurrence. Therefore, it was named health belief absence cluster totally. C2 had a moderate level of health belief yet less self-deficiency. This group usually had deviations in the evaluation and judgment of their abilities. It was less likely to adopt healthy behavior. So it was named the self-deficiency deprivation cluster. C3 reported good levels of health belief with the lowest health behavior disorder. This group generally believed they would encounter obstacles in adopting healthy behavior and was labeled higher perception behavior disorder cluster.

Table 2 Fitting Indexes of LPA for Health Belief Types (n=1186)

Class	K	AIC	BIC	SABIC	LMRT	BLRT	Entropy	Class Probability
1	40	66043.599	66246.732	66119.677	—	—	—	1
2	61	59204.513	59514.292	59320.533	<0.05	<0.001	0.911	0.494/0.501
3	82	55340.480	55756.904	55496.442	<0.05	<0.001	0.955	0.138/0.474/0.388
4	103	53664.900	54187.969	53860.803	<0.05	<0.001	0.961	0.020/0.446/0.152/0.382
5	124	52323.778	52953.492	52559.622	<0.05	<0.001	0.946	0.020/0.150/0.437/0.210

Abbreviations: K, freedom of mo AIC, the Akaike Information Criterion; BIC, the Bayesian Information Criterion; BLRT, Bootstrapped Likelihood Ratio Test; LMRT, Lo-Mendell-Rubin Adjusted Likelihood Ratio Test; SABIC, Sample Size Adjusted BIC.
Abbreviations: K, freedom of mo AIC, the Akaike Information Criterion; BIC, the Bayesian Information Criterion; BLRT, Bootstrapped Likelihood Ratio Test; LMRT, Lo-Mendell-Rubin Adjusted Likelihood Ratio Test; SABIC, Sample Size Adjusted BIC.

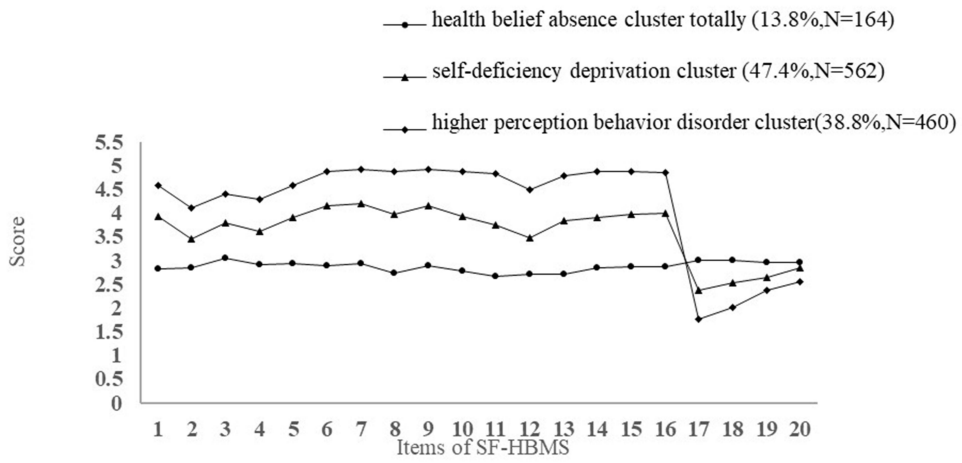

Figure 1 Scores of health belief in three profiles.
Abbreviation: SF-HBMS, Short Form Health Belief Model Scale.

Characteristic Differences of Latent Clusters Among Stroke Patients

The total scores of health belief and the scores of each dimension of latent class clusters are compared in Table 3. According to the results of the three clusters, the estimated potential groups were used as a new variable output. Then, the group number generated by the program was classified. The demographic and clinical characteristics were statistically described. The differences among the three clusters in related variables are compared in Table 4. There were statistically significant differences in mRS, health behavior, health knowledge, education, profession, residence, medical insurance mode, and hypertension among stroke patients in the three clusters (χ^2 values were 3.250, 102.300, 78.760, 27.036,

Table 3 Health Belief Scores of Different Clusters of 1186 Stroke Patients (Mean ± SD)

Class	Number	Susceptibility	Severity	Health Motivation	Self-Efficacy	Health Behavior Benefit	Health Behavior Disorder	The Total Score of Health Belief
C1	164	5.62±1.68	8.89±2.26	11.43±2.74	8.12±2.04	11.26±2.57	11.90±2.78	57.23±7.12
C2	562	7.40±1.44	11.3±1.98	16.47±1.77	11.14±1.46	15.68±1.55	10.40±2.68	72.38±4.76
C3	460	8.69±1.58	13.27±2.19	19.60±0.88	14.21±1.14	19.41±1.12	8.69±4.29	83.88±4.82
F		256.91	285.31	1479.09	1229.06	1732.87	63.47	1718.09
P		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Notes: Class 1 (health belief absence cluster totally); Class 2 (self-deficiency deprivation cluster); Class 3 (higher perception behavior disorder cluster).

Table 4 The Difference in Latent Profiles for Stroke Patients (n=1186)

Factors	Health Belief Absence Cluster Totally	Self-Deficiency Deprivation Cluster	Self-Deficiency Deprivation Cluster	Statistics (χ^2/*F*, *P*)
Age, mean ±SD	62.77±14.96	62.69±12.48	61.09±13.60	2.090 (0.124)
BMI, mean ±SD	23.6±3.14	23.9±2.95	24.1±3.37	1.740 (0.175)
HBS-SP, mean ±SD	57.54±8.93	61.32±8.47	68.71±12.17	102.300 (0.001**)
SKQ, mean ±SD	26.80±9.20	29.44±7.04	33.50±4.85	78.760 (0.001**)
Gender, n (%)				1.480 (0.477)
Male	99 (60.4)	310 (55.2)	263 (57.2)	
Female	65 (39.6)	252 (44.8)	197 (42.8)	

(*Continued*)

Table 4 (Continued).

Factors	Health Belief Absence Cluster Totally	Self-Deficiency Deprivation Cluster	Self-Deficiency Deprivation Cluster	Statistics (χ^2/*F*, *P*)
Education, n (%)				27.036 (0.001**)
Elementary school or below	81 (49.4)	261 (46.4)	161 (35.0)	
Middle school	37 (22.6)	175 (31.1)	145 (31.5)	
High school	21 (12.8)	72 (12.8)	88 (19.1)	
Undergraduate and above	25 (15.2)	54 (9.6)	66 (14.3)	
Residence, n (%)				14.904 (0.001**)
Rural	116 (70.7)	408 (72.6)	283 (61.5)	
Urban	48 (29.3)	154 (27.4)	177 (38.5)	
Profession, n (%)				26.706 (0.001**)
No	108 (65.9)	407 (72.4)	269 (58.5)	
Full-time working	26 (15.9)	63 (11.2)	67 (14.6)	
Part-time job	7 (4.3)	18 (3.2)	18 (3.9)	
Retire	23 (14.0)	74 (13.2)	106 (23.0)	
Primary caregivers [a], n (%)				3.387 (0.759)
Spouse	89 (54.3)	321 (57.1)	246 (53.5)	
Child	58 (35.4)	190 (33.8)	157 (34.1)	
Nanny or nurse	2 (1.2)	6 (1.1)	7 (1.5)	
The other	15 (9.1)	45 (8.0)	50 (10.9)	
Medical insurance mode [a], n (%)				20.009 (0.002*)
Urban residents/workers' medical insurance	57 (34.8)	188 (33.5)	206 (44.8)	
New rural cooperative medical Insurance	102 (62.2)	363 (64.6)	240 (52.2)	
No health insurance	3 (1.8)	3 (0.5)	3 (0.6)	
The other	2 (1.2)	8 (1.4)	11 (2.4)	
Household income/month (RMB) [a], n (%)				9.015 (0.173)
<3000	97 (59.1)	314 (55.9)	230 (50.0)	
3000-5000	48 (29.3)	200 (35.6)	183 (39.8)	
5000-10,000	16 (9.8)	41 (7.3)	43 (9.3)	
>10,000	3 (1.8)	7 (1.2)	4 (0.4)	
Marital status [a], n (%)				2.769 (0.844)
Nonmarried	7 (4.3)	18 (3.2)	11 (2.4)	
Married	140 (85.4)	496 (88.3)	409 (88.9)	
Divorced	2 (1.2)	5 (0.9)	5 (1.1)	
Widowed	15 (9.1)	43 (7.7)	35 (7.6)	
Clinical characteristics				
NIHSS, mean ±SD	4.29±5.24	4.07±5.35	3.64±5.05	1.290 (0.276)
mRS, mean ±SD	1.81±1.79	1.72±1.57	1.51±1.52	3.250 (0.039*)
Type of stroke, n (%)				4.720 (0.094)
Hemorrhagic	30 (18.3) 98 (21.3) 134 (81.7) 472 (84.0) 362 (78.7)	90 (16.0)	98 (21.3)	
Ischemic	134 (81.7)	472 (84.0)	362 (78.7)	
Number of stroke episodes, n (%)				0.844 (0.656)
The first	109 (66.5)	380 (67.6)	321 (69.8)	
Recurrence	55 (33.5)	182 (32.4)	139 (30.2)	

(*Continued*)

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Table 4 (Continued).

Factors	Health Belief Absence Cluster Totally	Self-Deficiency Deprivation Cluster	Self-Deficiency Deprivation Cluster	Statistics (χ^2/*F*, *P*)
Family history of stroke, n (%)				1.162 (0.559)
Yes	34 (20.7)	104 (18.5)	97 (21.2)	
No	130 (79.3)	458 (81.5)	363 (78.9)	
Hypertension, n (%)				8.680 (0.013)
No	71 (43.3)	175 (31.1)	164 (35.7)	
Have	93 (56.7)	387 (68.9)	296 (64.3)	
Diabetes, n (%)				0.332 (0.847)
No	120 (73.2)	418 (74.4)	335 (72.8)	
Have	44 (26.8)	14 (25.6)	12 (27.2)	
Hyperlipidemia, n (%)				0.136 (0.934)
No	132 (80.5)	452 (80.4)	366 (79.6)	
Have	32 (19.5)	110 (19.6)	94 (20.4)	
Heart disease, n (%)				0.319 (0.852)
No	142 (86.6)	480 (85.4)	390 (84.8)	
Have	22 (13.4)	82 (14.6)	70 (15.2)	

Notes: **P*<0.05; ***P*<0.001; [a] Fisher's exact test.
Abbreviations: SD, standard deviation; BMI, body mass index; SKQ, Stroke Knowledge Questionnaire; NIHSS, National Institute of Health Stroke Scale; mRS, modified Rankin Scale; HBS-SP, Health Behavior Scale for Stroke Patients.

14.904, 26.706, 21.328, 20.009, 8.680, $P<0.01$). The above factors are essential to affect the classification characteristics of health beliefs in stroke patients.

Discussion

The Differences in Health Beliefs Among Stroke Patients by LPA

Previous studies judged the health belief level of stroke patients from the scale's total score. They may have the same total score but different scores for each item. As a consequence, the heterogeneity of individuals should be fully considered when discussing the health belief level of stroke patients. LPA is a subfield of the potential class model used for analyzing continuous variables. Variable-centered features and inequities of different classes of populations can be further captured. LPA has been widely used in many fields, such as medicine, sociology, and psychology. In this study, LPA was used to investigate the health belief of stroke patients. Three types of health beliefs for stroke patients were obtained, and the health belief absence cluster totally constituted 13.8% of the total. The sum of the self-deficiency deprivation cluster and the higher perception behavior disorder cluster reached 86.2%. The total score of health belief in stroke patients was 3.74±0.51, which indicated that the health belief of stroke patients was generally "unclear". Compared with foreign conclusions,[35] the results of this study were low, consistent with the results of domestic surveys.[36] On the one hand, most respondents were older people living in rural areas and lacked health knowledge, so their health belief scores were low. On the other hand, the research tools used in this study differed from those used abroad, which may lead to differences in results. Health belief is the key for patients to determine the adoption of health behavior. It is suggested that medical staff should strengthen the health belief education of stroke patients and make patients aware of the threat of stroke, to establish positive and correct beliefs and attitudes and take the initiative to adopt healthy behaviors.[37]

The Effect of Related Variables on Latent Profile in Stroke Patients' Health Belief

This study showed that stroke survivors with hypertension were more likely to have a high level of health belief and were more likely to be classified as a self-deficiency deprivation cluster and a higher perception behavior disorder cluster. It may be because patients with hypertension experienced illness changes and were more concerned about the consequences of

stroke recurrence, thereby promoting improved health belief levels. Therefore, medical staff should implement secondary prevention measures for risk factors and implement individualized prevention strategies. Provide customized health education plans, focusing on how to effectively manage and reduce hypertension, and use easy to understand materials and methods, such as videos, health education brochures and WeChat official account interactive workshops, to deepen patients' awareness of hypertension and management ability. The survey found that people with health insurance have more positive health beliefs. Most people with health insurance have stable work and income, which was consistent with a previous study.[38] A patient's health knowledge will influence his attitude toward stroke to a greater extent. The study recommends that stroke-related knowledge be widely promoted in clinical nursing practice. The high recurrence rate of stroke and the severe consequences of recurrence should be emphasized. The study found that self-deficiency deprivation cluster and higher perception behavior disorder cluster health behavior scores and health beliefs were higher than health belief absence cluster totally. The higher the score of health behavior, the better their health beliefs. In agreement with the findings of Orji et al,[39] "health behavior and health belief were positively correlated". Good health behavior promotes and maintains health beliefs, suggesting that medical staff should strengthen the positive impact of adopting health behaviors on patients.

Stroke patients without work were likelier to show Class 2 (self-deficiency deprivation cluster). Patients on the job have more opportunities to solve various problems at work, with more successful experience and self-achievement. Therefore, it is suggested that medical staff should treat patients with lower economic levels by minimizing medical costs while ensuring effective treatment, in order to reduce the economic burden on patients. A lower mRS score corresponds to a better health belief, which was probably sorted out of higher perception behavior disorder cluster. Patients had relatively mild physical disorders. With the recovery of the disease, patients perceive fewer obstacles to adopting healthy behavior. It is suggested that medical staff focus on the obstacles to patients "perceived health behavior, analyze the causes and provide targeted suggestions. General information, residence and profession had specific impacts on health beliefs, possibly because rural patients engaged in physical labor have limited access to knowledge, which explains their shared belief in health. Therefore, stroke knowledge should be popularized more effectively in rural areas. Additionally, it is also important to note that patients" educational level has an impact on their health beliefs. Therefore, differentiated health education and intervention measures should be designed for patients with different educational backgrounds. For patients with lower education levels, more emphasis should be placed on improving their understanding and management of the disease. For patients with higher education levels, patients should be taught to objectively and rationally treat the disease, so as to accurately perceive its obstacles and benefits.

Limitation

The findings of this study must be seen in the light of some limitations. First, the cross-sectional study could not determine the causal relationship between influencing factors and stroke health beliefs. The second limitation concerns that the sample needs to be sufficiently representative in that only stroke patients from Henan Province was included. The scope of the study was relatively limited and future research can validate these clusters in different regions and cultural backgrounds. In addition, this study was conducted in the form of a questionnaire, which has a certain degree of subjectivity and may have memory bias. Further research is required to determine whether the health beliefs of community stroke patients are consistent. Future longitudinal studies can be designed to carry out large-sample, multicenter surveys to improve the conclusions of this study.

Conclusion

The health belief of stroke patients was moderate in this study. It can be divided into three clusters: the health belief absence cluster totally, the self-deficiency deprivation cluster, and the higher perception behavior disorder cluster. Health behavior, mRS, health knowledge, education, residence, profession and hypertension, and so on had different distributions in different clusters. In conclusion, this study used latent profile analysis to explore the population heterogeneity of health beliefs in stroke patients, providing a new perspective for understanding health beliefs from the perspective of population heterogeneity. Clinical nurses can offer targeted guidance according to patients' different health beliefs. Improving and promoting stroke patients' health status is of great significance.

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Author Contributions

All authors made a significant contribution to conception, study design, execution, acquisition of data, analysis and interpretation, took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted and agree to be accountable for all aspects of the work.

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Disclosure

The authors confirm that they do not have any conflicts of interest in the present article.

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