

Self-Management Behaviors of Young and Middle-Aged Patients After Minimally Invasive Surgery for Lumbar Disc Herniation: A Cross-Sectional Study

Liangjin Zhu

Affiliated Hospital of Inner Mongolia Medical College

Xuexia Chen

18947168509@163.com

Inner Mongolia Medical University

Feixia Zhu

Inner Mongolia Medical University

Xinni Tian

Inner Mongolia Medical University

Yingnan Yu

The Second Affiliated Hospital of Inner Mongolia Medical University

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Self-Management Behaviors of Young and Middle-Aged Patients After Minimally Invasive Surgery for Lumbar Disc Herniation: A Cross-Sectional Study

Liangjin Zhu, Xuexia Chen, Feixia Zhu, Xinni Tian, Yingnan Yu

Abstract Objective To explore the potential profiles and related influencing factors of self-management behaviors in young and middle-aged patients after minimally invasive surgery for lumbar disc herniation, providing a reference for implementing personalized health education.

Methods Patients who underwent minimally invasive surgery for lumbar disc herniation from June to December 2025 at the Affiliated Hospital of Inner Mongolia Medical University and the Second Affiliated Hospital of Inner Mongolia Medical University were selected as survey subjects.

The surveys included a general information questionnaire, pain visual analog scale, chronic disease self-management behavior scale, chronic disease resource survey questionnaire, chronic disease self-efficacy scale, Japanese Orthopedic Association low back pain score, and hospital anxiety and depression scale. Latent profile analysis was conducted on the self-management behaviors of the participants, and univariate analysis and multinomial logistic regression were used to analyze factors influencing different categories. **Results** A total of 310 young and middle-aged patients post minimally invasive lumbar disc herniation surgery were included, with a total self-management behavior score of (18.723 ± 9.345) . The self-management behaviors were classified into three latent categories: passive management type (22.6%), basic management type (51.0%), and active management type (26.5%). Logistic regression analysis indicated that educational level, chronic disease resource level, self-efficacy, lumbar function status, pain degree, and anxiety and depression levels were important factors distinguishing different self-management profiles ($P < 0.05$). **Conclusion** There is heterogeneity in the potential profiles of self-management behaviors in young and middle-aged patients after minimally invasive lumbar disc herniation surgery. Clinical staff can develop targeted self-management guidance programs based on different patient profiles to improve self-management behaviors.

Keywords: young and middle-aged adults; lumbar disc herniation; surgery; self-management; latent profile analysis

Lumbar disc herniation (LDH) is a degenerative disease of the lumbar disc, where part or all of the annulus fibrosus ruptures, the nucleus pulposus alone or together with the annulus fibrosus and

cartilage endplate protrude outward, stimulating or compressing the sinus vertebral nerves and nerve roots, resulting in a syndrome characterized by lower back and leg pain^[1]. It is commonly seen clinically and most commonly occurs in adults. In Western countries, the overall incidence of LDH ranges from 15%~30%, with a common occurrence among people aged 30~50^[2]. In China, there are over 200 million LDH patients, accounting for about 15.2% of the national population. Among them, those aged 20~40 account for over 60%^[3], and the LDH prevalence among those aged 41~60 is 8%. With technological advancements and changes in living and working habits, long-term desk work has led to prolonged lumbar disc compression, leading to a rising LDH incidence trend among younger people^[4]. Combined with declining labor capacity and reduced social activities, this poses significant challenges and burdens to patients, families, and society^[5]. With the rapid development of social technology and the popularization of minimally invasive concepts, the number of patients choosing minimally invasive spinal surgery has been increasing in recent years^[6]. For LDH patients undergoing minimally invasive surgery, postoperative self-management behaviors are key to improving prognosis. Lifestyle risk factors such as poor daily posture, lack of scientific exercise, and excessive body weight can worsen symptoms and increase the risk of recurrence^[7-8]. Currently, there is little research on self-management behaviors in LDH patients, limited to short-term interventions, cross-sectional surveys, and constructing self-management behaviors in LDH patients^[3]. This neglects individual heterogeneity, accurately assessing patients' self-management behaviors, and analyzing their influencing factors, which is of great significance for clarifying the direction and "targets" of self-management interventions. Latent profile analysis (LPA) is a classification method centered on individual characteristics, used to identify and classify populations with similar characteristics, providing more detailed target group segmentation for intervention formulation^[9]. Therefore, this study will use the LPA method to explore the potential categories and characteristics of self-management behaviors in young and middle-aged patients after minimally invasive lumbar disc herniation, analyze their influencing factors, and provide scientific evidence for formulating self-management guidance plans for these patients after minimally invasive surgery.

1. Materials and Methods

1.1 Research Subjects Convenience sampling was used to select young and middle-aged patients with LDH undergoing minimally invasive surgery in the neurosurgery and orthopedics wards of

tertiary general hospitals in Hohhot, Inner Mongolia Autonomous Region, from June 2025 to April 2026. Inclusion criteria: (1) Diagnosed with lumbar disc herniation by MRI, CT, or other examinations, aged 18–59 years; (2) No history of lumbar spine surgery; (3) Possess basic reading and writing ability, or able to complete the questionnaire smoothly with the assistance of researchers; (4) Agree to participate in this study and sign the informed consent form; (5) Undergoing minimally invasive surgery for the first time. Exclusion criteria: (1) Complicated with herpes zoster, lumbar tumors, or infectious diseases; (2) Complicated with fractures, lumbar spondylolisthesis, or lumbar tuberculosis; (3) Pregnant or breastfeeding women; (4) Patients undergoing other surgeries or receiving other invasive treatments simultaneously. According to Kendall's principle ^[10], the sample size should be 10–20 times the number of independent variables. This study has 20 independent variables, and considering 20% invalid questionnaires, the sample size is approximately 240–480; the sample size required for latent profile analysis is at least 300 ^[11]. To ensure the stability of the latent profile analysis model, the final sample size of this study is at least 300 cases.

Ethical Approval This prospective study was approved by Institutional Ethics Committee of the Affiliated Hospital of Inner Mongolia Medical University (KY2025122). All participants signed written informed consent before enrollment, and all research activities followed the Declaration of Helsinki.

1.2 Method

1.2.1 General Information Questionnaire References, compiled independently based on the discussions of the research group, and revised in combination with expert opinions, including demographic data such as patient age, gender, marital status, body mass index, educational level, occupation, living conditions, per capita monthly household income, medical expense payment methods, as well as details on pain severity, pain location, anesthesia method, prominent spinal segment, minimally invasive surgical approach, presence of chronic diseases, and disease course.

1.2.2 Visual Analog Scale Scores (VAS) for Pain The visual analogue scale for pain ^[12] assesses the patient's pain level, with scores ranging from 0 to 10. A score of 0 indicates no pain, 1–3 indicates mild pain, 4–6 indicates moderate pain, and ≥ 7 indicates severe pain.

1.2.3 Chronic Disease Self-management Behavior Scale (CDSMBMS) Developed by Lorig and others abroad ^[13], this scale was introduced by Fu Dongbo and others in 2005 and has been widely

used in assessing self-management behaviors in patients with LDH [14-16]. It includes three dimensions: exercise (6 items), cognitive symptom management (6 items), and communication with doctors (3 items), totaling 15 items. A 5-point Likert scale scoring method is used, with a total score ranging from 0 to 69 points. The exercise dimension is scored based on exercise time: no exercise scores 0, exercise less than 30 minutes/week scores 1, 30–59 minutes/week scores 2, 1–3 hours/week scores 3, and more than 3 hours/week scores 4. For the cognitive symptom management and communication with doctors dimensions, the options “never,” “occasionally,” “sometimes,” “often,” and “very often” are scored from 0 to 5, respectively. The higher the score, the better the patient’s self-management abilities. The scale's Cronbach’s α coefficient is 0.903.

1.2.4 Chronic Illness Resources Survey (CIRS) Based on the social-environmental support theory by Glasgow, a chronic disease resource utilization questionnaire was developed [17], translated and localized into Chinese by Huali [18] and Zhong Huiqin et al [19]. It includes seven dimensions: healthcare team, family and friends, personal coping, neighborhood and community, media policy, organizations, and work environment, with a total of 21 items. The Likert 5-point scoring method was used, with 3 points as the midpoint. Items averaging <3 points indicate unsatisfactory utilization, while ≥ 3 points indicate relatively ideal utilization. The higher the overall average score, the better the patients' acquisition and utilization of resources. The Cronbach’s α coefficient was 0.894.

1.2.5 Chronic Diseases Self-efficacy Scale (CDSES) Developed by Lorig and others at Stanford University, USA, it has been used domestically after a direct translation [20] and is widely used among LDH patients for self-assessment [21]. It consists of 6 items, including two dimensions: symptom management self-efficacy (items 1–4) and general disease management self-efficacy (items 5–6). Each item uses a 1–10 scale, where 1 indicates no confidence at all and 10 indicates absolute confidence. The average score of the 6 items reflects the level of self-efficacy, and the total score of self-efficacy also ranges from 1 to 10, with higher scores indicating higher levels of self-efficacy. The Cronbach’s α coefficient of this scale is 0.902.

1.2.6 Japanese Orthopaedic Association Low Back Pain Score (JOA) This scale is used to assess the postoperative outcomes of patients with lumbar spine disease. It was introduced to China in 1998 through Sinicization. The total score of this scale [22] ranges from 0 to 29, with lower scores indicating more severe lumbar dysfunction. The Chinese version includes four main

parts: ① subjective symptoms, including low back pain, leg pain or tingling, and gait; ② clinical signs, including the straight leg raise test (or enhanced test), sensory and motor impairments; ③ limitations in daily activities, including lying down and turning over, standing, washing, and lifting heavy objects; ④ bladder function. Except for the subjective symptom scoring which uses a 0–3 scale, all other parts use a 0–2 scale. The Cronbach's α coefficient of this scale is 0.753.

1.2.7 Hospital Anxiety and Depression Scale (HADS) Compiled by Zigmond^[23] and sinicized by Ye Weifi et al^[24], it includes two subscales for anxiety (Hospital Anxiety and Depression Scale-A, HADS-A) and depression (Hospital Anxiety and Depression Scale-D, HADS-D). The scale consists of 14 items, with 7 items each addressing anxiety and depression. Each item is scored from 0 to 3, with a total score range of 0 to 21 for each subscale. The scoring criteria for both anxiety and depression are: 0–7 points indicate no symptoms, 8–10 points indicate doubtful symptoms, and 11–21 points indicate definite presence of symptoms. The Cronbach's α coefficient of this scale is 0.838.

1.3 Data Collection and Quality Control

Data collection was conducted one day before patient discharge by three researchers who had received standardized training. The investigators explained the purpose and content of the study to patients who met the inclusion criteria, obtained their cooperation, and had them sign the informed consent form. The questionnaire took approximately 10–20 minutes to complete. After finishing it independently, patients submitted it on the spot, and the questionnaire was verified on site. If there were any missing items, patients were asked to complete them immediately. Data collection primarily used paper-based questionnaires supplemented by electronic questionnaires. Each device was allowed to be used only once to prevent duplicate responses. All questions were set as mandatory to ensure completeness, and standardized instructions were used to explain the questionnaire content and assist patients in completing it. After double-checking the data for accuracy, it was entered into an Excel spreadsheet.

1.4 Statistical Methods

Data statistical analysis was conducted using SPSS 29.0 and Mplus 8.3 software. Count data were described using frequency, percentage, or proportion. Measurement data conforming to a normal distribution were presented as mean $\pm$ standard deviation. Cronbach's α coefficient was used to test the internal consistency reliability of the scale and its dimensions, and Harman's

single-factor test method was employed to examine common method bias. Mplus 8.3 was used for latent profile analysis to explore the latent class characteristics of self-management behavior in middle-aged and young patients with LDH undergoing minimally invasive surgery. SPSS 29.0 software was used to analyze the influencing factors of different latent profile categories. In univariate analysis, χ^2 test was used for categorical variables, and one-way analysis of variance was used for continuous variables; in multivariate analysis, latent profile classification results were used as unordered multinomial dependent variables, and variables with statistical significance in univariate analysis were included in an unordered multinomial logistic regression model to further analyze the influencing factors of different latent profile category membership. All statistical tests were two-tailed, and $P<0.05$ was considered statistically significant.

Mplus 8.3 software was used for latent profile analysis of self-management behavior in middle-aged and young patients with LDH undergoing minimally invasive surgery, starting with a single-class model and gradually increasing the number of classes to identify the model that best fits the data. Model fit indices [25-26]: (1) The smaller the values of the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Adjusted Bayesian Information Criterion (aBIC), the better the model fit; (2) higher entropy values (Entropy >0.8 indicate that the classification accuracy of the model reaches 90%); (3) the Lo-Mendell-Rubin likelihood ratio test (LMR) and the Bootstrap Likelihood Ratio Test (BLRT) should be significant ($P<0.05$), indicating that the k-class model is significantly better than the k-1 class model; (4) the proportion of the smallest latent subgroup should not be less than 5% of the total sample.

2 Results

2.1 General information of young and middle-aged patients with lumbar disc herniation after minimally invasive surgery

A total of 336 questionnaires were distributed in this study, and 310 valid questionnaires were recovered, with a valid recovery rate of 92.26%. The general information of the patients is shown in Table 1.

Table 1 General Data of Young and Middle-Aged Patients with Lumbar Disc Herniation After Minimally Invasive Surgery

Variable	Category	Frequency (n)	Percentage (%)
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Gender	Male	156	50.3
	Female	154	49.7
Age	Ages 18–44	50	16.1
	Ages 45–59	260	83.9
Marital Status	Unmarried	8	2.6
	Married	294	94.8
	Divorced or Widowed	8	2.6
Educational level	Illiterate	12	3.9
	Junior high school and below	150	48.4
	High school / Technical secondary school	108	34.8
	Junior college and above	40	12.9
Household economic income	<2000 yuan	62	20
	2001–4000 yuan	90	29
	4001–6000 yuan	101	32.6
	6001–8000 yuan	37	11.9
	8001–10000 yuan	15	4.8
Body Mass Index	>10000 yuan	5	1.6
	<18.5	10	3.2
	18.5~23.9	121	39
	24~27.9	129	41.6
Occupation	≥28	50	16.1
	Retired/laid off	75	24.2
	Employed	78	25.2
Medical Payment Methods	Unemployed	157	50.6
	Employee/Resident Medical Insurance	205	66.1
	New Rural Cooperative Medical Scheme	58	18.7
	Self-paid	47	15.2
Living arrangements	Living alone	15	4.8
	With spouse	188	60.6

	With children	25	8.1
	With spouse and children	79	25.5
	Other	3	1
	Waist	231	74.5
Painful area	Legs	49	15.8
	Waist and legs	30	9.7
	0 points	20	6.5
Pain level	1–3 points	123	39.7
	4–6 points	129	41.6
	≥7 points	38	12.3
	None	160	51.6
Any other chronic diseases	One type	119	38.4
	Two or more types	31	10
Anesthesia method	General anesthesia	251	81
	Local anesthesia	59	19
	L1-2	8	2.6
	L2-3	10	3.2
Protruding segment	L3-4	29	9.4
	L4-5	142	45.8
	L5-S1	121	39
Minimally invasive surgery	Microscopic discectomy	284	91.6
	Transforaminal endoscopic surgery	15	4.8
	Interlaminar endoscopic surgery	11	3.5

2.2 Potential Profile Analysis of Minimally Invasive Surgery Patients with Lumbar Disc Herniation in Middle-aged and Young Adults

The total self-management behavior scores for young and middle-aged patients after minimally invasive lumbar disc herniation were 18.723 ± 9.345 points, with physical exercise, cognitive symptom management, and communication with doctors being 3.839 ± 3.095 , 9.723 ± 4.724 , and 5.161 ± 2.710 respectively. A potential cross-sectional analysis was conducted on the

self-management behavior scale scores of 310 patients after minimally invasive lumbar disc herniation. Model fitting results showed an overall downward trend in AIC, BIC, and the adjusted BIC (aBIC) as the number of potential categories gradually increased from 1 to 5, indicating that model fit improved as the number of classes increased. Among them, the two models showed significantly improved fit compared to the first model (AIC=4554.638, BIC=4592.003, aBIC=4560.287), with an entropy value of 0.906, indicating high classification accuracy, and both LMRT and BLRT tests reached significant levels ($P<0.001$); The fit indicators of the three models further improved (AIC=4454.910, BIC=4507.222, aBIC=4462.819), The entropy value was 0.862, indicating a relatively high classification accuracy; meanwhile, both LMRT and BLRT tests were significant ($P<0.001$), and the distribution of class proportions (0.226, 0.510, 0.265) was relatively reasonable, indicating good explanatory power and stability of the models. Among the four types of models, AIC, BIC, and aBIC indices continued to decline (AIC=4433.643, BIC=4500.901, aBIC=4443.812), but the LMRT test did not reach a significant level ($P=0.236>0.05$), indicating that compared to Class 3 models, the improvement in Class 4 models is not significant; at the same time, there are smaller categories in the category proportions (0.035), with uneven distribution, which may affect model stability and practical interpretive value; although Class 5 models further decrease AIC and aBIC (AIC=4428.356, aBIC=4440.785), BIC actually increases (BIC=4510.561), and LMRT ($P=0.391>0.05$) and BLRT ($P=0.267>0.05$) did not reach significant levels; additionally, there were smaller categories (0.029) in the class proportions, further reducing model stability and interpretability.

In summary, these three types of models serve as the optimal potential profiles for self-management behavior in minimally invasive postoperative patients with lumbar disc herniation in young and middle-aged patients, as detailed in Table 2.

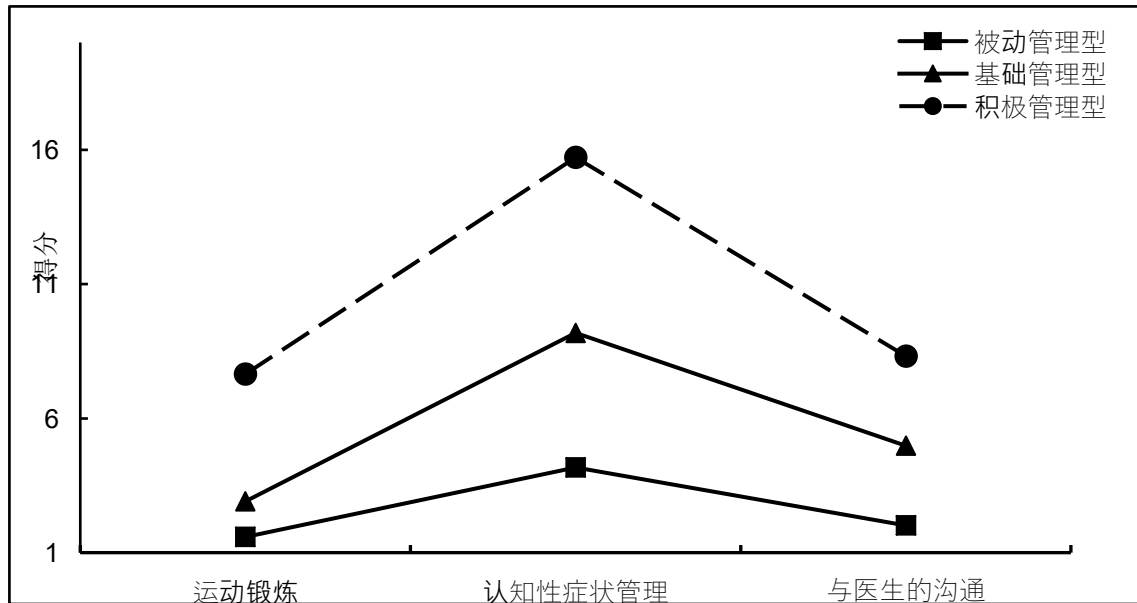
Table 2 Model fitting results of latent classes in young and middle-aged patients after minimally invasive surgery for lumbar disc herniation

Profile	AIC	BIC	aBIC	Entropy	LMRT	BLRT	Proportion
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1Class	4929.549	4951.968	4932.939	—	—	—	1
2Class	4554.638	4592.003	4560.287	0.906	<0.001	<0.001	0.713/0.287
3Class	4454.91	4507.222	4462.819	0.862	<0.001	<0.001	0.226/0.510/0.265
4Class	4433.643	4500.901	4443.812	0.864	0.236	<0.001	0.226/0.035/0.239/0.500
5Class	4428.356	4510.561	4440.785	0.860	0.391	0.267	0.029/0.474/0.219/0.226/0.0
							52

Based on the latent class characteristics of self-management behaviors in young and middle-aged patients after minimally invasive surgery for lumbar disc herniation, the following classifications are named: Passive Management Type: Patients in this category generally score low in dimensions such as exercise, cognitive symptom management, and communication with doctors, indicating a lack of awareness and behavior in actively participating in disease management, mainly showing passive acceptance of management, accounting for 22.6% of the sample; Basic Management Type: Patients in this category show moderate performance across the three dimensions, indicating a certain awareness of self-management and basic management behavior, but still have room for improvement in regular exercise, symptom cognition adjustment, and doctor-patient communication, accounting for 51.0% of the sample; Active Management Type: Patients in this category generally score high in exercise, cognitive symptom management, and communication with doctors, indicating that they can actively participate in disease management, possess good health behavior execution and doctor-patient interaction abilities, accounting for 26.5% of the sample, as shown in Figure 1.

Figure 1 Different Categories of Self-Management Behavior Characteristics in Young and Middle-Aged LDH Minimally Invasive Surgery Patients



2.3 Univariate Analysis of Potential Profiles of Self-Management Behaviors in Young and Middle-Aged LDH Patients Undergoing Minimally Invasive Surgery

The results showed that there were statistically significant differences ($P < 0.05$) among patients with different profile classifications in terms of age, educational level, household income, medical payment methods, and the presence of other chronic diseases, as detailed in Table 3.

Table 3 Univariate Analysis of Latent Profiles of Self-Management Behaviors in Young and Middle-Aged Patients After Minimally Invasive Surgery for Lumbar Disc Herniation

Variable	Classification	Passive	Basic	Active	χ^2	P
		management	management	management		
		type (n=70)	type (n=158)	type (n=82)		
Gender	Male	35 (50.0)	78 (49.4)	43 (52.4)	0.208a	0.901

	Female	35 (50.0)	80 (50.6)	39 (47.6)		
Age	18–44 years old	6 (8.6)	24 (15.2)	20 (24.4)	7.196a	0.027
	45–59 years old	64 (91.4)	134 (84.8)	62 (75.6)		
	Unmarried	4 (5.7)	3 (1.9)	1 (1.2)		
Marital Status	Married	63 (90.0)	152 (96.2)	79 (96.3)	4.493b	0.319
	Divorced or Widowed	3 (4.3)	3 (1.9)	2 (2.4)		
	Illiterate	6 (8.6)	6 (3.8)	0 (0.0)		
	Junior high school and below	45 (64.3)	78 (49.4)	27 (32.9)	33.12a	< 0.001
Educational level	High school / Technical secondary school	19 (27.1)	52 (32.9)	37 (45.1)		
	Junior college and above	0 (0.0)	22 (13.9)	18 (22.0)		
	<2000yuan	26 (37.1)	35 (22.2)	1 (1.2)		
	2001~4000yuan	25 (35.7)	51 (32.3)	14 (17.1)		
Household economic income	4001~6000yuan	17 (24.3)	47 (29.7)	37 (45.1)	63.566b	< 0.001
	6001~8000yuan	2 (2.9)	17 (10.8)	18 (22.0)		
	8001~10000yuan	0 (0.0)	5 (3.2)	10 (12.2)		
	>10000yuan	0 (0.0)	3 (1.9)	2 (2.4)		
	<18.5	2 (2.9)	5 (3.2)	3 (3.7)		
Body Mass Index	18.5~23.9	26 (37.1)	60 (38.0)	35 (42.7)	3.405b	0.764
	24~27.9	34 (48.6)	63 (39.9)	32 (39.0)		

	≥28	8 (11.4)	30 (19.0)	12 (14.6)		
	Retired/laid off	15 (21.4)	42 (26.6)	18 (22.0)		
Occupation	Employed	18 (25.7)	38 (24.1)	22 (26.8)	1.065a	0.9
	Unemployed	37 (52.9)	78 (49.4)	42 (51.2)		
	Employee/Resident	35 (50.0)	106 (67.1)	64 (78.0)		
Medical Payment	Medical Insurance					
	New Rural Cooperative				13.868a	0.008
Methods	Medical Scheme	18 (25.7)	29 (18.4)	11 (13.4)		
	Self-paid	17 (24.3)	23 (14.6)	7 (8.5)		
	Living alone	1 (1.4)	6 (3.8)	8 (9.8)		
	With spouse	38 (54.3)	96 (60.8)	54 (65.9)		
	With children	9 (12.9)	12 (7.6)	4 (4.9)		
Living arrangements	With spouse and children	21 (30.0)	43 (27.2)	15 (18.3)	12.530b	0.096
	Other	1 (1.4)	1 (0.6)	1 (1.2)		
	Waist	53 (75.7)	123 (77.8)	55 (67.1)		
Painful area	Legs	12 (17.1)	20 (12.7)	17 (20.7)	4.194a	0.38
	Waist and legs	5 (7.1)	15 (9.5)	10 (12.2)		
	0 points	4 (5.7)	10 (6.3)	6 (7.3)		
	1–3 points	24 (34.3)	60 (38.0)	39 (47.6)		
Pain level	4–6 points	32 (45.7)	67 (42.4)	30 (36.6)	4.204b	0.653
	≥7 points	10 (14.3)	21 (13.3)	7 (8.5)		
	None	32 (45.7)	74 (46.8)	54 (65.9)		
Any other chronic diseases	One type	27 (38.6)	67 (42.4)	25 (30.5)	12.065a	0.017
	Two or more types	11 (15.7)	17 (10.8)	3 (3.7)		
Anesthesia method	General anesthesia	59 (84.3)	126 (79.7)	66 (80.5)		
	Local anesthesia	11 (15.7)	32 (20.3)	16 (19.5)	0.665a	0.717
	L1-2	1 (1.4)	6 (3.8)	1 (1.2)		
Protruding segment	L2-3	0 (0.0)	8 (5.1)	2 (2.4)	9.033b	0.318

	L3-4	7 (10.0)	15 (9.5)	7 (8.5)		
	L4-5	28 (40.0)	70 (44.3)	44 (53.7)		
	L5-S1	34 (48.6)	59 (37.3)	28 (34.1)		
	Microscopic discectomy	61 (87.1)	146 (92.4)	77 (93.9)		
Minimally invasive surgery	Transforaminal endoscopic surgery	5 (7.1)	7 (4.4)	3 (3.7)	2.599b	0.638
	Interlaminar endoscopic surgery	4 (5.7)	5 (3.2)	2 (2.4)		

2.4 Multifactor Analysis of Latent Profiles of Self-Management Behaviors in Young and Middle-Aged LDH Patients Undergoing Minimally Invasive Surgery

Unordered multinomial logistic regression analysis was used to explore the factors influencing self-management profile classification. Using the passive management type as the reference category, age, educational level, household income, medical payment method, presence of other chronic diseases, visual analog scale score, chronic disease resources, chronic disease self-efficacy, back pain score, anxiety, and depression were included in the model. The assignment method for independent variables is shown in Table 4. The results showed that educational level, chronic disease resource level, self-efficacy, back pain functional status, pain intensity, and anxiety and depression levels were important factors distinguishing different self-management profile classifications ($P < 0.05$), as shown in Table 5.

Table 4 Methods of Assigning Values to Independent Variables

Variable Name	Variable Assignment Description
Self-Management Behavior Profile Classification	Passive management type = 1; Basic management type = 2; Active management type = 3
Age	18–44 years old = 1; 45–59 years old = 2
Education Level	Illiterate = 1; Junior high school and below = 2; High school/technical secondary school = 3; College and above = 4
Household Income	< 2,000 yuan = 1; 2,001–4,000 yuan = 2; 4,001–6,000 yuan = 3; 6,001–8,000 yuan = 4; 8,001–10,000 yuan = 5; > 10,000 yuan = 6
Medical Payment Method	Employee/resident medical insurance (Z1=0, Z2=0, Z3=0)

Presence of Other Chronic Diseases	New Rural Cooperative Medical Scheme = 2 (Z1=0, Z2=1, Z3=0)
Visual Analog Score	Self-paid (Z1=0, Z2=0, Z3=1)
Total Chronic Disease Resources	None = 1; One type = 2; Two or more types = 3
Score	
Total Chronic Disease Self-Efficacy	Continuous variable
Score	
Total Low Back Pain Score	Continuous variable
Total Anxiety Score	Continuous variable
Total Depression Score	Continuous variable

Table 5 Multivariate Analysis of Latent Profiles of Self-Management Behaviors in Young and Middle-Aged LDH Patients Undergoing Minimally Invasive Surgery

Variables	B	SE	Wald χ^2	P	OR	95%CI
Basic management type vs. passive management type						
Age	-0.409	0.663	0.381	0.537	0.664	0.181~2.436
Education level	0.756	0.376	4.032	0.045	2.130	1.018~4.454
Household income	0.431	0.263	2.699	0.100	1.539	0.920~2.576
Medical payment method: employee/resident medical insurance						
Medical payment method: New Rural Cooperative Medical Scheme	-0.615	0.567	1.175	0.278	0.541	0.178~1.643
Medical payment method: self-paying	-2.162	0.654	10.939	0.001	0.115	0.032~0.414
Presence of other chronic diseases	-0.246	0.344	0.510	0.475	0.782	0.398~1.536
Visual analog scale score	-0.266	0.121	4.833	0.028	0.766	0.605~0.972
Chronic disease resources	0.084	0.030	7.974	0.005	1.087	1.026~1.152

Chronic disease self-efficacy	0.091	0.025	12.800	<0.001	1.096	1.042~1.152
Low back pain score	0.105	0.059	3.114	0.078	1.111	0.988~1.248
Anxiety	-0.206	0.068	9.240	0.002	0.814	0.713~0.930
Depression	-0.270	0.066	16.930	<0.001	0.763	0.671~0.868
Active management type vs. passive management type						
Age	-0.883	0.893	0.977	0.323	0.414	0.072~2.382
Education level	1.405	0.502	7.829	0.005	4.075	1.523~10.900
Household income	0.735	0.341	4.639	0.031	2.085	1.068~4.068
Medical payment method: employee/resident medical insurance						
Medical payment method: New						
Rural Cooperative Medical Scheme	-1.326	0.901	2.165	0.141	0.265	0.045~1.553
Medical payment method: self-paying	-3.572	0.949	14.164	<0.001	0.028	0.004~0.181
Presence of other chronic diseases	-0.590	0.515	1.313	0.252	0.554	0.202~1.521
Visual analog scale score	-0.403	0.165	5.927	0.015	0.669	0.483~0.925
Chronic disease resources	0.171	0.040	18.053	<0.001	1.187	1.097~1.284
Chronic disease self-efficacy	0.238	0.038	39.155	<0.001	1.269	1.178~1.367
Low back pain score	0.400	0.091	19.270	<0.001	1.493	1.248~1.785
Anxiety	-0.439	0.113	15.195	<0.001	0.644	0.517~0.804
Depression	-0.314	0.098	10.328	0.001	0.730	0.603~0.885

3 Discussion

3.1 There is significant heterogeneity in self-management behaviors among young and middle-aged LDH patients undergoing minimally invasive surgery

This study, using latent profile analysis for the first time, classified self-management behaviors of young and middle-aged patients after minimally invasive lumbar disc herniation surgery into three potential categories: passive management type (22.6%), basic management type (51.0%), and active management type (26.5%), indicating significant heterogeneity in self-management behaviors within this population. This finding validates that self-management behavior is a complex behavioral pattern influenced by multiple factors ^[27]. In the study, the basic management type accounted for the largest proportion, indicating that most patients have certain self-management awareness and basic behaviors, but still have deficiencies in exercise, symptom cognition regulation, and doctor-patient communication, consistent with the studies by Xiong Ting, Liu Yingjie, and others ^[27-28]. Active management type patients demonstrated high health behavior execution and initiative, suggesting good disease adaptation ability and resource utilization awareness. In contrast, passive management type patients scored low across all dimensions, indicating severely insufficient self-management behaviors, requiring clinical focus.

Significant differences were found among different patient categories in terms of age, educational level, income, health insurance type, and presence of chronic comorbidities. Young patients (18–44 years) had the highest proportion in the active management type (24.4%), whereas patients aged 45–59 years comprised the highest proportion in the passive management type (91.4%). This result suggests that age is not the sole determinant of self-management behavior; younger patients may be more inclined to proactive management due to stronger information acquisition abilities and higher health literacy, which is consistent with the findings of Chen Wei et al., that younger age correlates with better self-management behavior ^[29]. The underlying reason may be that the younger population has significantly higher acceptance and utilization capabilities for online health information, giving them certain advantages in self-management behaviors. Additionally, the distribution differences in educational level, income, and health insurance payment methods further support the “social determinants of health” theory ^[30], which implies that individuals with higher socio-economic status are more likely to access high-quality medical resources and social support, thereby exhibiting more positive self-management behaviors. Therefore, identifying different self-management behavior categories and their characteristics can help healthcare professionals develop targeted self-management guidance programs, achieve

precise health education interventions, and improve patients' self-management behaviors.

3.2 Factors Influencing the Three Potential Dimensions of Self-Management Behavior in Young and Middle-Aged LDH Patients Undergoing Minimally Invasive Surgery

This study shows that educational level, level of chronic disease resources, self-efficacy, functional status of low back pain, pain intensity, and levels of anxiety and depression are important factors in distinguishing different self-management profile classifications. These factors collectively shape patients' self-management behavior patterns from multiple dimensions, including individual internal resources, external support, psychological state, and disease experience.

3.2.1 Internal Resources: Education Level and Self-Efficacy

Education level is an important predictor distinguishing basic management, active management, and passive management. Compared to illiterate patients or those with junior high school or below, those with high school/technical secondary education or above are more likely to be classified as basic management or active management types, especially those with college degrees and above, whose active management type has an ORM as high as 4.075. This may be because patients with higher education levels have a deeper understanding of the disease and are more proactive in participating in disease management [31-32]. Self-efficacy is one of the most significant factors among all variables. Among the basic and active management types, the OR values for self-efficacy were 1.096 and 1.269 respectively, both reaching highly significant levels ($P < 0.001$). Self-efficacy reflects patients' thinking patterns and action efficiency. Patients with high self-efficacy tend to focus their energy on problem-solving and thus exhibit good self-management behaviors [33].

3.2.2 External Support: Utilization Level of Chronic Disease

Resources The utilization level of chronic disease resources also plays an important role in distinguishing different self-management categories. Chronic disease resource scores for actively managed patients were significantly higher than those for basic and passive management (53.89 ± 8.86 vs. 46.32 ± 9.23 vs. 40.59 ± 8.58), and in regression analysis, for every 1 point increase in chronic disease resources, the probability of being active managed increased by 18.7%

(OR=1.187, $P<0.001$). Chronic disease resources cover multiple levels of support, including medical teams, family and friends, media policies, and organizational structures. Foreign studies show that social support factors provide resource guarantees for patients' long-term self-management and healthy outcomes [34]. The results suggest that nursing interventions should not only focus on individual patients but also actively mobilize resources from their families, communities, and healthcare systems to build multidimensional support networks.

3.2.3 Psychological State: Anxiety and Depression

Research found that anxiety and depression are psychological factors that significantly negatively affect patients' self-management behaviors, consistent with Wong et al [35]. Between basic and positive management, the higher the anxiety and depression scores, the lower the probability that the patient falls into the higher self-management category. The possible reason is that anxiety and depression may weaken an individual's motivation, attention, and execution, reducing patients' persistence and initiative in self-management behaviors. Notably, the anxiety and depression scores of passive management patients both exceeded 10, placing them at the critical range of "definitely having symptoms," suggesting that this group may have more pronounced emotional disorders. Therefore, in clinical practice, attention should be paid to psychological health screening and intervention for post-LDH patients, and psychological counseling or medication may be introduced when necessary to improve their emotional state, thereby indirectly enhancing self-management abilities.

3.2.4 Disease experience: pain level and functional status of low back pain

Pain level has a significant negative impact on self-management behavior, while functional status of low back pain has a significant positive effect. The higher the pain level, the more patients tend to be passive in management; The better the functional state of low back pain, the more likely the patient is to show active management behaviors. This result aligns with clinical common sense, which is that persistent pain weakens patients' mobility and confidence, restricting participation in exercise and self-regulation behaviors; Those with better functional status have stronger physical abilities and behavioral autonomy. Therefore, postoperative pain management and functional rehabilitation training should be breakthroughs for improving self-management behaviors. Nursing staff should guide patients to res

pond scientifically to pain and gradually restore daily activities.

3.2.5 Socioeconomic factors: economic income and medical insurance payment methods

Household economic income and medical insurance payment methods also significantly affect the ownership of self-management categories. Patients with higher economic income are more likely to be classified as active management (OR=2.085, P=0.031), while the probability of self-paying patients being classified as basic management and active management is only 0.115 times and 0.028 times that of passive management, consistent with previous studies [27]. Economic pressure and insufficient medical coverage may limit patients' access to quality medical resources, rehabilitation services, and health education, thereby suppressing the development of self-management behaviors. Therefore, at the policy level, attention should be paid to medical coverage and accessibility of rehabilitation services for vulnerable groups, and in clinical practice, more cost-effective health education programs should be provided to economically disadvantaged patients.

In summary, the self-management behavior of young and middle-aged patients after minimally invasive LDH surgery is influenced by multiple factors. Nursing staff should develop personalized, multidimensional intervention strategies based on patients' different characteristics, focusing on groups with low self-efficacy, high anxiety and depression, significant pain, underutilized resources, and socioeconomically disadvantaged groups to improve their overall self-management level.

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Liangjin Zhu^{1, 2}, Xuexia Chen^{2*}, Feixia Zhu², Xinni Tian², Yingnan Yu³

1: Inner Mongolia Medical University, Department of neurosurgery, Affiliated Hospital of Inner Mongolia Medical University, Hohhot , Inner Mongolia, 010050, China

2: Inner Mongolia Medical University, School of Nursing, Hohhot, Inner Mongolia, 010050, China

3: Inner Mongolia Medical University, Spine Surgery Center, The Second Affiliated Hospital of Inner Mongolia Medical University, Hohhot, Inner Mongolia, 010050, China

*Corresponding author: Xuexia Chen , E-mail address:18947168509@163.com