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Characterization of Potential Categories of Perceived Social Support for Patients after Percutaneous Coronary Intervention and Analysis of Influencing Factors

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Abstract: This study aimed to explore the potential profile categories of perceived social support in patients after percutaneous coronary intervention and the differences in characteristics and influencing factors of different categories. From September 2024 to March 2025, 254 post-stenting patients in a tertiary hospital in Anhui Province as study subjects. The general information questionnaire, comprehension social support scale, medical coping style questionnaire, and Chinese cardiovascular patients' quality of life assessment questionnaire were used to conduct the survey. Latent profile analysis was used to explore the categories of social support in post-PCI patients, and the influencing factors of their latent profiles were explored by univariate analysis and multivariate logistic regression analysis. The results of the potential profiles showed that post-PCI patients' perceived social support could be categorized into three potential categories: multidimensional low support group (22.05%), multidimensional medium support group (31.10%), and multidimensional high support group (46.85%). Multiple logistic regression analysis showed that greasy, salty, and spicy eating habits and confrontation coping were protective factors in the multidimensional medium support group compared with the multidimensional low support group; and that male, quality of life, and submission coping were protective factors in the multidimensional high support group ($P<0.05$). There is obvious heterogeneity in the perceived social support of postoperative patients, and healthcare professionals should implement targeted nursing care measures by combining the different characteristics of the potential categories and their influencing factors, in order to promote the improvement of physical and mental health of postoperative patients.

1. Introduction

Coronary Heart Disease (CHD) is a general term for Coronary Artery Disease (CAD) and its complications, which may include angina, shortness of breath, fatigue, and myocardial infarction[1]. According to the World Health Organization (WHO), cardiovascular diseases account for the largest proportion of Non-Communicable Disease (NCD) deaths and caused at least 19 million deaths in 2021, with ischemic heart disease accounting for 13% of all deaths and the fastest growing number of deaths from this disease between 2000 and 2021. Percutaneous Coronary Intervention (PCI) is currently recognized as one of the main treatments for coronary artery disease, restoring blood flow to the heart by physically compressing and reconstructing the vascular "channel"[2]. However, patients who have undergone PCI are susceptible to a range of physical and psychological challenges, including in-stent restenosis and pain[3]. Additionally, the prevalence of psychological symptoms such as uncertainty regarding the disease and anxiety is significant[4].

Perceived social support refers to the support and help that an individual subjectively feels when confronted with life's stresses, dilemmas, or challenges. However, subsequent long-term follow-up studies indicated that the social support levels of patients were significantly lower compared to those in the acute phase[5]. Additionally, the Stress-Buffering Model is a seminal theory in the domain of social support research. This theoretical model has been extensively utilized to elucidate the mechanisms by which social support mitigates an individual's stress response and the consequences of stress. The efficacy of adequate social support in ameliorating the deleterious effects of stressors has been well-documented. Concurrently, PCI has been demonstrated to exert a significant stress on patients, the presence of adequate social support has been shown to positively influence patients' postoperative quality of life to a certain extent[6]. The extant literature on the comprehension of social support in PCI patients predominantly focuses on the analysis of the overall level of social support, neglecting the variation and heterogeneity factors among different individuals. Furthermore, there is a paucity of studies on the differences between different categories of social support.

Therefore, this study identifies different potential category characteristics of PCI patients based on LPA and explores the influencing factors of people with different category characteristics. The objective is to provide a theoretical basis for the development of targeted intervention strategies for PCI patients with different perceptual social support categories.

2. Methods

2.1 Study design and participants

A convenience sampling method was employed to investigate patients hospitalized for PCI in the cardiovascular medicine of a tertiary-level hospital in Anhui Province from September 2024 to March 2025.According to the principles of sample size calculation as outlined in the literature on logistic regression analysis, the sample size should be 5 to 10 times the number of independent variables. This study incorporated 14 independent variables, and given a 80% response rate and data accuracy, the final required sample size was determined to be a minimum of 175 cases. The collection of the paper version of the questionnaire yielded 256 responses, and the validity of the paper version was determined to be 254.Inclusion criteria: (1) patients who met the diagnostic criteria for coronary artery disease established by the World Health Organization and underwent successful PCI; (2) age ≥18 years; (3) stable vital signs and normal speech and hearing; (4) informed consent to participate in this study voluntarily. Exclusion criteria: (1) Combination of other organic pathologies; (2) cardiac function class IV; (3) irritable and uncooperative. This study was approved by the Ethics Committee (KYXM-202407-010).

2.2 Variables and measures

2.2.1 General information questionnaire

The questionnaire was developed by the researcher. The demographic information collected included age, gender, height, weight, education level, dietary habits, occupation, marital status, primary caregiver, family type, per capita monthly income, place of residence, form of payment for medical care, and financial burden. The disease information collected included the following: A comprehensive evaluation encompassing numerous parameters was conducted, including the presence of comorbidity with heart failure, hypertension, fall risk, functional capacity in activities of daily living, coronary artery angiography report, number of prior hospitalizations for coronary artery disease, the presence of additional chronic diseases, cardiac function grading, and the timing of surgery, among others.

2.2.2 Perceived social support scale

The PSSS was developed by Zimet and Chineseized by Jiang Qianjin[7]. The scale under consideration has a total of 12 entries and 3 dimensions, including 3 dimensions of family support, friend support, and other people's support. Each of these dimensions consists of 4 entries, each of which is scored on a 7-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree, " with a total score of 1 to 7.Each item was evaluated on a 7-point Likert scale ranging from "strongly disagree" to "strongly agree, " with a total score ranging from 12 to 84 points. Higher scores indicated higher levels of social support. The Chinese version of the Collaborative Social Support Scale demonstrated a Cronbach's alpha coefficient of 0.80, and the scale in this study exhibited a Cronbach's alpha coefficient of 0.853.

2.2.3 Medical copy model questionnaire

The MCMQ was developed by Feifel and revised by Shen Xiaohong et al[8].The MCMQ was designed to assess patients' attitudes toward facing diseases. The questionnaire contained a total of 20 items, encompassing three dimensions: confrontation, avoidance, and submission. It should be noted that eight of these items were reverse scored. Each item was evaluated using a 4-point Likert scale, with higher scores denoting a patient's preference for that particular dimension. The study also reported Cronbach's alpha coefficients of 0.799, 0.732, and 0.722 for the three dimensions, respectively($P<0.01$).

2.2.4 China questionnaire of quality of life in patients with cardiovascular disease

The CQQC was utilized to assess the quality of life of cardiovascular patients in China[9]. It is noteworthy as the inaugural universal questionnaire for cardiovascular disease in China. The questionnaire encompasses six dimensions: physical strength, patient's condition, medical status, general life, psycho-social situation, and work condition. It comprises a total of 24 entries, with a maximum possible score of 154 points. The Cronbach's α coefficient of the questionnaire was determined to be 0.910.In this study, the Cronbach's α coefficient of the questionnaire was calculated to be 0.854.

2.3 Data collection and quality control methods

The study was conducted using a paper-based questionnaire with a uniform preamble stating the

purpose and significance of the study, which was administered with the consent of the patients as well as the head of the department. The patient completed the questionnaire autonomously, with the objective of avoiding the impact of treatment on the patient's well-being. For individuals with writing, reading, and comprehension disabilities, the questionnaire could be completed by the investigator according to the respondents' answers after reading each one individually in accordance with the training requirements. The distribution, collection, and inspection of the questionnaires on site for omissions and improper completion was completed within a time frame of 15-20 minutes. The questionnaires were meticulously reviewed and entered into the Epidata 3.1 database to ensure the accuracy and completeness of the data.

2.4 Statistical methods

The statistical analysis was conducted using SPSS 25.0.The measurement data that conformed to a normal distribution were expressed as the mean ± standard deviation. Those data that did not conform to a normal distribution were expressed as the median and quartiles. The count data were expressed as frequency, percentage, or rate. Comparisons between groups were made using the $\chi 2$ test. Comparisons between hierarchical data and continuous variables that did not conform to a normal distribution were made using the Kruskal-Wallis H test, with a test level of $\alpha = 0.05$.And the potential profile analysis was executed using Mplus 8.11 software, commencing with a single-category initial model. The number of categories was then incrementally increased, and the model with the optimal fit was selected based on the model metrics.

3. Results

3.1 Common method bias test

The Harman method was employed to test for common method bias, resulting in a total of 15 factors with surface eigenvalues >1.The first factor exhibited an explanation rate of 19.32%, which fell significantly below the critical value of 40%. This finding suggests that the data set under investigation is not subject to significant common method bias.

3.2 General information about Post-PCI patients

The age of our study population was 42-91 years, of which 183 (72.0%) were male and 71 (28.0%) were female; 157 (61.8%) patients lived in rural areas; 147 (57.9%) had elementary school education or less; 183 (72.0%) patients were discharged from the hospital between 1 day and 1 week after the procedure; coronary angiography reports showed that 131 patients with double-branch lesions (51.6%), 74 (29.1%) patients with three or more branch lesions, and 49 (19.3%) patients with single branch lesions.

3.3 Results of potential patient categories analysis among Post-PCI patients

The utilization of the mean of the entries of the three dimensions of the PSSS as exogenous indicators enabled the sequential selection of one to five potential profile models. This approach was undertaken to conduct an exploratory potential profile analysis of patients' overall perception of social support following percutaneous coronary stent implantation. In this study, the number of potential profile categories was systematically increased from an independent model assuming a potential category of 1.The optimal model was identified, categorized, and named according to the evaluation indexes. The findings indicate that the values of AIC, BIC, and ABIC decrease in

proportion to the increase in model categories, and the Entropy value is >0.8; nevertheless, the significance of LMR in models 4 and 5 is P>0.05.In model 3, the proportion of the smallest category is less than 5%, and the entropy value is smaller than that of model 2.However, all the indexes conform to the classification standard of the potential profile, and the probability of each category is evenly distributed. Therefore, the evaluation indicators and practical significance are combined to determine that model 3 is the best-fitting model. The probability of each category is distributed uniformly, and when combined with the evaluation indicators and practical significance, model 3 is determined to be the best-fitting model in table 1.

The categorization of potential profiles was informed by the scores of the three categories in each dimension of the PSSS and the total score. In category 1, 79 cases (31.10%) were observed to have a PSSS score of 5.11 (3.39, 11.13). The scores of the dimensions fell within the range of categories 2 and 3, and the scores were in the middle level. Therefore, the designation of the group was "multidimensional medium support group. The second category encompasses a total of 119 cases, constituting 46.85% of the sample, which attained the highest scores across all dimensions. These cases exhibited a PSSS score of 5.36 (5.03, 13.17) and were designated the "Multidimensional High Support Group." The third category encompasses 56 cases (22.05%) with a PSSS score of 3.97 (2.92, 9.36). This lower overall score has led to the designation of this category as the "multidimensional lower support group. "(Figure 1).

Table 1. Post-PCI perceived social support potential profile indicators (n=254)

Model Category	LL	AIC	BIC	ABIC	Entropy	BLRT	LMR	Category Probability (%)
						P	P	
1C	-1118.62	2249.24	2270.464	2251.442				
2C	-1038.341	2096.681	2132.054	2100.352	0.928	<0.001	<0.001	23.62/76.38
3C*	-1003.772	2035.544	2085.067	2040.684	0.881	<0.001	<0.05	31.10/46.85/22.05
4C	-977.806	1991.612	2055.284	1998.221	0.915	<0.001	0.2314	25.99/2.76/26.38/44.88
5C	-966.87	1977.74	2055.561	1985.816	0.902	<0.001	0.3416	25.98/2.75/24.01/39.37/7.87

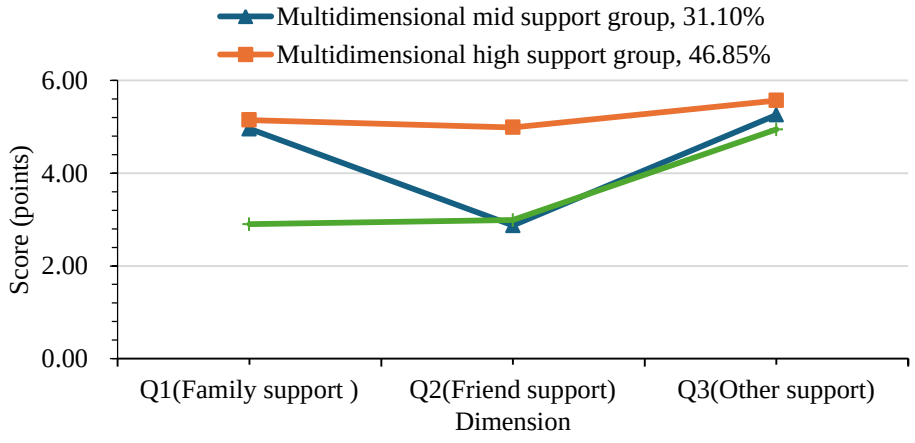

Figure 1. Distribution of characteristics of 3 potential categories of perceived social support among Post-PCI patients

3.4 Univariate analysis of potential categories among Post-PCI patients

A comparison of general information on perceived social support status of patients after PCI in the three potential categories of this study is shown in table 2.

Table 2 Univariate analysis of potential categories among Post-PCI patients(n=254)

Project [example (percentage, %)]	Totals (n=254)	Multidimensional Mid support (n=79)	Multidimensional High support (n=119)	Multidimensional Lower support (n=56)	Test statistic	P-value
Gender					12.2671)	0.002
Male	183(72.0)	48(60.8)	98(82.4)	37(66.1)		
Female	71(28.0)	31(39.2)	21(17.6)	19(33.9)		
Age					17.9393)	<0.001
18-45 years	2(0.8)	0(0.0)	2(1.7)	0(0, 0)		
45-60 years	86(33.9)	17(21.5)	55(46.2)	14(25.0)		
≥ 60 years	166(65.3)	62(78.5)	62(52.1)	42(75.0)		
BMI(kg/m²)					6.583)	0.037
≤18.49	5(2.0)	3(3.8)	1(0.8)	1(1.8)		
18.50~23.99	112(44.0)	39(49.4)	43(36.1)	30(53.6)		
24.00~27.99	118(46.5)	32(40.5)	65(54.6)	21(37.5)		
≥28.00	19(7.5)	5(6.3)	10(8.4)	4(7.1)		
Dietary habits					12.6841)	0.048
Greasy, salty and spicy	62(24.4)	13(16.5)	35(29.4)	14(25.0)		
Combine meat and vegetables	37(14.6)	8(10.1)	24(20.2)	5(8.9)		
Light diet	93(36.6)	35(44.3)	35(29.4)	23(41.1)		
Other	62(24.4)	23(29.1)	25(21.0)	14(25.0)		
Smoking status					11.6521)	0.02
Never	93(36.6)	37(46.8)	31(26.1)	25(44.6)		
Smoking	92(36.2)	23(29.1)	53(44.5)	16(28.6)		
Quit smoking	69(27.2)	19(24.1)	35(29.4)	15(26.8)		
Killip class					10.8433)	0.004
Level I	148(58.3)	35(44.3)	82(68.9)	31(55.4)		
Level II	92(36.2)	39(49.4)	31(26.1)	22(39.2)		
Level III	14(5.5)	5(6.3)	6(5.0)	3(5.4)		

Note: 1) χ^2 values; 2) fisher's exact probability method; 3) H-values.

3.5 Multifactorial analysis of potential categories among Post-PCI patients

Multivariate logistic regression analyses were conducted with the three categories of perceived social support as the dependent variables, the statistically significant variables in the univariate analyses of variance as the independent variables, and the "multidimensional lower support group" as the reference group. The values of the variables are enumerated in table 3.

Multivariate logistic regression analysis demonstrated that greasy, salty and spicy dietary habits, as well as confrontation coping styles, were significant group influences on multidimensionality ($p < 0.05$); the present study identified male patients, level of social support, quality of life, and submission coping style as multidimensional high-support group influencing factors ($P < 0.05$), in table 4 and 5.

Table 3. Assignment of independent variables for potential categories of perceived social support among Post-PCI patients

Independent variable	Method of assigning a value
Gender	male=1; female =2
Dietary habits	greasy, salty and spicy (0, 0, 0); combine meat and vegetables (0, 0, 1); light diet (0, 1, 0); other (1, 0, 0)
Perceive social support	Substitution of original value
Quality of life	Substitution of original value
Confront	Substitution of original value
Yield	Substitution of original value

Table 4.Multiple logistic regression analysis of potential categories of perceived social support among Post-PCI patients (n=254)

Program	Multidimensional Mid support group					
	β	SE	Wald χ2	P	OR	95%CI
Constant term	-57.131	2085.933	0.001	0.978	-	-
Greasy, salty and spicy	-2.652	1.048	6.402	0.011	0.070	0.009~0.550
Confront	-0.205	0.102	4.010	0.045	0.814	0.666~0.996

Table 5. Multiple logistic regression analysis of potential categories of perceived social support among Post-PCI patients (n=254)

Program	Multidimensional High support group					
	β	SE	Wald χ2	P	OR	95%CI
Constant term	-17.119	8.533	4.025	0.045	-	-
Male	-3.418	1.524	5.028	0.025	0.033	0.002~0.650
Perceive social support	0.790	0.133	35.227	<0.001	2.204	1.698~2.861
Quality of life	-0.148	0.044	11.261	0.001	0.862	0.791~0.940
Yield	-0.658	0.205	10.309	0.001	0.518	0.347~0.774

Note: The multidimensional lower support group is used as the reference group

4. Discussion and Limitations

4.1 Discussion

4.1.1 Heterogeneity in the level of perceived social support among post-PCI patients

The findings of this study indicated substantial intergroup variability in the extent of perceived social support among patients who had undergone percutaneous coronary intervention (PCI). The identified profiles could be categorized into three distinct categories: a multidimensional lower support group, a multidimensional medium support group, and a multidimensional high support group. These categories constituted 22.05%, 31.10%, and 46.85% of the study population, respectively. This observation suggests that the level of perceived social support of patients after PCI is generally at a medium-high level, which is consistent with the findings of previous studies[5]. The observed phenomenon may be attributable to the composition of the study population, which predominantly consists of middle-aged and elderly patients. The disease course is protracted,

necessitating prolonged use of maintenance medication. A substantial level of perceived social support has been shown to enhance patients' adherence to treatment and alleviate their mood, thereby promoting their subjective well-being[10]. A high level of subjective well-being has been demonstrated to positively impact patients' quality of life. The level of perceived social support of PCI postoperative patients in this study was divided into multiple categories, suggesting that healthcare professionals should develop personalized intervention strategies according to different categories of postoperative patients with different characteristics to meet the needs of postoperative patients and promote the development of postoperative care in the direction of precision, efficiency, and categorization, so as to promote the improvement of the quality of life of postoperative patients.

4.1.2 Factors influencing potential categories of perceived social support levels in Post-PCI patients

(1) Gender factor

The present study found gender to be an influential factor for Post-PCI patients. The results indicated that males were a protective factor for the multidimensional high support group, and females had a greater probability of belonging to the multidimensional high support group. Therefore, female patients undergoing PCI had a higher level of perceived social support than their male counterparts. The surgical procedure is a chronic source of stress for patients, and individual differences in chronic stress have been demonstrated to affect the degree of fatigue and the recovery process of patients after PCI, particularly in female patients[11]. It is suggested that medical professionals develop targeted postoperative care measures and implement personalized postoperative health education. Female patients require a more attentive approach, entailing regular communication to promote active expression of needs and inner thoughts. Family members should also be encouraged to communicate with female patients more frequently, employing a calm and gentle tone. This approach is crucial for meeting the physical and mental needs of female patients. In the case of male patients, clear and straightforward communication is essential to ensure comprehension of postoperative rehabilitation measures and requirements.

(2) Dietary habits

The present study found that dietary habits were an influential factor in the postoperative period of PCI. Greasy, salty, and spicy dietary habits were protective in the multidimensional medium support group compared to the multidimensional lower support group. Non-heavy tastes had a greater probability of being attributed to the multidimensional medium support group. Therefore, the heavier the taste, the lower the level of perceived social support. This suggests that patients with higher levels of perceived social support are more likely to eat healthier in their daily lives, and that high levels of social support can relieve mental stress as well as avoid unhealthy habits and reduce alcohol use[12]. It is recommended that healthcare professionals develop customized, personalized, and interactive dietary education programs for postoperative PCI patients, taking into account their age, literacy level, and family circumstances.

(3) Quality of life level

The present study indicated that patients' quality of life post-percutaneous coronary intervention (PCI) emerged as a significant factor, with a high quality of life proving to be a protective element for the multidimensional high support group when contrasted with the multidimensional lower support group. Furthermore, the probability of patients belonging to the multidimensional high support group exhibited a decline concomitant with an enhancement in their quality of life. Therefore, as the level of quality of life increases, the level of perceived social support among patients decreases. The quality of life and postoperative recovery process of patients are influenced by their personality traits. Previous studies have demonstrated that psychological resilience

contributes to patients' quality of life[13]. The present study examined the quality of life of PCI postoperative patients and found that their quality of life was at a moderate level. The authors of the present study hypothesize that this discrepancy may be related to the social environment and the patients' psychological state. A favorable and relaxing environment is conducive to improving the quality of life of postoperative patients, while a stressful and depressing environment is the opposite. It is recommended that healthcare professionals consider patients' personality traits and living environment when developing personalized rehabilitation programs. In addition, collaboration with patients' families is advised to enhance positive mindset and self-management skills, thereby promoting improved quality of life during the postoperative period.

(4) Medical copy model

The present study found that confrontation and yielding coping styles were influential factors for patients after PCI. Furthermore, high levels of confrontation coping styles were protective factors for the support group in the multidimensionality compared to the lower support group in the multidimensionality. And the probability of patients belonging to the support group in the multidimensionality decreases as the level of confrontation coping is raised. Therefore, the higher the level of face coping, the lower the level of perceived social support among patients after PCI. Previous studies have shown that control of the disease can be guided by patients' beliefs and understanding of their disease, and that positive coping styles and beliefs facilitate better control of the disease[14], resulting in a reduced need for external support.

In addition, the confrontation dimension scores were greater than the yielding dimension scores in the post-PCI patients in this study, indicating that the study population preferred confrontation coping styles, and that positive coping styles can improve self-management skills and thus improve patients' recovery outcomes. It is suggested that medical workers formulate personalized rehabilitation programs for patients based on their conditions and personality characteristics, and guide patients to moderately integrate into social life as far as they are able according to their conditions.

5. Conclusions

A substantial degree of heterogeneity was observed in the perceived social support of postoperative patients following percutaneous coronary stent implantation (PCI). This heterogeneity could be categorized into three distinct groups: the multidimensional lower support group, the multidimensional medium support group, and the multidimensional high support group. The study's findings underscore the pivotal role of gender, dietary habits, quality of life, and medical coping styles in shaping the perceived social support level across diverse categories of postoperative PCI patients. These observations indicate that healthcare professionals can implement customized care strategies to enhance the quality of care and promote the recovery process for different categories of postoperative patients.

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