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The Serial Mediation Effects of Social Support and Self-Efficacy on Health Literacy and Self-Management Behaviors Among Young and Middle-Aged Cardiac Patients After Percutaneous Coronary Intervention: A Cross-Sectional Study in China

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Background: Coronary heart disease (CHD) is a significant public health concern affecting an increasing number of young and middle-aged adults. Effective self-management is essential to promote the recovery and quality of life of patients with CHD after percutaneous coronary intervention (PCI), and is closely related to health literacy. However, little is known about the underlying mechanisms of this association.

Objective: This study aimed to investigate the mediating effects of social support and self-efficacy in the relationship between health literacy and self-management behaviors among young and middle-aged patients with CHD after PCI.

Methods: A cross-sectional study was conducted among 360 CHD patients aged 18–59 who after PCI within 1 to 3 months. The data were collected from September 2022 to July 2023 in a tertiary hospital in China. The questionnaires were utilized to gather data on demographic characteristics, social support, self-efficacy, health literacy, and self-management behaviors. The serial mediation model was examined via bootstrapping techniques using SPSS PROCESS v.4.3 macros (Model 6).

Results: Participants health literacy was associated with self-management behaviors both directly (β=0.334, P<0.001) and indirectly through social support (β=0.149, P<0.001) and self-efficacy (β=0.095, P<0.001). Social support and self-efficacy serially mediated the association between health literacy and self-management behaviors (β=0.226, P<0.001), with the total indirect effects accounting for 44.3%, these three mediating paths account for 24.8%, 15.8%, and 3.7% of the overall effect, respectively.

Conclusion: Health literacy influences self-management behaviors that the study's findings suggest were significant. Social support and self-efficacy act as mediators in the relationship between health literacy and self-management behaviors. Our findings provide helpful guidance for the future development of targeted and effective psychosocial interventions to enhance CHD patients' self-management, ultimately improving prognosis and quality of life.

Keywords: young and middle-age, health literacy, self-management behaviors, social support, self-efficacy, serial mediation

Background

Coronary Heart Disease (CHD) is a leading cause of morbidity and mortality worldwide, affecting 126 million or 1.72% of the world's population.[1] According to the China Cardiovascular Health and Disease Report 2021, China currently has about 330 million patients with cardiovascular diseases, including 11.39 million coronary heart diseases, or 12,159 per 100,000 urban residents.[2] The data from the United States Heart Association for 2022, CHD is the leading cause of cardiovascular death, accounting for 41.3% of cardiovascular mortalities.[3] The prevalence of CHD in middle-aged and young individuals has risen by 1.5 times from previous levels, attributed to intense social stress, rapid life progression, minor disease signs, inadequate disease

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understanding, and a poor way of living.[4] The most common treatment technique for CHD is PCI, which, however, cannot reverse or delay the biological progression of arteriosclerosis,[5] Treatment with PCI is ineffective in decelerating or reversing atherosclerosis' progression, nor does it fully eradicate risks to cardiovascular safety.[6] Research indicates that between 10% and 20% of CHD after PCI patients experience intrastent restenosis, with a 3.3% occurrence rate of drug-eluting stents,[7,8] at the same time, the odds of cardiac adverse events were more than 7.1%[9] and 20%%[10] months after PCI. The incidence of PCI angina pectoris ranges from 20% to 40%,[11,12] severely affecting outcomes and quality of life after surgery. Middle-aged and young individuals, forming the core of family and society, undertake the twin duties of both family and societal roles. Sickness leads to increased financial strain and significant impact on their family and community.[13]

The term "self-management" denotes the measures patients undertake to manage their illness, lessen the frequency of its complications, and mitigate its adverse impacts.[14] This represents an innovative method for the secondary prevention of chronic illnesses and serves as a highly efficient and functional model for disease rehabilitation management.[15] The effectiveness of self-management-based interventions has been well-established in the literature, with favorable outcomes reported in various aspects, including increased medication adherence, decreased outpatient visits and hospital readmission, and improved physical and mental health[16,17]. Health literacy is an essential facilitator of successful self-management in patients with chronic diseases such as CHD. Health literacy is defined as the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health.[18]

Self-efficacy reflects one's own self-assurance, with self-management and self-efficacy being key determinants in forecasting the outcome of CHD.[19] The role of Social Support is crucial in shaping external environmental elements. This denotes the tangible or spiritual assistance and backing from relatives, friends, and partners, among others, mirroring the intimacy and caliber of an individual's social interactions, serving as the most reliable evidence of social network usage.[20] The primary determinants in self-management are deemed to be Social Support and Self-efficacy. The study by Luke Parsons[21] reveals a substantial positive correlation between health literacy and self-management.

Previous studies have identified various factors that may link the association between health literacy and self-management behaviors, among which social support and self-efficacy are most studied. Social support encompasses the provision of information, financial assistance, and psychological aid from families, medical institutions, and other sources.[22] For patients with chronic illness, social support can enhance their capacity to cope with the disease and foster their physical and mental well-being. Numerous studies have indicated that social support plays a pivotal role in the self-management behaviors of CHD patients following PCI.[23,24] Elevated levels of self-efficacy have the potential to bolster patients' confidence in self-management and enhance overall patient health outcomes.[25] Studies showed that self-efficacy could potentially promote CHD patients' self-management behaviors and mediate the association between health literacy and self-management behaviors.[26,27] Thus, is there an indirect impact of health literacy on self-management practices via self-efficacy and social support? How does this function? Consequently, a deeper investigation is required into the inherent connection among health literacy, self-efficacy, social support, and self-management practices in young and middle-aged CHD patients after PCI.

Although CHD patients' self-management behaviors have been shown to be associated with healthy literacy, social support, and self-efficacy, it remains unclear whether social support and self-efficacy act as serial mediators in the association between healthy literacy and self-management behaviors. In addition, previous studies on the self-management behaviors of CHD patients are predominantly focused on the older population, and there are few studies on the young and middle-aged population. Therefore, we conducted the current study to comprehensively investigate the current state of self-management behaviors in young and middle-aged patients with CHD after PCI, while also examining the influencing mechanism of health literacy on self-management behaviors. Additionally, we aimed to explore the serial mediating effects of social support and self-efficacy on the association between health literacy and self-management behaviors. Our findings would provide a solid theoretical foundation for clinicians seeking to enhance self-management behavior in this specific patient population. (This study proposes the following hypotheses-Figure 1).

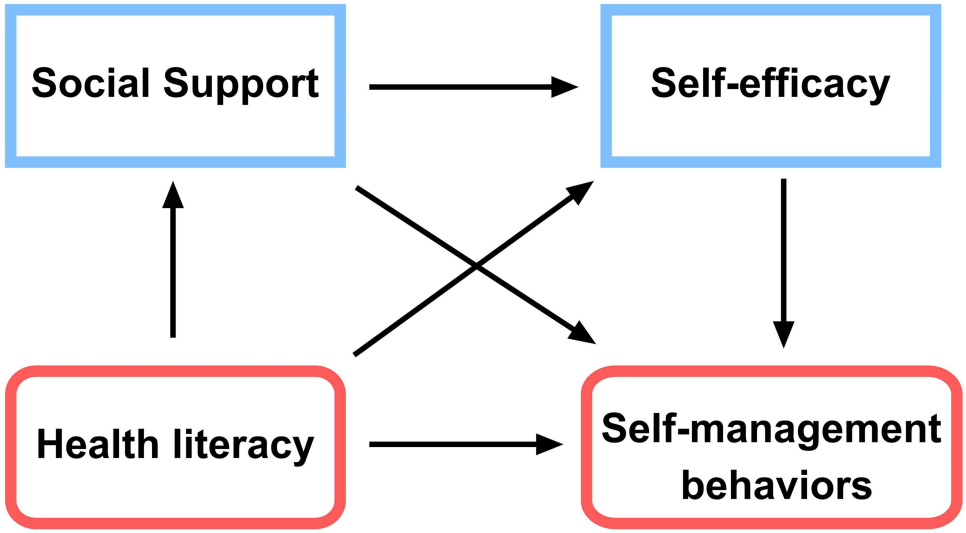

Figure 1 Research hypothesis.

Methods

Study Design and Participants

A questionnaire survey was conducted among 360 young and middle-aged patients with CHD 1 to 3 months after PCI in the outpatient department of Cardiology of a tertiary general hospital in Wenzhou city by convenient sampling method, spanning from September 2022 to July 2023. Inclusion criteria included the following: (1) Age between 18 and 59 years old; (2) diagnosed with CHD in accordance with the "Diagnostic Criteria for Coronary Heart Disease[28]"; (3) normal cognitive and mental function to complete the questionnaire survey; (4) willingness to participate in the study with written informed consent. Exclusion criteria include the following: (1) Participants who were unable to complete the questionnaire due to severe physical and mental illness; (2) Patients with stage III or IV heart failure. (3) Damage to vital organ function or co-occurrence with other serious chronic conditions, such as malignant tumors, severe liver and kidney dysfunction, etc. (4) Had serious systemic diseases or mental disorders as diagnosed by the physician/ psychiatrist.

Sample Size Estimation

The present study employed a cross-sectional study. The general data questionnaire consisted of 11 items, encompassing 23 variables across three dimensions of perceptive social support scale, self-efficacy scale, four dimensions of health literacy scale, and four dimensions of self-management behaviors scale. Following Kendall's rough sample estimation method[29], the recommended sample size ranged from 115 to 230 cases (5–10 times the number of variables). Considering a potential sample loss rate of 20% and allowing for convenient sampling error, the final maximum sample size was determined as 360 cases.

Data Collection

The participants filled out various surveys, encompassing the population questionnaire, the Chinese Health Literacy Scale, the General Self-efficacy Scale, the Perceived Social Support Scale, and the self-management Behavior Scale. Participants completed all surveys, which were then gathered by a pair of skilled researchers. Despite being unable to read, the investigator orally delivered the survey questions and documented their answers for the participants. At any stage of gathering data, patients receiving PCI for coronary heart disease are made aware, both verbally and in written form, of the confidential aspect, with the assurance that their choices will not impact the services provided to them. Prior to receiving any data, the participants provided their consent by signing various forms. Ensuring the safety of all information is our priority. The findings are provided as a summary and are not specific to any individual. The data was

solely utilized in our study before being discarded post-publication of our results. Patients have the option to complete the questionnaire either independently or with our assistance, in a serene clinic room for approximately 20–30 minutes. The research and its appeal for voluntary involvement. The study allowed participants the freedom to opt out of the study.

Measurements

Demographic Information

A researcher-designed General Information Questionnaire was used to collect the patient's demographic information, including age, gender, education level, marital status, monthly income, occupation, medical insurance coverage, and comorbidity with other chronic diseases.

Self-Management Behaviors

Self-management behaviors were measured using the Coronary Heart Disease Self-Management Behaviors Scale, initially developed by Lorig in 2003[30] and translated into Chinese by Wang 2011.[31] The scale encompasses 21 items under four dimensions: diet management, treatment adherence, symptom management, and daily activity management. Each item is rated on a 5-point Likert scale ranging from 1 to 5, and the total score ranges from 21 to 105 points, with a higher score indicating more effective self-management behaviors. We calculated the score index by dividing the actual score of the scale by its maximum possible value and multiplying it by 100%. Based on the score index, we further categorized participants into low (< 60%), moderate (60% to 80%), and high (>80%) levels of self-management behaviors. The scale demonstrated good internal consistency in this study, with a Cronbach's alpha coefficient of 0.91.

Health Literacy

Health literacy was assessed using the Health literacy scale for chronic disease patients, originally developed by Jordan in 2010[32] and subsequently adapted by Sun and Fu in 2012.[33] The scale includes 24 items under four dimensions: information acquisition ability (9 items), communication and interaction ability (9 items), health improvement willingness (4 items), and financial support (2 items). Each item is rated on a 5-point Likert scale ranging from 1 to 5, and the total score ranges from 24 to 120, with a higher score indicating better health literacy. The scale exhibits relatively good validity and reliability. The scale demonstrated good internal consistency in this study, with a Cronbach's alpha coefficient of 0.92.

Social Support

The perceived social support score (PSSS) developed by Jiang[34] was used to assess the level of support received from various sources. It includes 12 items under three dimensions measuring support from family, friends, and others, respectively. Each item is scored on a 7-point Likert scale ranging from 1 to 7, and the total score ranges from 12 to 84, with a higher score indicating a higher level of social support. Based on the score, we further categorized the participants into low (12–36), moderate (37–60), and high (61–84) levels of social support (Jiang, 2001). The scale demonstrated good internal consistency in the current study, with a Cronbach's alpha coefficient of 0.93.

Self-Efficacy

Self-efficacy was measured using the General Self-Efficacy Scale, initially developed by Schwarzer et al[35] and translated into Chinese by Wang et al.[36] Previous studies have confirmed the scale's high reliability and validity. The scale comprises ten items, each rated on a 4-point Likert scale ranging from 1 to 4. The total score ranges from 10 to 40, with a higher score indicating higher self-efficacy. The scale demonstrated good internal consistency in this study, with a Cronbach's alpha coefficient of 0.92.

Data Analysis

The statistical analysis of the data was conducted using SPSS 25 software. For descriptive analysis, continuous data were presented as "means ± standard deviations", while categorical data were presented as numbers and proportions. For univariable analysis, the comparison of scale scores between two groups was performed using *t*-tests, while the comparison of scale scores

among multiple groups was conducted using ANOVA. Pearson correlation analysis was employed to examine the correlations among key variables. The serial mediation effect test was performed using model 6 of the SPSS 25 add-in PROCESS v4.3 developed by Hayes[37]. Bootstrapping with 5000 samples was used to evaluate the mediation effect, with non-zero 95% bootstrap confidence intervals signifying statistical significance. Statistical significance was defined as P<0.05.

Results

Comparison of Self-Management Behaviors by Sample Characteristics

Table 1 shows the basic demographic characteristics of the 360 participants and the comparison of self-management behaviors by sample characteristics. Most participants were male (75.6%), aged 45–59 years old (73.06%), and living in urban areas (73.9%). Most of them were married (85%), living with their wives (62.8%), and had an education level of

Table 1 Comparison of Self-Management Behaviors Scores by Sample Characteristics (N=360)

Variables	Data	n	%	Self-management Behaviors Scores	t/F	P
Age	18–44	97	26.94	60.71±8.10	−6.480	<0.001
	45–59	263	73.06	67.09±8.34		
Sex	Male	272	75.6	64.11±8.89	−4.983	<0.001
	Female	88	24.4	69.28±7.03		
BMI	<18.49	10	2.8	62.30±9.33	2.432	0.089
	18.5–24.9	187	51.9	66.28±8.75		
	>25	163	45.3	64.52±8.63		
Residence	Urban	266	73.9	64.88±9.07	−1.803	0.015
	Rural	94	26.1	66.77±7.63		
Co-residence	Wife	226	62.8	66.42±8.07	23.373	<0.001
	Parents/children	106	29.4	65.82±8.38		
	Others	28	7.8	55.18±9.15		
Education	Primary and below	26	7.2	60.88±11.33	4.824	0.003
	Junior High school	174	48.3	66.47±8.26		
	High School/Junior College	125	34.7	64.18±8.98		
	University and above	35	9.7	67.37±6.45		
Marital status	Married	306	85	66.09±8.58	3.764	<0.001
	Not married	54	15	61.31±8.65		
Occupation	Civil servant	34	9.4	67.32±7.55	1.750	0.156
	Professional technical personnel	116	32.2	64.22±9.31		
	Worker	93	25.8	66.44±8.10		
	Farmers/Others	117	32.5	65.10±8.91		
Monthly income (yuan)	<2k	33	9.2	58.33±7.91	8.456	<0.001
	2k-4k	198	55	65.99±8.69		
	4k-5k	108	30	66.04±8.32		
	>5k	21	5.8	67.19±8.24		
Type of medical insurance	Employee medical insurance	135	37.5	67.36±8.04	11.370	<0.001
	Urban/rural insurance	200	55.6	64.84±8.71		
	Others	25	6.9	58.88±9.29		
Disease duration (years)	<1	72	20	61.69±9.25	8.494	<0.001
	2–5	175	48.6	66.55±8.26		
	>5	113	31.4	65.88±8.60		

Table 2 Health Literacy, Social Support, Self-Efficacy, and Self-Management Behavior Scores and Correlation Analysis (r)

Variables	$\bar{x}$	SD	1	2	3	4
1 health literacy	64.74	7.425	1		1	
2 Social Support	65.94	6.483	0.42**	1		
3 Self-Efficacy	27.59	4.176	0.40**	0.31**	1	
4 Self-management behavior	65.69	8.703	0.51**	0.50**	0.46**	1

Note: *P<0.05, **P<0.001.

high school or junior college (83%). The group comparison analysis showed significant differences in the self-management behavior scores by age, sex, residence, co-residence, education, marital status, monthly income, type of medical insurance, and duration of disease diagnosis (P<0.05).

Correlations Among Key Variables

Table 2 shows the mean scores and correlations of health literacy, social support, self-efficacy, and self-management behaviors. The health literacy score was 64.74±7.43, the self-efficacy score was 27.59±4.14, the social support score was 65.94±6.48, and the self-management score was 65.69±8.70. Health literacy demonstrated positive correlations with social support (r=0.42, P<0.01), self-efficacy (r=0.40, P<0.01), and self-management behaviors (r=0.51, P<0.01). Self-management behaviors exhibited positive correlations with social support (r=0.50, P<0.01) and self-efficacy (r=0.46, P<0.01). Social support was also positively correlated with self-efficacy (r=0.31, P<0.01).

Mediation Analysis

The PROCESS plug-in was employed to conduct serial mediation analysis using Model 6, while the Bootstrap method (with repeated sampling of 5000) was utilized to calculate a 95% confidence interval. All variables were assessed based on standard values, with health literacy serving as the independent variable, self-management behaviors as the dependent variable, and self-efficacy and social support as serial mediating variables.

Figure 2 and Table 3 and Table 4 delineate the total, direct, and indirect influences of health literacy on self-management behaviors mediated through social support and self-efficacy. The total effect of health literacy on self-management behaviors was significant (c=0.599, 95% CI=0.494 to 0.704). When two mediators were added, the direct

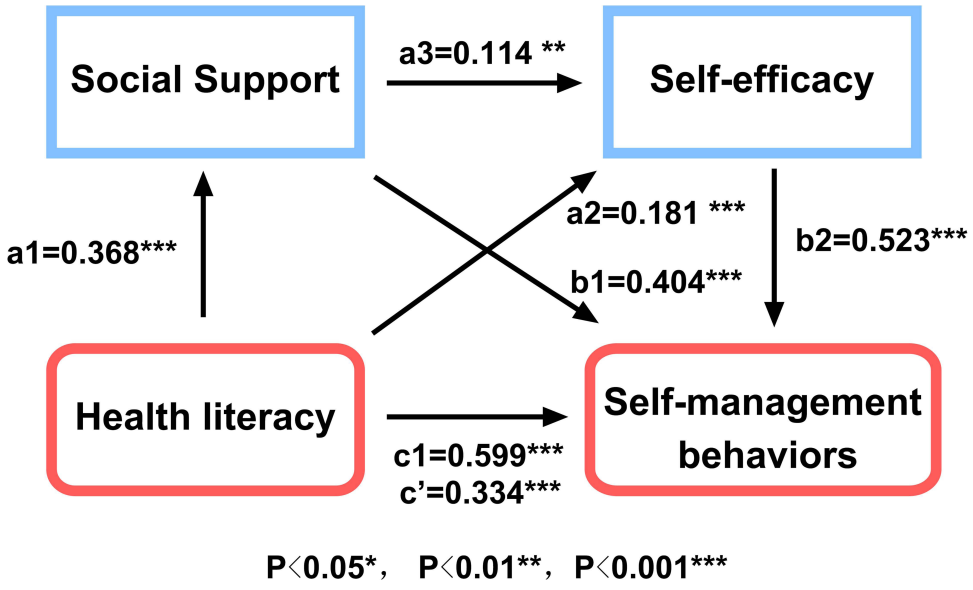

Figure 2 Mediating effect diagram.

Table 3 Regression Relationship and Effect Analysis of Each Variable in the Serial Mediation Model

Regression Equation	Equation Variable		Equation Fitting Index			Regression Coefficient		95% confidence Interval
	Dependent Variable	Independent Variable	R	R^2	F	B	t	
Model1	Self-management behaviors	Health literacy	0.511	0.261	126.555	0.599***	11.250***	0.494–0.704
Model2	Social support	Health literacy	0.421	0.178	77.444	0.368***	8.800***	0.286–0.451
Model3	Self-efficacy	Health literacy	0.429	0.184	40.164	0.181***	6.111***	0.123–0.240
	Self-efficacy	Social support				0.114***	3.367***	0.048–0.181
Model4	Self-management behavior	Health literacy	0.641	0.411	82.671	0.334***	6.034***	0.225–0.442
	Self-management behavior	Social support				0.404***	6.598***	0.283–0.524
	Self-management behavior	Self-efficacy				0.523***	5.572***	0.338–0.708

Notes: *P<0.05, **P<0.001.

Table 4 Serial Mediation Model of Health Literacy and Self-Management

Path	Effect Size	Standard Error	Effect Ratio	95% Confidence Interval
Total effect	0.599	0.053	100%	0.494–0.704
Direct effect	0.334	0.055	55.7%	0.225–0.442
Total mediating effect	0.266	0.034	44.3%	0.204–0.338
Mediating effect 1	0.149	0.028	24.8%	0.098–0.209
Mediating effect 2	0.095	0.024	15.8%	0.053–0.147
Mediating effect 3	0.022	0.008	3.7%	0.007–0.04

Notes: Mediating effect 1: Health literacy → social support → self-management behaviors. **Mediating effect 2**: Health literacy → self-efficacy → self-management behaviors. **Mediating effect 3**: Health literacy → social support → self-efficacy → self-management behaviors.

effect of health literacy on self-management behaviors decreased but remained significant (c'=0.334, 95% CI=0.225 to 0.442). The total indirect effect of health literacy on self-management behaviors was significant (ab=0.266, 95% CI=0.204 to 0.338). Both mediators, social support and self-efficacy, showed a significant effect on self-management behaviors, as represented by corresponding mediator paths (a1b1=0.149, 95% CI: 0.098 to 0.209; a2b2=0.095, 95% CI: 0.053 to 0.147). Furthermore, a significant indirect effect was found for health literacy through social support and self-efficacy (a1a3b2=0.022, 95% CI=0.007 to 0.04). These three mediating paths account for 24.8%, 15.8%, and 3.7% of the total effect, respectively.

Discussion

Status of Self-Management Behaviors in Patients with CHD

This study revealed that the self-management behaviors score among patients was indicating a lower middle level. This finding aligns with the baseline level observed in a comprehensive study of patients with CHD conducted by Ye Jing et al,[38] suggesting that self-management ability among young and middle-aged individuals in this specific group is suboptimal compared to other populations, and lower than the baseline level reported for CHD patients under 60 years old in Wufeng's study[39]. Furthermore, when comparing it to the baseline level of self-management ability among young and middle-aged CHD patients without PCI, our results indicate a relatively lower capacity after PCI. This discrepancy may be attributed to the perception held by younger patients that PCI can rapidly restore blood vessel patency and achieve vascular reconstruction, while overlooking the importance of secondary prevention as a key measure against recurrent vascular stenosis. Additionally, it could also be associated with their tendency to neglect self-management due to high work-related stress, familial responsibilities, and academic commitments. The univariate analysis revealed that age, gender, place of residence, cohabitation status, educational attainment, marital status, monthly family income, type of medical insurance coverage and duration of disease were significant factors influencing the occurrence of CHD following PCI.

Wang Mengyu[40] pointed out that age has an impact on self-management, and as age increases, patients' ability to self-manage behavior improves. Compared to the group aged ≤40 years old, those aged 61–80 years old exhibited higher scores in treatment compliance management. This can be attributed to the limited energy and time young patients have for self-management due to work commitments, which often occupy a significant amount of their time and energy. Consequently, they may not pay sufficient attention to the risk factors associated with coronary heart disease and lack strong awareness of self-health management, resulting in a higher overall incidence of coronary heart disease. With the increase in monthly family income, there was a gradual and statistically significant improvement in self-management behavior scores ($P<0.01$). This suggests that higher levels of family income after PCI are associated with better self-management behavior. Several domestic studies have indicated a positive correlation between per capita household income and medical expenses, suggesting that higher income levels are associated with increased utilization of medical services by patients[41].

Economic status plays a significant role in individuals' health management, as higher average monthly incomes provide material support for improved healthcare management and enhance patients' ability to manage diseases. The higher the level of education, the more proficient individuals become in self-management behavior[42]. Patients with a higher educational background possess an increased capacity to assimilate daily health self-management knowledge and exhibit enhanced acceptance abilities. Furthermore, their understanding of daily life management deepens, enabling them to effectively manage their own health and recognize the positive impact of adopting healthy habits on disease recovery. The research findings of Liu Qian[43] demonstrate a consistent pattern, indicating that the duration of the disease positively correlates with the level of self-management ability in patients with CHD. This observation can be attributed to the inclusion of young and middle-aged individuals as study subjects, particularly those who have undergone PCI within one year, most of whom suffer from acute coronary syndrome characterized by sudden onset and high mortality rates. Consequently, these patients experience significant psychological pressure which subsequently motivates them to prioritize self-management aspects such as daily life routines, medication adherence, and emotional regulation during the first year following PCI surgery. CHD patients who are married can receive care and support from their spouses, enabling them to effectively communicate and address negative emotions. Additionally, being in a marital relationship provides access to increased family and social support.[44] Patients with medical insurance experience relatively minimal economic burden, benefit from material security to effectively manage their own health, alleviate additional concerns associated with illness, and consequently enhance their ability to focus on disease management. When formulating corresponding intervention measures, clinical workers should thoroughly consider the aforementioned factors and implement targeted and personalized interventions.

Status of Health Literacy, Social Support and Self-Efficacy in Patients with CHD

The health literacy was below the medium of 72, indicating insufficient health literacy, it was lower than that of hypertensive patients.[45] This finding aligns with the outcomes of Wang Qiao's research,[46] indicating a low level of health literacy among young and middle-aged CHD patients following PCI. Previous studies have highlighted that individuals' self-awareness of their health, the efficacy of self-management in maintaining good health, and the accessibility to health information can directly influence their overall health status.[47]

The social support score ranging from 37 to 60 suggests a moderate level of perceived social support. Furthermore, scores falling between 61 and 84 indicate a high level of perceived social support.[48] Hence, the social support perception capacity of patients with coronary heart disease in this study is at a moderate level, surpassing the score of 61.21±7.18 points obtained by Tang Qiqun et al's group of patients with coronary heart disease.[49] Social support has the potential to enhance patients' positive experiences and sense of self-worth. It can positively influence physical and mental health through strengthening the self-management abilities of individuals with CHD.[50] Social support can effectively alleviate patients' psychological stress, mitigate the impact of stressors, address their emotional needs comprehensively, and enhance their self-management capabilities.[51]

In this study, the self-efficacy score was 27.59±4.18, the obtained value was higher than the survey result reported by Ren Yan et al,[52] which investigated the general self-efficacy of 284 community-dwelling elderly patients with chronic diseases in Shanghai (25.8±5.7). Conversely, it was lower than the findings reported by Schwarzer et al[35], who examined

the general self-efficacy of 7767 adults and reported an average score of 28.6. The findings revealed that a majority of participants exhibited inadequate self-efficacy, potentially attributed to insufficient knowledge about the disease and limited confidence in coping strategies[53]. Pain and discomfort resulting from disease symptoms and treatment, as well as the long-term management of chronic illnesses, can diminish patients' confidence in their ability to fight the disease. The heavy psychological burden can also impact patients' adherence to treatment and self-management behaviors, ultimately increasing the risk of disease recurrence.[54]

This study demonstrated a positive correlation between participants' overall health literacy score and their self-management behaviors, which aligned with the results reported by Liu et al.[55] The correlation suggests that self-management ability may be affected by health literacy level, high lighting the need for medical professionals to prioritize developing patients' information acquisition skills post-surgery. Considering factors such as age, marital status, and educational levels, healthcare providers should diversify health promotion strategies, enhance patient's access to health knowledge, and promptly assist them in implementing effective health measures to elevate their overall health literacy. Health providers should provide patients and their families with knowledge about coronary heart disease, PCI procedures, recovery, and methods to enhance their professional understanding of the disease and surgery. These approaches can help patients take the disease seriously and actively cultivate and adopt correct health habits, which is beneficial to improving their health literacy.[56]

Social support is a fundamental component of self-efficacy and a significant determinant in managing symptoms, underscoring the criticality of patients receiving adequate social and familial assistance. The presence of robust social support positively correlates with heightened levels of patient self-efficacy. Consequently, healthcare professionals should proactively establish enduring and efficacious social support frameworks for patients while harnessing and mobilizing existing societal networks. Ultimately, prioritizing the patient's perspective serves as the foundation for all endeavors. In the realm of clinical medical care, healthcare professionals can enhance the nursing continuum by providing psychological support. Overall, imparting health education and offering solace to patients elevates the level of societal support for individuals in their youth and middle age following PCI procedures. Augmenting the backing from relatives, friends, and society for young and middle-aged patients post-PCI is crucial in order to ameliorate their self-perceived efficacy.

The Mediating Effect of Social Support on Health Literacy and Self-Management Behaviors

This study demonstrated that social support played a significant mediating role in the relationship between health literacy and self-management behavior, accounting for the largest proportion of the total mediating effect. This suggests that a higher level of social support is associated with better self-management behaviors. People with higher social support have more access to external health information, as well as greater availability and positivity of support channels. Additionally, social support enhances individuals' enthusiasm for acquiring health-related knowledge and fosters an active attitude toward managing their health, thereby addressing existing deficiencies in self-management. The extensive social network can facilitate patients in comprehensively and systematically enhancing their understanding of disease and clarifying the self-management requirements for their conditions.[57] Provision of social support can not only offer tangible assistance but also alleviate the burden on patients. It serves to provide mental and emotional support as well as encouragement, thereby mitigating negative emotions and fostering a positive outlook in patients.

The Mediating Effect of Self-Efficacy on Health Literacy and Self-Management Behaviors

The findings of this study demonstrated that self-efficacy played a significant mediating role in the relationship between health literacy and self-management behavior, accounting for the second largest proportion of the total mediation effect. Our findings indicate that higher levels of self-efficacy are associated with better self-management behaviors. Self-efficacy reflects individuals' beliefs and judgments regarding their ability to perform specific behaviors, whereby higher scores indicate greater confidence in their abilities.[58] Therefore, to enhance patients' self-management behaviors, clinical staff should prioritize enhancing patients' self-efficacy and guiding them in accordance with Bandura's social cognition theory. The level of health literacy has a significant predictive impact on self-efficacy. Patients with a high level of health literacy and sufficient knowledge tend to possess strong self-confidence, thereby exhibiting a heightened sense of self-efficacy. This enables them to accurately assess their behaviors and subsequently enhance their self-management through the cultivation of self-efficacy.

The Serial Mediating Effect of Social Support and Self-Efficacy on Health Literacy and Self-Management Behaviors

This study investigated the association between health literacy, social support, self-efficacy, and self-management behaviors in patients with coronary heart disease (CHD). The findings confirm a significant mediating effect wherein health literacy directly influences self-management behavior and also acts as a chain mediator through social support and self-efficacy. The mediation effect accounts for 44.07%, indicating that enhancing the health literacy level of CHD patients is beneficial for improving both social support and self-efficacy, ultimately leading to enhanced self-management behaviors. The mediating role of social support and self-efficacy between health literacy and self-management is significant, with a total indirect effect size of and a direct effect size of 55.93%. This highlights the importance of social support and self-efficacy in explaining the impact of health literacy on self-management. The mediating role of social support and self-efficacy between health literacy and self-management behavior in young and middle-aged patients with coronary heart disease after PCI accounts for the third largest proportion of the total mediation effect. Health literacy refers to the personal characteristics and social resources necessary for individuals to access, comprehend, evaluate, and utilize healthcare services to make informed health decisions. Possessing a high level of health literacy is advantageous in making disease-preventive choices. Patients with higher health literacy have a higher level of social support, which can foster their sense of identity and belonging, enhance positive emotions, reinforce beliefs, and promote active engagement in disease self-management.[59]

Patients with better social support also have more self-efficacy, which is reflected in more confidence in engaging in disease management and enhanced ability to mitigate negative emotions arising from fear associated with confronting the illness. During hospitalization, patients become more aware of the significance of disease management following appropriate treatment, thereby experiencing an increase in their self-efficacy.[60] The sense of self-efficacy plays a crucial role in promoting patients' adoption of appropriate disease management behaviors. A higher level of self-efficacy enhances patients' motivation and ability to engage in self-management, thereby increasing the likelihood of implementing effective self-care practices[61]. Therefore, it is recommended that healthcare professionals enhance patients' social support and self-efficacy, motivating them to strengthen their confidence and sense of responsibility in self-management. They should help patients alleviate fear and effectively harness their enthusiasm to amplify the impact of health literacy on self-management behavior and elevate their levels of self-management.

Summary of the Findings

With the aging of society, there is an increasing incidence of chronic diseases, leading to elevated rates of mortality and disability. These high characteristics not only impose economic pressure on individuals, families, and society but also exert additional strain on the medical system[62]. Following the onset of chronic diseases, patients require self-management to actively modify their psychology, physiology, and overall well-being in order to alleviate symptoms associated with these conditions[63]. Coronary heart disease, being one of the major chronic ailments, constitutes a fundamental component of the global burden associated with cardiovascular diseases and serves as a primary cause of mortality.[64] Its prevalence rate escalates proportionally with advancing age, while concurrently exhibiting significant progression among younger individuals.[65]

In the present study, we examined the levels and associations among four key variables: health literacy, social support, self-efficacy, and self-management behaviors. We found that the mean score of self-management behaviors was positively correlated with health literacy, social support, and self-efficacy. A serial mediation model revealed a significant correlation between health literacy and self-management behaviors, which was partially mediated by social support and self-efficacy sequentially, with the total indirect effects accounting for 44.3% of the overall effect. Our findings emphasize the essential role of psychosocial factors in influencing self-management behaviors, providing important implications for future comprehensive and targeted psychosocial interventions to improve self-management behaviors among CHD patients following PCI.

Innovation Point

Innovation of research perspectives and methods. According to a review of the literature, health literacy is found as a reflection of health service development. The state has incorporated it into the outbreak planning of health services. This study is

integrated into health. Based on the connotation of information, behavioral skills and preventive behaviors in IMB model, this paper explores the chain mediating effect relationship between health literacy, self-efficacy and self-management in patients with coronary heart disease after PCI.

Limitations

This study has several limitations. First, the cross-sectional study design cannot establish a causal relationship among variables, which relies on future longitudinal study design. Second, our sample was recruited from one tertiary hospital using a convenience sampling method and may not represent CHD patients from other lower levels of hospitals in different areas. Future multi-center studies using random sampling methods are needed to get a more representative sample. Third, all variables were measured based on a self-reported questionnaire, which may be subject to recall bias. Future studies should consider employing more objective measurements. Fourth, self-management is influenced by numerous factors. This investigation solely focuses on the impact of health literacy on self-management and the mechanisms of social support and self-efficacy. Future studies should explore other psychosocial factors that may influence self-management.

Conclusions

The self-management of young and middle-aged patients after PCI is currently below the moderate level, with social support and self-efficacy playing a serial mediating role in the relationship between health literacy and self-management. Considering the current levels of self-management and self-efficacy among young and middle-aged patients, it is imperative for medical professionals to develop a viable cardiac rehabilitation plan following percutaneous coronary intervention (PCI), with due consideration given to incorporating self-management and self-efficacy factors as fundamental components of the rehabilitation process. In the realm of clinical medical care, healthcare professionals can enhance young and middle-aged patients' comprehension of social support following PCI through the implementation of psychological nursing interventions. This can be achieved by reinforcing nurse-patient communication, providing comprehensive health education, offering solace to patients, as well as bolstering the backing from relatives, friends, and society for these individuals post-PCI. Consequently, this approach aims to ameliorate patients' perception of self-efficacy. Therefore, during the course of treatment and nursing, patients should prioritize the cultivation of their own health literacy to enhance self-management capabilities. Consequently, it is recommended that healthcare professionals explore strategies to augment patients' health literacy in order to bolster their self-management proficiency.

Data Sharing Statement

The datasets used during the current study are available from the corresponding author on reasonable request.

Ethical Approval

The study was granted approval by the Institutional Review Board of Directors at the Second Affiliated Hospital of Wenzhou Medical University, China (2022-K-77-02), in accordance with the principles delineated in the Declaration of Helsinki. Participants were duly informed about their right to withdraw from or decline participation at any point during the study without facing any adverse consequences. Prior to utilization, all samples underwent deidentification procedures.

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Author Contributions

Wenqin Liu: Conceptualization, methodology, software, validation, formal analysis, writing-original draft preparation, writing-review and editing, visualization, supervision, project administration.

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Ruo Zhang: Conceptualization, methodology, software, validation, formal analysis, writing-original draft preparation, writing-review and editing, visualization, supervision, project administration.

All authors are actively engaged in the drafting, writing, and substantial revision as well as critical review of articles. A consensus has been reached regarding the journal to which the article will be submitted. Thoroughly review and reach agreement on all versions of the article prior to submission, during revisions, acceptance of the final version for publication, and any significant changes introduced during proofreading. Assume responsibility and accountability for the content of the article.

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Disclosure

The authors declare that there are no competing interests.

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