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The impact of perceived social support on chronic disease self-management among older inpatients in China: The chain-mediating roles of psychological resilience and health empowerment

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Abstract

Background Chronic disease self-management is a critical concern in public health, in which perceived social support plays an important role. However, the underlying pathways and mechanisms linking perceived social support to chronic disease self-management remained unclear. This study investigated whether psychological resilience and health empowerment mediated the relationship between perceived social support and the effectiveness of chronic disease self-management.

Methods A total of 368 older inpatients with chronic non-communicable diseases were recruited from three grade-A tertiary hospitals in Changsha City, China, using a convenience sampling method between January and June 2023. Data were collected using the General Information Questionnaire, the Chronic Disease Self-Management Scale, the Perceived Social Support Scale, the Connor–Davidson Resilience Scale, and the Health Empowerment Scale. Descriptive demographic analysis and Pearson correlation analysis were conducted using SPSS 26.0, and model 6 in the macro program Process 4.1 was employed to test the chain mediation effect.

Results Most older inpatients were aged 60–69 years (52.2%), followed by those aged 70–79 years (30.7%). Regression analysis revealed that perceived social support, psychological resilience, and health empowerment collectively explained 45.7% of the variance in chronic disease self-management. Mediation analysis demonstrated that perceived social support not only had a direct positive impact on chronic disease self-management (effect = 0.141, 95% CI: LL = 0.041, UL = 0.241), but also indirectly affected chronic disease self-management through three significant mediating pathways: the independent mediating effect of psychological resilience (effect = 0.102, 95% CI: LL = 0.061, UL = 0.155), the independent mediating effect of health empowerment (effect = 0.042, 95% CI: LL = 0.010, UL = 0.080), and the chain mediating effect between psychological resilience and health empowerment (effect = 0.024, 95% CI: LL = 0.006, UL = 0.047).

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Conclusion Perceived social support influenced chronic disease self-management directly and indirectly through psychological resilience and health empowerment. These findings offered practical guidance for developing more effective intervention strategies aimed at improving chronic disease self-management among older inpatients.

Keywords Chronic disease, Self-management, Social support, Resilience, Empowerment, Mediation Analysis

Introduction

Chronic non-communicable diseases (CNCDs) are characterised by being non-contagious, having a prolonged incubation period, and progressing slowly [1]. Currently, the prevention and control of CNCDs are urgent global priorities, as they account for 74% of deaths worldwide [2]. In China, the most populous country in the world, CNCDs are responsible for 88.5% of total deaths, with cerebrovascular diseases, malignant tumours, and chronic respiratory diseases comprising 80.7% of these cases [3], representing a significant public health challenge. Older inpatients, who exhibit higher rates of CNCDs, are particularly vulnerable to physical decline and an increased disease burden, leading to elevated morbidity and mortality rates [4]. The chronic nature and slow progression of CNCDs impose substantial health and economic burdens on individuals [5]. Chronic disease self-management refers to the active participation of patients in the care process, using various health management strategies with the assistance of healthcare providers to improve their physical health and daily functioning [6]. Effective self-management has been shown to enhance physical function, improve health outcomes, elevate quality of life, and alleviate the social and economic burden associated with chronic diseases [7].

According to the Health Promotion Model (HPM), health-promoting behaviour integrates three core elements: individual characteristics, behaviour, and environment. It emphasises that health promotion is a dynamic process influenced by internal and external factors [8]. Perceived social support refers to the subjective experience of spiritual and material support from social networks, including the quality and quantity of the support received [9]. It represents a multi-level external environmental support structure directly related to individual behaviour and exerts a comprehensive influence. Insufficient perceived social support can result in adverse psychological conditions, such as loneliness and depression, thereby affecting recovery [10]. Conversely, strong perceived social support can mitigate the negative effects of traumatic events and facilitate patient recovery [11]. Furthermore, previous research demonstrated that social support, which is the material, emotional, and behavioural help and support provided by family, friends, or others in a social network, can have a positive impact on an individual's self-management behaviours and health [12, 13]. Patients'perceptions of support from external sources have been used as an indirect measure of social support [14]. Although studies have suggested that perceived social support positively predicts chronic disease self-management [15], the specific mechanisms by which perceived social support affects chronic disease self-management in older inpatients with CNCDs are still unclear.

Current intervention studies on chronic disease management programmes emphasise promoting health by enhancing patients' positive attributes, rather than merely reducing negative ones [16]. Resilience, in particular, is recognised as a key attribute for patients managing the challenges of chronic diseases [17]. Psychological resilience refers to an individual's ability to maintain positive mental functioning amidst adversity or significant trauma [18]. The HPM highlights the importance of individuals'subjective initiative, with psychological resilience forming a crucial component of individual characteristics, encompassing the ability to cope with various life challenges. Developing psychological resilience not only reduces negative emotions such as anxiety, depression, and stress [19] but also enhances self-confidence and problem-solving abilities [20]. Previous research has consistently demonstrated a positive correlation between perceived social support and psychological resilience, suggesting that patients who have perceived high levels of social support are more likely to exhibit greater psychological resilience [21-23]. Given the associations between perceived social support, psychological resilience, and chronic disease self-management, it is proposed that psychological resilience might mediate the relationship between perceived social support and chronic disease self-management.

In addition to intrinsic characteristics and external support, the HPM considers behaviour to be a core element in promoting health. Empowerment is considered a prerequisite for good health [24]. Health empowerment refers to the process and outcome of an individual's ability to control disease and promote health by actively acquiring knowledge and competence, increasing beliefs, changing health behaviours, enhancing a sense of selfconsciousness, and achieving self-development and selfsatisfaction [25]. Health empowerment occurs when patients adopt positive attitudes and behaviours, supported by external support systems, to achieve favourable health outcomes and goals [26]. Therefore, health empowerment involves positive changes in healthrelated behaviours of individuals and can be seen as a behavioural outcome that reflects the core elements of the HPM. It has been confirmed that perceived social support predicts health empowerment by motivating patients to actively acquire and apply knowledge about their disease through external support systems [27]. With this, health empowerment not only achieves providing patients with knowledge and skills but also enhances self-confidence, which positively promotes patients'selfmanagement behaviours [28]. Therefore, we hypothesise that perceived social support might facilitate patients to actively engage in chronic disease self-management by enhancing the mediating role of health empowerment.

Drawing on the literature review and the HPM, it is suggested that chronic disease self-management behaviour might be influenced by individual characteristics (e.g., psychological resilience), behavioural outcomes (e.g., health empowerment), and external environmental factors (e.g., perceived social support). In addition to examining the direct impact on patients' chronic disease self-management [17, 28, 29], it is important to examine the pathways involved. Perceived social support can positively influence health empowerment and psychological resilience [21–23, 27], enabling patients to adopt positive coping styles to deal with distress [20], while preliminary evidence suggests that psychological resilience training can facilitate the process of health empowerment [30]. Therefore, we hypothesise that psychological resilience may be a prerequisite for achieving health empowerment. Based on these, perceived social support may continuously mediate the relationship between chronic disease self-management through psychological resilience and health empowerment, thus forming a chain of mediation.

However, the interrelationships between perceived social support, chronic disease self-management, psychological resilience, and health empowerment deserve more attention in the situation of older inpatients with CNCDs, and the specific internal mechanisms and pathways of influence between them remain unclear. The objective of this study is to explore the potential pathways through which perceived social support, psychological resilience, and health empowerment affect chronic disease self-management among older inpatients with CNCDs. This study aims to provide a more comprehensive understanding of designing tailored interventions. Based on these considerations, four hypotheses and corresponding models are proposed (Fig. 1): (1) perceived social support positively predicts chronic disease selfmanagement among older inpatients; (2) psychological resilience mediates the relationship between perceived social support and chronic disease self-management; (3) health empowerment mediates the relationship between perceived social support and chronic disease self-management; (4) psychological resilience and health empowerment play a chain-mediating role between perceived social support and chronic disease self-management.

Materials and methods

Design and setting

This study used data from three grade-A tertiary hospitals in Changsha, Hunan Province, China, collected between January and June 2023 in a cross-sectional study. In China, medical institutions are classified into three categories according to grading standards: community hospitals (Level I), secondary hospitals (Level II) and tertiary hospitals (Level III) [31]. Grade-A tertiary is the highest level of medical institutions. A convenience sampling method was used to recruit older inpatients from these hospitals, which were large, comprehensive public institutions offering a wide range of medical services, including treatment, emergency care, and rehabilitation. Their high patient volume provided a robust sample for this research. Data collection was carried out by nurses who received thorough training in consent procedures and data collection protocols. The Ethics Committee of Hunan Normal University (approval number: 2022114) approved the study.



Fig. 1 Hypothesised relationships between perceived social support, psychological resilience, health empowerment, and chronic disease self-management. H1: Hypothesis 1, H2: Hypothesis 2, H3: Hypothesis 3, H4: Hypothesis 4

Participants and procedure

The inclusion criteria for this study were as follows: (1) age ≥ 60 years; (2) consciousness and the ability to communicate normally; (3) diagnosis of at least one CNCDs according to the World Health Organisation (WHO) diagnostic criteria [32]; (4) the ability to understand and complete the questionnaires. Patients with cognitive impairments or psychiatric disorders were excluded. Eligible participants were informed of the purpose, content, and procedures of the study and provided written informed consent before participation. All questionnaires were completed independently by patients, with caregivers providing assistance to check for omissions or errors in filling in the questionnaire, ensuring completeness and accuracy. Any questionnaires with missing items were deemed invalid. The sample size was estimated based on 10 to 20 times the number of independent variables [33]. A total of 31 variables were involved in this study, including 17 variables about demographic and clinical information, 3 domains in the perceived social support scale, 3 domains in the Connor-Davidson resilience scale, 5 domains in the health empowerment scale, and 3 domains in the chronic disease self-management scale. The required sample size was calculated to be between 310 and 620 participants. A total of 392 questionnaires were distributed, and 368 valid questionnaires were collected, resulting in a response rate of 93.88%.

Data collection tools

Demographic and clinical information

The demographic characteristics of the participants, including age, sex, number of children, length of hospital stay, marital status, type of residence, residential situation, occupation, educational attainment, monthly income, monthly sources of income, type of CNCDs, duration of CNCDs, medical payment method, self-care ability, primary caregiver status, and caregiving responsibilities, were designed by the researcher according to the purpose of the study.

Chronic Disease Self-Management Scale (CDSMS)

Chronic disease self-management was evaluated using the scale compiled by Lorig in 1996, including exercise, cognitive symptom management, and communication with physicians, with a total of 15 items in these three dimensions [34], such as "How much time have you spent walking in the past week". Zhang in 2009 tested the Chinese version of the CDSMS in Chinese patients, and it demonstrated good reliability and validity [35]. Among them, physical exercise (6 items) adopted the Likert 5-level scoring method, 0 = no exercise, 1 = < 30 min, 2 =30-59 min, 3 = 1-3 h, 4 = > 3 h; cognitive symptom management (6 items) and communication with pshysicians (3 items) were scored on a 6-point Likert scale, 0 = none at all, 1 = very rarely, 2 = rarely, 3 = sometimes, 4 = often, and 5 = all the time, on a scale of 0–69. The higher the score, the better the self-management behaviour of the subjects, and Cronbach's α coefficient in this study was 0.776.

Perceived Social Support Scale (PSSS)

The Perceived Social Support Scale was designed by Zimet and other scholars in 1988 [36]. The Chinese version was applied to hospitalised patients in China by Zhang in 2018. The Cronbach's α coefficient for the total scale was 0.840, demonstrating good reliability and validity [37]. The scale includes 3 dimensions of family support, friend support, and other support (teachers, classmates, relatives), with a total of 12 items, such as "My family can help me concretely". The seven-level scoring method was adopted, with 1 to 7 points indicating "strongly disagree" to "strongly agree", and the total score was 12 to 84 points. The higher the score, the better the level of social support. Cronbach's α coefficient in this study was 0.832.

Connor-Davidson Resilience Scale (CD-RISC)

The scale was compiled by Connor and Davidson in 2003 [38], and the Chinese version was revised by Yu and Zhang in 2007 [39], which had good reliability and validity and contained 25 items in three dimensions, namely tenacity, strength, and optimism, such as "I can adapt to change". The Likert 5-level scoring method was adopted, with 0 to 4 points for the item options "never" to "always" respectively, and the total score was 0 to 100 points. The higher the score, the better the psychological resilience. Cronbach's α coefficient in this study was 0.808.

Health Empowerment Scale (HES)

The level of health empowerment of older patients with CNCDs was evaluated using the health empowerment scale developed by Yang in 2017 [40]. There were 26 specific items in the scale, which were divided into 5 dimensions: participation in treatment, responsibility belief, knowledge growth, support, and self-reconstruction, with questions such as "I actively learn about the disease". Each item was scored on a scale of 1 to 5, from "strongly disagree" to "strongly agree", on a scale of 26 to 130. The higher the score, the higher the level of health empowerment. Cronbach's α coefficient in this study was 0.860.

Statistical analysis

Data analysis was conducted using the SPSS 26.0 software package. Continuous variables were expressed as the mean \pm standard deviation (SD), while categorical data were presented as n (%). Single-factor analysis was

performed using an independent sample t-test or analysis of variance. Participants were divided into two subgroups based on their CDSMS scores: (a) mild chronic disease self-management (0–34.5) and (b) high chronic disease self-management (34.5–69). Pearson's correlation coefficient was used to determine the relationships between chronic disease self-management, perceived social support, psychological resilience, and health empowerment. The mediating effect in Model 6 was tested using the SPSS macro program Process 4.1 [41], with a bootstrap sample size of 5000 and a 95% confidence interval (CI). P-value of < 0.05 was considered statistically significant.

Results

General characteristics of the study

Baseline characteristics and variations in CDSMS scores among older inpatients are presented in Table 1. The study sample comprised 368 older inpatients, with 198 males (53.8%) and 170 females (46.2%). The average age of the older inpatients in our study was 70.99 ± 7.94 years. Most participants were aged between 60-69 years (52.2%) and 70-79 years (30.7%), which aligned with the definition of elderly populations provided by the WHO. The mean CDSMS score for the sample was relatively low, at 20.67 \pm 10.10, indicating a generally low level of chronic disease self-management behaviours. No significant differences in CDSMS scores were observed based on the number of children, marital status, living arrangements, or medical payment method (P > 0.05). However, univariate analysis revealed statistically significant differences in CDSMS scores based on sex, age, length of hospital stay, type of residence, educational attainment, occupation, monthly income, monthly sources of income, type of CNCDs, duration of CNCDs, self-care ability, primary caregiver status, and caregiving responsibilities (P <0.05).

Comparison of PSSS, CD-RISC, and HES between patients with low and high CDSMS scores

The PSSS, CD-RISC, and HES scores for older inpatients in the two groups are presented in Table 2. Among older inpatients with low CDSMS scores, the mean PSSS score was 58.77 (SD: 11.11), the mean CD-RISC score was 51.43 (SD: 14.67), and the mean HES score was 86.69 (SD: 16.24). In contrast, participants with high CDSMS scores had a mean PSSS score of 69.87 (SD: 6.57), a mean CD-RISC score of 69.67 (SD: 12.17), and a mean HES score of 105.13 (SD: 19.20). Significant differences were observed between the two groups for PSSS, CD-RISC, and HES (P < 0.001), with participants in the low CDSMS group showing lower PSSS, CD-RISC, and HES scores compared to those in the high CDSMS group.

Correlation analysis of major study variables

Table 3 presents the correlation analysis of all study variables. The Pearson correlation analysis revealed that perceived social support among older inpatients was positively correlated with psychological resilience (r = 0.535, P < 0.01), health empowerment (r = 0.549, P < 0.01), and chronic disease self-management (r = 0.450, P < 0.01). Similarly, psychological resilience demonstrated a positive correlation with health empowerment (r = 0.612, P < 0.01) and chronic disease self-management (r = 0.495, P < 0.01). Furthermore, health empowerment was positively associated with chronic disease self-management (r = 0.462, P < 0.01).

Common method biases tests

During the survey process, the anonymity and confidentiality of the questionnaire were emphasised to minimise potential common methodological biases. Harman's single-factor analysis was performed on all items across the four variables, and it was found that the unrotated first factor explained only 31.75% of the total variance [42]. This result suggested that no significant common method bias existed in this study.

Multiple mediating analyses between variables of older inpatients

Table 4 and Fig. 2 presented the results of the regression analysis examining the relationship between perceived social support and chronic disease self-management. After controlling for 13 factors-including age, sex, occupation, educational attainment, length of hospital stay, type of residence, monthly income, monthly sources of income, type of CNCDs, duration of CNCDs, self-care ability, primary caregiver status, and caregiving responsibilities. We converted multicategorical unordered variables into dummy variables, with the specific reference group settings and variable assignments shown in Supplementary Material 1. The analysis revealed that the total effect of perceived social support on chronic disease self-management ($\beta = 0.309$, t = 6.728, P < 0.01) and the direct effect (β = 0.141, t = 2.785, *P* < 0.01) were statistically significant. Furthermore, when psychological resilience and health empowerment were included in the regression equation, perceived social support significantly predicted psychological resilience ($\beta = 0.408$, t = 8.993, P < 0.01) and health empowerment (β = 0.291, t = 6.145, P < 0.01). Psychological resilience significantly predicted health empowerment (β = 0.407, t = 8.113, *P* < 0.01) as well as chronic disease self-management ($\beta =$ 0.252, t = 4.529, P < 0.01). Additionally, health empowerment emerged as a significant positive predictor of chronic disease self-management ($\beta = 0.143$, t = 2.641, P <

Variables	n (%)	CDSMS (M ± SD)	t/F	Р
Age (years)			5.077	0.007 ^b
60–69	192 (52.2)	22.23 ± 10.30		
70–79	113 (30.7)	19.30 ± 9.37		
≥ 80	63 (17.1)	18.38 ± 10.12		
Sex			2.067	0.040 ^a
Male	198 (53.8)	21.69 ± 9.05		
Female	170 (46.2)	19.49 ± 11.13		
Number of Children			1.362	0.174
≤ 1	99 (26.9)	21.86 ± 9.02		
> 1	269 (73.1)	20.24 ± 10.46		
Length of hospital stay			4.818	0.009 ^b
<7	149 (40.5)	20.14 ± 9.90		
7–14	164 (44.6)	19.87 ± 11.03		
≥ 14	55 (14.9)	24.53 ± 6.35		
Marital status	, , , , , , , , , , , , , , , , , , ,		- 0.130	0.897
Unmarried/Divorced/Widowed	43 (11.7)	20.49 ± 9.74		
Married	325 (88.3)	20.70 + 10.17		
Type of residence	()		- 2 908	0.004 ^a
Countryside	161 (43.8)	1896+959	2.900	0.001
City	207 (56 2)	22.01 + 10.32		
Residential situation	207 (30.2)	22.01 ± 10.52	0.876	0.454
	31 (8.4)	21 90 + 12 50	0.070	0.151
Live with spouse only	179 (48.6)	21.30 ± 9.24		
Live with children only	55 (14.9)	21.50 ± 9.21 20.07 + 7.42		
Live with spouse and children	103 (28 0)	1954 ± 1180		
	105 (20.0)	17.54 ± 11.00	5 /08	< 0.001 ^b
Farmer	1/10 (38.0)	1796 + 1033	J. T J0	< 0.001
Self-employment household	44 (12 0)	21.84 ± 10.87		
Staff member	44 (12.0)	10.77 ± 10.07		
	70 (10.0)	19.77 ± 10.41		
	70 (19.0)	23.03 ± 7.03		
Educational attainment	70 (19.0)	22.00 ± 9.7 5	15 007	< 0.001b
Drimony and below	09 (26 6)	16 16 ± 11 05	15.007	< 0.001
	90 (20.0) 157 (40.7)	10.10 ± 11.05		
	157 (42.7)	20.02 ± 9.95		
	47 (12.9)	25.21 ± 7.05		
Monthly income (DMR)	47 (12.0)	28.70 ± 7.90	E AEQ	0.005b
	22 (0 0)	20.21 + 6.70	5.456	0.005
< 1000	33 (9.0) 370 (75 9)	20.21 ±0.70		
> 5000	279 (75.8)	19.92 ± 10.02		
≥ 5000	50 (15.2)	24.73±8.14	10.052	< 0.001b
Monthly sources of Income	124 (22.4)	22.22 + 10.02	10.953	< 0.001
	124 (33.4)	22.32 ± 10.02		
Pension	154 (41.8)	22.18 ± 8.45		
Government subsidies	14 (3.8)	20.57 ± 11.91		
	// (20.9)	15.06 ± 11.10	5044	
Type of CNCDs		22.64	5.844	< 0.001ª
≤ 1	185 (50.3)	23.64 ± 8.82		
≥ 2	183 (49./)	1/./3±10.48		L
Duration of CNCDs (years)			8.549	< 0.001 ^b

Table 1 Baseline characteristics and differences in the CDSMS of older inpatients (n = 368)

Table 1 (continued)

Variables	n (%)	CDSMS (M±SD)	t/F	Р
< 5	116 (31.5)	23.13 ± 8.82		
5–10	120 (32.6)	21.20 ± 10.91		
≥ 10	132 (35.9)	18.03 ± 9.82		
Medical payment method			2.090	0.066
Self-payment	21 (5.7)	22.43 ± 12.10		
Urban worker medical insurance	101 (27.4)	22.16 ± 9.09		
Urban resident insurance	88 (23.9)	21.51 ±11.36		
New rural insurance	143 (38.9)	18.66 ± 9.71		
Commercial medical insurance	5 (1.4)	19.40 ± 10.36		
Else	10 (2.7)	24.10 ± 4.61		
Self-care ability			25.589	< 0.001 ^b
Strong	205 (55.7)	23.46 ± 9.53		
Normal	124 (33.7)	18.57 ± 8.85		
Weak	39 (10.6)	12.72 ± 11.14		
Primary caregiver status			4.112	0.003 ^b
Oneself	126 (34.2)	23.22 ± 8.53		
Spouse	153 (41.6)	19.24 ± 11.24		
Child	72 (19.5)	20.25 ± 8.68		
Else	17 (4.6)	16.33 ± 10.30		
Caregiving responsibilities			2.037	0.042 ^a
Yes	114 (31.0)	22.27 ± 9.12		
No	254 (69.0)	19.96 ± 10.46		

Note:^a Statistically significant *P*-value from continuous variables using *t*-test; ^b Statistically significant *P*-value from categorical variables using variance; Based on normality test, the normally distributed data was reported as mean and standard deviation values (mean ± SD). *CDSMS*, Chronic Disease Self-Management Scale. *RMB* the official currency of China

Table 2 Comparison of low CDSMS and high CDSMS in older inpatients (n = 368)

Variables	Low CDSMS ($n = 3$	338)	High CDSMS ($n = 3$		
	Mean (SD)	Range	Mean (SD)	Range	t
PSSS	58.77 (11.11)	32.00-84.00	69.87 (6.57)	60.00-83.00	- 8.256***
Family support	21.07 (3.77)	12.00-28.00	24.40 (1.83)	21.00-28.00	- 8.492***
Friends support	18.44 (4.58)	4.00-28.00	22.43 (3.24)	16.00-28.00	- 4.669***
Others supports	19.26 (4.31)	4.00-28.00	23.03 (2.24)	20.00-27.00	- 8.007***
CD-RISC	51.43 (14.67)	13.00-100.00	69.67 (12.17)	45.00-96.00	- 6.609***
Tenacity	26.02 (8.14)	6.00-52.00	35.63 (6.40)	20.00-48.00	- 7.696***
Strength	17.01 (4.56)	5.00-32.00	22.10 (4.30)	14.00-32.00	- 5.880****
Optimism	8.40 (2.94)	2.00-16.00	11.93 (2.42)	5.00-16.00	- 6.403***
HES	86.69 (16.24)	50.00-130.00	105.13 (19.20)	61.00-130.00	- 5.870***
Responsibility belief	14.29 (3.77)	7.00-20.00	17.40 (3.17)	8.00-20.00	- 4.391***
Getting support	20.70 (4.46)	12.00-30.00	24.60 (4.48)	12.00-30.00	- 4.591***
Participate in therapy	16.01 (3.94)	5.00-25.00	20.07 (4.45)	10.00-25.00	- 5.338***
Enhance knowledge	18.67 (4.71)	6.00-30.00	23.17 (5.78)	12.00-30.00	- 4.912***
Rebuild oneself	17.02 (3.80)	9.00-25.00	19.90 (4.38)	10.00-25.00	- 3.932***

Note: ***P < 0.001; SD standard deviation, PSSS Perceived Social Support Scale, CD-RISC Conner-Davidson Resilience Scale, HES Health Empowerment Scale, CDSMS Chronic Disease Self-Management Scale

Table 3 Correlation analysis of all study variables

Variables	M±SD	1	2	3	4
1. PSSS	59.67 ±11.22	-			
2. CD-RISC	52.91 ±15.30	0.535**	-		
3. HES	88.19 ± 17.23	0.549**	0.612**	-	
4. CDSMS	20.67 ± 10.10	0.450**	0.495**	0.462**	-

Note: **P < 0.01; *M*, mean; *SD* standard deviation, *PSSS* Perceived Social Support Scale, *CD-RISC* Conner-Davidson Resilience Scale, *HES* Health Empowerment Scale, *CDSMS* Chronic Disease Self-Management Scale

0.01). These findings indicated that psychological resilience and health empowerment played significant roles in the influence of perceived social support on chronic disease self-management.

Table 5 presented the results of the bootstrap analysis, which confirmed the establishment of mediation effects. Perceived social support affected chronic disease self-management through three indirect pathways. The total effect of perceived social support on chronic disease self-management was 0.309 (95% CI: 0.219–0.399), with a total indirect effect value of 0.168 (95% CI: 0.107–0.240). In Path 1, perceived social support exhibited a significant

indirect predictive effect on chronic disease self-management via psychological resilience, with an indirect effect value of 0.102 (95% CI: 0.061–0.155), accounting for 33.01% of the total effect. In Path 2, perceived social support demonstrated a significant indirect predictive effect on chronic disease self-management via health empowerment, with an indirect effect value of 0.042 (95% CI: 0.010–0.080), representing 13.59% of the total effect. Lastly, in Path 3, perceived social support had a significant indirect predictive effect on chronic disease selfmanagement through psychological resilience and health empowerment, yielding an indirect effect value of 0.024 (95% CI: 0.006–0.047), constituting 7.77% of the total effect.

Discussion

This study examined the association between perceived social support and chronic disease self-management, as well as the underlying mechanisms of psychological resilience and health empowerment in older inpatients with CNCDs in China. Our findings indicated that perceived social support positively predicted chronic disease self-management among older inpatients (Hypothesis 1). Additionally, this relationship was mediated

Table 4 Regression analysis of CD-RISC and HES in the chain mediation model between PSSS and CDSMS

	CD-RISC		HES			CDSMS						
	β	SE	t	95%Cl	β	SE	t	95%Cl	β	SE	t	95%Cl
PSSS	0.408	0.045	8.993**	0.319,0.497	0.291	0.047	6.145**	0.198,0.385	0.141	0.051	2.785**	0.041,0.241
CD-RISC					0.407	0.050	8.113**	0.309,0.506	0.252	0.056	4.529**	0.142,0.361
HES									0.143	0.054	2.641**	0.037,0.249
R ²	0.404				0.472				0.457			
F	17.094**				20.934**				18.441**			

Note: All variables in the model have been standardised. **P < 0.01; SE standard error, β unstandardized coefficients, PSSS Perceived Social Support Scale, CD-RISC Conner-Davidson Resilience Scale, HES Health Empowerment Scale, CDSMS Chronic Disease Self-Management Scale



Fig. 2 The role of psychological resilience and health empowerment as the chain mediators in the relationship between perceived social support and chronic disease self-management with standardised beta (IBM SPSS macro program PROCESS v4.1 Model 6). ***P* < 0.01, ****P* < 0.001. PSSS, Perceived Social Support Scale; CD-RISC, Conner-Davidson Resilience Scale; HES, Health Empowerment Scale; CDSMS, Chronic Disease Self-Management Scale

Table 5 Multiple mediated analysis between variables of olderinpatients (n = 368)

Effect types	Effect	SE	95%Cl	Effect ratio
Total effect	0.309	0.046	(0.219, 0.399)	100.00%
Direct effect	0.141	0.051	(0.041, 0.241)	45.63%
Total indirect effect	0.168	0.034	(0.107, 0.240)	54.37%
Path 1	0.102	0.024	(0.061, 0.155)	33.01%
Path 2	0.042	0.018	(0.010, 0.080)	13.59%
Path 3	0.024	0.011	(0.006, 0.047)	7.77%

Note: Path 1 (perceived social support \rightarrow psychological resilience \rightarrow chronic disease self-management); Path 2 (perceived social support \rightarrow health empowerment \rightarrow chronic disease self-management); Path 3 (perceived social support \rightarrow psychological resilience \rightarrow health empowerment \rightarrow chronic disease self-management)

by psychological resilience and health empowerment (Hypotheses 2 and 3). Notably, our results also demonstrated that psychological resilience and health empowerment functioned as chain mediators between perceived social support and chronic disease self-management (Hypothesis 4).

The self-management of chronic diseases in older inpatients was suboptimal

The average score for chronic disease self-management among the 368 older inpatients was 20.67 ± 10.10 , indicating a relatively low level, which was consistent with previous studies involving older populations [43]. This might be attributed to the decline in physical function, alongside physical and mental fatigue caused by prolonged illness, which adversely affected daily living and social activities [44]. We found that female patients performed less well in chronic disease self-management, which may be due to the fact that women tend to take on more of a caregiving role for their families and others, which can result in their self-management being neglected [45]. Self-management also significantly declined the older the inpatients were, which is not only because older inpatients usually face the burden of multiple chronic disease complications, but also because some older individuals tend to rely heavily on healthcare providers, lacking the awareness and motivation for chronic disease selfmanagement [46]. Furthermore, older inpatients living with their spouses and children showed lower levels of self-management, which can be attributed to the fact that within the context of traditional Chinese culture, which emphasises filial piety and family harmony, the elderly often expect to be cared for by their children or younger generations. This cultural expectation may diminish their motivation and ability to self-manage their health conditions [47].

Our findings indicated that inpatients hospitalised for more than 14 days exhibited higher CDSMS scores. Extended hospitalisation might have provided more opportunities for patients to receive professional guidance and education from healthcare providers, allowing them to better understand and acquire the skills necessary for effective self-management of chronic diseases, thereby improving their behavioural ability. Additionally, individuals with higher educational levels might have had a comparative advantage in accessing health information, learning, decision-making, and communication skills, facilitating more effective chronic disease management, consistent with findings from similar studies [48, 49]. Notably, patients with more types of CNCDs and longer disease duration tended to have lower CDSMS scores. This suggested that individuals with multiple chronic conditions experienced poorer health, reduced functional status, and diminished quality of life, along with an increased treatment burden and a higher risk of unplanned hospitalisations [50]. These factors significantly affected their physical and mental well-being, as well as their ability to manage chronic conditions. Therefore, it is crucial to consider the specific types and progression of chronic diseases among older inpatients, identify potential conflicts in self-management, and provide coordinated support. Healthcare providers should establish a multidisciplinary collaboration mechanism to address the individualised needs of older inpatients with CNCDs, to disseminate knowledge of chronic diseases, and to improve older inpatients'knowledge and ability to self-manage their chronic diseases.

CDSMS scores were closely related to the perceived social support, psychological resilience, and health empowerment of older inpatients

Our study revealed that individuals in the low chronic disease self-management group exhibited lower scores in perceived social support, psychological resilience, and health empowerment. This might be attributed to these patients receiving limited social support from family, friends, or the community when facing the challenges of chronic disease [51], which could lead to feelings of loneliness and helplessness. Additionally, they often lacked the psychological resilience and coping mechanisms necessary to manage stress, challenges, and setbacks, making them more susceptible to negative emotional states [52]. Pearson correlation analysis demonstrated a significant positive relationship between chronic disease self-management and perceived social support, psychological resilience, and health empowerment. Perceived social support is a known positive predictor of health-promoting behaviours [53], which could have enhanced patients' resilience [54]. Moreover, higher levels

of psychological resilience have been shown to effectively improve chronic disease self-management behaviours [55].

It was worth noting that many hospitalised patients tended to rely solely on their doctors'advice, often neglecting the need for active participation in health decision-making and management. Furthermore, they lacked a clear understanding of the principles and practices of health management [56]. Patients lacking health empowerment could not fully understand or exercise their rights in health management, which adversely affected their ability to benefit from social support and psychological resilience. These limitations often restricted their health-related knowledge and confidence, leading to reduced self-management capabilities. It is suggested that it is possible to encourage patients to take the initiative to participate in medical decisionmaking by using digital tools and the doctor-patient shared decision-making model to enhance their initiative and self-confidence in the healthcare process, and to promote the ability of older inpatients to enhance their self-management.

Establishment of the mediation between perceived social support and chronic disease self-management

Through hierarchical regression and mediation model analyses, this study identified that perceived social support, psychological resilience, and health empowerment significantly impacted chronic disease self-management. Among these factors, perceived social support exerted a positive influence, accounting for 40.4% of the variance in chronic disease self-management. Perceived social support can alleviate the physical and psychological distress associated with chronic diseases by facilitating the effective use of personal and external resources. For older inpatients with CNCDs, family members serve as a primary source of social support, playing a crucial role in encouraging disease management and aiding decisionmaking [57]. Additionally, healthcare providers impart disease-related knowledge and skills to patients, enhancing their understanding and management of the disease [58]. We recommended that healthcare providers establish a comprehensive support system to alleviate the psychological burden on older inpatients with CNCDs, improve their coping abilities, and facilitate active treatment and rehabilitation. Policymakers should also focus on developing and strengthening chronic disease monitoring frameworks, enhancing prevention and treatment policies, implementing standardised chronic disease management, and promoting improved self-management among older inpatients.

In older inpatients, social support indirectly affected self-management ability through health empowerment, with an effect size of 4.2%. Health empowerment enhances the inherent competence and self-confidence of individuals with CNCDs, thereby improving chronic disease outcomes by promoting healthy decision-making and lifestyle changes [59, 60]. Additionally, research indicates a positive correlation between family support and patient empowerment [61, 62]. Patients with strong social support tend to have a better understanding of their illness and actively seek assistance from their community. Currently, the main form of health empowerment practice focuses on developing and implementing health education strategies that can improve inpatients'clinical symptoms, diet and nutrition, medication, and treatment [63]. We suggest that healthcare professionals promote health empowerment through health education manuals, patient diaries, and empowerment groups during the hospitalisation of older inpatients with CNCDs. Furthermore, internet-based health empowerment initiatives not only compensate for the limitations of geographical distance and reduce the cost of sustainable healthcare services, but also improve patients'self-management behaviours [64]. After discharge, telemedicine interventions such as video counselling and online support groups can help patients achieve sustained health empowerment over the long cycle of chronic disease self-management.

The mediation analysis demonstrated that perceived social support indirectly influenced chronic disease self-management among older inpatients through psychological resilience, with an effect size of 10.2%. Social support is an external resource that can stimulate patients'internal psychological resilience, fostering a positive and optimistic mindset [65]. Psychological resilience plays a crucial role in enhancing social support acceptance, improving disease control capabilities, and ultimately facilitating chronic disease self-management [66, 67]. Cognitive Behavioural Therapy, Acceptance and Commitment Therapy, and Positive Mindfulness-Based Therapy have been shown to be effective psychotherapeutic procedures for enhancing psychological resilience [68]. These therapies can help patients identify and change negative thinking styles and improve their ability to cope with stress. Moreover, recent studies have shown that in addition to psychological resilience, physical resilience is receiving increasing attention in chronic disease management and geriatric health [69]. Physical resilience refers to a patient's ability to maintain or regain physical functioning under the stress of chronic illness, and its importance in patients with chronic illness has been validated by the Physical Resilience Inventory (PRIFOR- 4) developed by Hu et al. [70-72]. Although this study focused on psychological resilience, the

potential of physical resilience in the self-management of chronic disease should also be emphasised. Therefore, it is recommended that different interventions be used to enhance psychological resilience in older inpatients with CNCDs based on their specific self-management needs and enhanced social support resources, and that future research should further focus on physical resilience in this population.

Notably, this study was the first to reveal that psychological resilience and health empowerment function as chain mediators in the relationship between perceived social support and chronic disease self-management in older inpatients with CNCDs. These findings suggested that perceived social support impacted chronic disease self-management through the pathway from psychological resilience to health empowerment. The interplay between personality traits (psychological resilience), behavioural outcomes (health empowerment), and environmental factors (perceived social support) on chronic disease self-management in older inpatients with CNCDs was comprehensively examined. The findings are consistent with the core concepts of the Health Promotion Model (HPM), affirming the significance of these factors in promoting chronic disease self-management [8]. Unlike the Health Belief Model, which primarily focuses on personal perceptions of health threats, the HPM offers a more holistic framework by incorporating internal and external elements that contribute to health promotion [73]. This wider scope renders it especially suitable for championing chronic disease self-management amongst older adults admitted with chronic conditions. Given these insights, future research and clinical practice should focus on designing and implementing integrated interventions. The establishment of social support networks, development of psychological training courses, encouragement for older inpatients to participate in medical rehabilitation decision-making, and combined strategies for health empowerment and psychological resilience will achieve optimal outcomes.

Limitation

This study has certain limitations. First, as a cross-sectional study, data were collected at a single point in time, which made it challenging to establish the temporal order and dynamic changes between variables. This limitation also complicated the inference of causality. Future research should adopt longitudinal tracking designs to rigorously test and confirm whether the current findings reflect true causal relationships. Second, self-reported questionnaires were used, which introduced the potential for self-report bias, such as recall bias, thereby reducing the objectivity of measurements and potentially limiting the generalisability of the results. To mitigate common method bias in future studies involving older inpatients, researchers should emphasise the anonymity and confidentiality of the questionnaires. Moreover, incorporating objective indicators, such as wearable devices or medical monitoring devices that capture physiological data, could address the limitations associated with self-reporting. Lastly, although this study examined the mediating relationships between variables, it did not account for potential moderating variables. Future studies should consider factors that might influence the two mediators to provide a more comprehensive analysis.

Conclusion

Our study identified key factors associated with chronic disease self-management among older inpatients with CNCDs in China and elucidated the multichainmediated effects of psychological resilience and health empowerment in the relationship between chronic disease self-management and perceived social support. These findings offer a novel perspective and theoretical basis for improving the rehabilitation of older inpatients with CNCDs. The importance of psychological resilience and health empowerment was highlighted, and future research and clinical practice should prioritise these aspects.

Abbreviations

CNCDs	Chronic noncommunicable diseases
PSSS	Perceived Social Support Scale
CD-RISC	Conner-Davidson Resilience Scale
HES	Health Empowerment Scale
CDSMS	Chronic Disease Self-Management Scale
RMB	Renminbi, the official currency of China

Supplementary Information

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Supplementary Material 1.

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Authors' contribution

Chunni Lin and Xiayi Zhu designed the study and wrote the first draft. Chunni Lin, Xiayi Zhu, and Xiaohui Wang performed the literature search. Ying Wu, Lingyue Wang, and Xiang Hu conducted the survey study and collected and analyzed the data. Li Cong and Xiaohui Wang obtained funding. Jing Wen and Li Cong supervised and finalized the manuscript. All authors contributed to the review and approved the submitted version.

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Data availability

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

Declarations

Ethics approval and consent to participate

The study was established by the Declaration of Helsinki, and approved by the Ethics Committee of Hunan Normal University (No. 2022114) approved the study. Written informed consent was obtained from all participants or their legal guardians at recruitment. The relevant guidelines and regulations performed all methods.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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