

Factors Associated with Self-Regulatory Fatigue in Chinese Older Patients with Coronary Heart Disease: A Cross-Sectional Survey

Xiaofu Ji, Hongyu Yu

School of Nursing, Jinzhou Medical University, Jinzhou, Liaoning, People's Republic of China

Correspondence: Hongyu Yu, School of Nursing, Jinzhou Medical University, Jinzhou, Liaoning, People's Republic of China, Tel +86 15941628522, Email 838821920@qq.com

Purpose: To identify important determinants of self-regulatory fatigue in older adults with coronary heart disease based on demographics, health literacy, and health empowerment factors.

Patients and Methods: A total of 201 older patients with coronary heart disease (CHD) from First Affiliated Hospital of Jinzhou Medical University by cluster sampling method. Demographic Questionnaire, the Health Literacy Management Scale (HLSCP), the Patient Perception Empowerment Scale (PPES), and the Self-Regulatory Fatigue Scale (SRF-S) were used to collect the data.

Results: The coronary heart disease elderly scored 44.20 ± 6.98 points in self-regulatory fatigue. The results showed that residence, monthly household income, hospitalized times of CHD since illness, health literacy and health empowerment were significant determinants of self-regulatory fatigue ($p < 0.001$). Self-regulatory fatigue was negatively correlated with health literacy ($r = -0.639$, $P < 0.01$) and health empowerment ($r = -0.580$, $P < 0.01$).

Conclusion: Residence, monthly household income, hospitalized times of CHD since illness influence self-regulatory fatigue among coronary heart disease patients. Health literacy and health empowerment were independent predictors of self-regulatory among coronary heart disease patients.

Keywords: coronary heart disease, older adults, health literacy, health empowerment, self-regulatory fatigue

Introduction

Coronary heart disease (CHD) is one of the highest non-communicable chronic diseases in morbidity and mortality worldwide.¹ Worldwide, approximately 17 million people die from cardiovascular disease each year, with coronary heart disease accounting for 67.1% of all cardiovascular deaths.² Due to the accelerated aging of the Chinese population and changes in people's lifestyles, such as frequent smoking, heavy alcohol consumption, unhealthy eating habits,³ the incidence and mortality of coronary heart disease have increased since the early 1970s, posing a severe threat to national health. The mortality rate of coronary heart disease in China exceeded 120/100,000 in 2018, and the prevalence of coronary heart disease among people over 60 years old was as high as 27.8%.⁴ Coronary heart disease is also the leading cause of death among the elderly in China.⁵

Self-regulatory fatigue refers to the physical and psychological stress of patients, enduring the discomfort of the disease and rapidly depleting the patient's self-control resources.⁶ The long duration of the disease and susceptibility to recurrence are characteristics of coronary artery disease that predispose patients to physical and psychological challenges.⁷ In addition, health-promoting behaviors are the basis of clinical treatment and secondary preventive care for coronary heart disease and will directly influence treatment outcomes. Patients with coronary heart disease need to adhere to health promotion behaviors, including strict control of diet, exercise, lipid monitoring, and medication.⁸ These behaviors overuse self-control resources, which may lead to a significant reduction of their self-control resources in

a short period of time, and even be depleted.⁹ This is the most critical factor that leads to the failure of self-control tasks.¹⁰ Facing such difficulties may decrease self-control and make patients experience self-regulatory fatigue.¹¹

Some studies have shown that self-regulation fatigue can lead to decreased life quality and self-management in patients.¹² Therefore, it is important to pay attention to the patient's self-regulatory fatigue and take effective measures to improve it. The finite resource model¹³ argues that people's psychological resources are limited but also temporary and can be replenished through some channels.

In previous studies, people had mainly used external interventions to reduce patients' self-regulatory fatigue.^{14,15} Health literacy is the ability to make sound health decisions for themselves to maintain and promote their health.¹⁶ According to WHO, health literacy is a more accurate predictor of population health status than patients' race, education level, socio-economic factors, etc.¹⁷ According to previous studies, low health literacy can lead to poor outcomes, such as a lack of understanding of disease and low adherence.¹⁸ Health empowerment refers to a positive partnership and patient self-care strategies developed to improve health outcomes and quality of life in chronic disease and is a prerequisite for wellness.¹⁹ Literature illustrated that health literacy and perceived empowerment play a dominant role in health behaviors.²⁰ The purpose of this study, therefore, were to explore the impact of health literacy and perceived empowerment on the self-regulatory fatigue of older patients with coronary heart disease. We hypothesized that 1) Demographic and illness characteristics were important determinants of self-regulatory fatigue among older patients with CHD. 2) highly health literacy and perceived empowerment would predict lower self-regulatory fatigue, after controlling for the effects of background variables.

Methods and Materials

Design and Participants

A cross-sectional study was conducted. A total of 211 patients with CHD were sampled by cluster sampling method at the First Hospital of Jinzhou Medical University (Liaoning Province, China) from September 2021 to January 2022. The patient inclusion criteria were as follows: (a) confirmed diagnosis of coronary heart disease; (b) aged 60 years or older; (c) had some language skills; (d) voluntarily participated in this study. The exclusion criteria were as follows: (a) unstable vital signs in the acute phase or with symptoms such as severe liver and kidney insufficiency; (b) unconscious and serious psychological disorders. But 10 dropped out in the questionnaire survey. Finally, 201 eligible participants were included in the analysis.

Measurements

Demographic Characteristics

A self-designed questionnaire that consisted of age, sex, education, marital status, family residence, medical payment methods and monthly household income was used to collect demographic characteristics of patients. Family history of CHD, the number of combined chronic diseases, duration of CHD and hospitalized times for CHD since illness captured disease-related conditions of patients.

Self-Regulatory Fatigue Scale(SRF-S)

The Self-Regulatory Fatigue Scale (SRF-S) was developed by Nes et al²¹, in Australia. It has frequently been used as a measurement of individual self-regulatory fatigue status. In the Chinese version developed by Wang et al²², the overall Cronbach alpha coefficient for this study scale was 0.772. The SRF-S contains 3 dimensions, cognitive (6 items), emotional (5 items), and behavioral (5 items), with a total of 16 items. A 5-point Likert scale was used with range of scores from 1–5, representing strongly disagree (1) to strongly agree (5), respectively, with higher scores indicating more severe self-loss.

Health Literacy Management Scale (HLSCP)

The Health Literacy Management Scale (HLSCP) was developed by Professor Jordan²³ of the University of Melbourne, Australia, in 2010. It Described the level of individual health-related knowledge and skills. This study used the Chinese

version of HLSCP translated by Sun et al²⁴, Cronbach's alpha was 0.980 in this study. The scale had 24 items and contains four dimensions: Information acquisition ability (9 items), Communicative interaction ability (9 items), Health improvement willingness (4 items), and Economic support willingness (2 items). The scale used a 5-point Likert scale, with scores ranging from 0–5. A score of 96 or above is considered greater health literacy, while a score of 95 and below represented less health letter literacy.

Patient Perception Empowerment Scale (PPES)

The Patient Perception Empowerment Scale (PPES) was developed by Lewin et al.²⁵ To measure patients with coronary heart disease about their health empowerment and decision-making. Ye et al²⁶ translated it into Chinese. The Cronbach's alpha for this study was 0.935. It included of 4 dimensions, namely, information (3 items), decision (3 items), individual (2 items) and self-management (3 items). Each item was rated on a 5-point scale from 1 (“strongly disagree”) to 5 (“strongly agree”), with the total range of scores from 0–30. Higher scores indicated the better perception of empowerment.

Data Collection

The questionnaire consisted of demographic characteristics, HLSCP, PPES, and SRF-S. We explained the purpose and method of this study to the nursing directors of the hospital and asked for their cooperation in data collection. After obtaining permission, Three graduate nursing students receiving instruction of coronary heart disease and unified training served as research assistants and visited the clinical departments to distribute and collect the questionnaires. Each participant was fully informed of the aim of the survey. Since the survey subjects were all elderly, the questionnaire was filled out by the investigator after asking the patients about the contents. Secondary check when exporting data.

Statistical Analysis

All statistical analyses were performed using IBM SPSS 26.0 (IBM Corp, Armonk, NY, USA). Categorical variables were expressed as frequency (percentages), whereas continuous data were expressed as mean \pm SD. The *t*-test and the ANOVA test were applied to compare statistical differences in self-regulatory fatigue scores between groups. Pearson correlation analysis was used to examine the relationship between health literacy, health empowerment, self-regulatory fatigue, cognitive, emotional and behavioral. Factors with $P < 0.05$ in univariate analysis were input into the hierarchical multiple regression analysis was conducted to find independent factors associated with self-regulating fatigue. The variance inflation factor (VIF) for each covariate was below 5, a result considered acceptable. In this study, differences were indicated as statistically significant when $P < 0.05$.

Results

Demographic Characteristics

Most of those eligible participants were from city areas (58.2%), married (74.1%) and had an educational background of Junior High School (47.8%). Regarding the monthly household income, 52.7% of them had a monthly salary of 1000–3000 yuan (\$141.90 - \$425.70). In addition, most of this population had no family history of CHD (73.6%) and duration of disease less than 1 year (43.8%). The results of the *t*-test and the ANOVA test showed significant differences in self-regulatory fatigue among CHD patients in terms of age, education, marital status, residence, monthly household income, the number of combined chronic diseases, and hospitalized times of CHD since illness. Overall characteristics of the sample can be found in [Table 1](#).

Score of HLSCP, PPES and SRF-S of the CHD Patient

The mean (SD) scores for SRF-S were (44.20 \pm 6.98), with (15.31 \pm 3.10), (14.67 \pm 2.91) and (14.21 \pm 2.57) in cognitive, emotional, and behavioral, respectively. Besides, 89.6% had better health literacy and 10.4% lacked health literacy. The mean (SD) scores for HLSCP were (69.74 \pm 19.95). AS shown in [Table 2](#).

Association Between Health Literacy, Health Empowerment and Self-Regulatory Fatigue.

Table I Distribution of Demographic and Illness Characteristics and the Associations with Self-Regulatory Fatigue (n=201)

Variables	Number	Percentage (%)	SRF-S	t/F value	P value
Gender				-3.54	0.724
Male	119	59.2%	44.05±7.31		
Female	82	40.8%	44.41±6.52		
Age				5.133	0.007
60–69	52	25.9%	42.01±5.28		
70–79	67	33.3%	45.28±7.43		
≥80	82	40.8%	45.32±7.63		
Education				6.611	<0.001
Primary School and below	52	25.9%	46.57±7.53		
Junior High School	96	47.8%	44.57±6.02		
High School/Secondary School	34	16.9%	42.29±7.41		
University and above	19	9.5%	39.26±6.27		
Marital status				-2.148	0.033
Married	149	74.1%	43.58±6.54		
Other (unmarried, divorced, widowed)	52	25.9%	45.98±7.93		
Residence				-6.194	<0.001
Rural	84	41.8%	47.51±6.90		
City	117	58.2%	41.82±6.03		
Medical Payment Methods				1.177	0.241
Medical Insurance	188	93.5%	44.35±6.91		
Self-financed	13	6.5%	42.00±7.92		
Family history of CHD				0.316	0.753
Yes	53	26.4%	44.31±7.17		
No	148	73.6%	44.29±7.13		
Monthly household income (yuan)				12.923	<0.001
<1000	8	4.0%	53.25±8.25		
1000–3000	106	52.7%	45.32±6.34		
3000–5000	59	29.4%	43.49±5.99		
>5000	28	13.9%	38.89±7.12		
Number of combined chronic diseases				9.764	<0.001
0	65	32.3%	41.41±6.17		
1	94	46.8%	44.88±6.28		
≥2	42	20.9%	47.00±8.23		
Duration of CHD				2.556	0.570
<1 year	88	43.8%	43.80±6.78		

(Continued)

Table 1 (Continued).

Variables	Number	Percentage (%)	SRF-S	t/F value	P value
1≤years<2	57	28.4%	43.77±7.32		
2≤years≤5	37	18.4%	46.86±7.29		
>5years	19	9.4%	42.15±5.14		
Hospitalized times of CHD since illness				4.376	0.014
1	66	32.8%	42.21±5.86		
2	122	60.7%	45.04±7.31		
≥3	13	6.5%	46.46±7.36		

Abbreviations: CHD, coronary heart disease; t, t-test; F, F-test; P, P-value.

Table 2 Score of HLSCP, PPES, and SRF-S Among the CHD Patients (n=201)

Scale	Variable	Items	Total Score (±SD)	Entries Mean (±SD)
HLSCP	Total		69.74±19.95	2.90±0.83
	Information acquisition ability	9	26.32±7.29	2.92±0.81
	Communicative interaction ability	9	26.01±8.04	2.89±0.89
	Health improvement willingness	4	11.76.05±3.71	2.94±0.92
	Economic support willingness	2	5.63±1.61	2.81±0.80
PPES	Total		31.38±7.26	2.85±0.66
	Information	3	8.58±2.01	2.86±0.67
	Decision	2	5.66±1.44	2.83±0.72
	Individual	3	8.56±2.13	2.85±0.71
	Self-management	3	8.57±2.15	2.85±0.71
SRF-S	Total		44.20±6.98	2.76±0.43
	Cognitive	6	15.31±3.10	2.55±0.51
	Emotional	5	14.67±2.91	2.93±0.58
	Behavioral	5	14.21±2.57	2.84±0.51

Abbreviations: SD, standard deviation; HLSCP, Health Literacy Management Scale; PPES, Patient Perception Empowerment Scale; SRF-S, Self-Regulatory Fatigue Scale.

As presented in Table 3, Self-regulating fatigue was negatively correlated with health literacy ($r=-0.639$, $P<0.01$) and health empowerment ($r=-0.580$, $P<0.01$). Moreover, there was a positive association between health literacy and empowerment ($r=0.600$, $P<0.01$).

Effect Of Demographic Statistical Data On SRF-S.

The SRF-S evaluation score of CHD patients was used as the dependent variable, and the first layer using factors with statistical significance in the ANOVA test was used as the independent variable. The second layer put HLSCP and PPES scores as independent variables for linear regression analysis. The regression equation demonstrates that the residence,

Table 3 Correlation Among Health Literacy, Health Empowerment, and Self-Regulatory Fatigue (n=201)

Variables	1.	2.	3.	4.	5.	6.
1.HLSCP	1					
2.PPES	0.600**	1				
3.SRF-S	-0.639**	-0.580**	1			
4.cognitive	-0.491**	-0.465**	0.822**	1		
5.emotional	-0.488**	-0.422**	0.822**	0.485**	1	
6.behavioral	-0.591**	-0.539**	0.796**	0.479**	0.518**	1

Note: **p<0.01.

Abbreviations: SD, standard deviation; HLSCP, Health Literacy Management Scale; PPES, Patient Perception Empowerment Scale; SRF-S, Self-Regulatory Fatigue Scale.

Table 4 Multiple Linear Regression for Self-Regulatory Fatigue (n=201)

Number of Layers	Factors	Regression Coefficient	Standard Error	Standard Regression Coefficient	t	p
First layers	(constant)	36.230	3.647		9.935	<0.001
	Age	0.941	0.609	0.103	1.545	0.124
	Education	-0.688	0.560	-0.088	-1.229	0.220
	Marital status	0.306	1.022	0.019	0.300	0.765
	Residence	3.752	1.042	0.265	3.602	<0.001
	Monthly household income (yuan)	-1.706	0.666	-0.191	-2.564	0.011
	Number of combined chronic diseases	1.134	0.637	0.117	1.780	0.077
	Hospitalized times of CHD since illness	2.352	0.821	0.192	2.864	0.005
Second layers	(constant)	64.591	1.657		38.988	<0.001
	HLSCP	-0.159	0.023	-0.454	-7.005	<0.001
	PPES	-0.297	0.062	-0.308	-4.761	<0.001

Note: Adjusted R²=0.276 (F=11.882, P<0.001).

Abbreviations: HLSCP, Health Literacy Management Scale; PPES, Patient Perception Empowerment Scale; SRF-S, Self-Regulatory Fatigue Scale.

monthly household income, hospitalized times of CHD since illness, health literacy, and empowerment were significant for self-regulatory fatigue (in Table 4).

Discussion

This study found that health literacy and health empowerment were important determinants of self-regulatory fatigue in older patients with CHD. The results of this study may help healthcare professionals to provide specific interventions for CHD patients.

This study showed that older patients with CHD had high self-regulatory fatigue scores. Higher than previous scores in peritoneal dialysis patients.²⁷ The findings suggest that patients with coronary heart disease have more severe self-loss

in their self-management process. Coronary heart disease is characterized by the difficulty of complete recovery and requires long recovery times, with patients taking long-term medications and changing their lifestyle choices. This requires strong self-control, which also depletes patient resources. Individuals have limited self-regulatory resources and will experience attrition.²⁸ Meanwhile, emotional control had the most significant influence on patients' self-regulatory fatigue. This finding was consistent with a previous study focused on cancer survivors.²⁹ Patients with coronary artery disease primarily type A and D personalities,³⁰ characterized by quick temper and irritability, quickly triggering adverse emotional problems. Therefore, health care professionals and caregivers of coronary heart disease should focus on the patients' self-regulatory fatigue.

The results showed that residence, monthly household income, and hospitalized times of CHD since illness for CHD were the influencing factors for self-regulatory fatigue in older adult patients with CHD. Patients living in city areas have lower self-regulatory fatigue than those living in rural areas. The reasons might be that the city has more medical resources, and patients can get timely solutions to their health problems. The lower monthly family income, the heavier patient's self-regulatory fatigue. CHD is a chronic disease, and long-term medication will increase the patient's family economic burden and psychological burden, and the economic basis is the self-health management motivation. Therefore, health care professionals can enhance patients' confidence in self-management of the disease, reduce patients' negative emotions and decrease patients' self-regulation fatigue through relaxation training and psychological guidance. The more hospitalized times of CHD since illness, the higher the level of self-regulatory fatigue. It was consistent with the finding of Li et al.³¹ Studies¹⁰ showed that high levels of self-control sustained over long periods can deplete self-control. Patients admitted to the hospital multiple times for coronary artery disease have undergone long periods of self-control and have a higher depletion of self-control resources, so their self-regulatory fatigue is higher.

The present study showed that health empowerment was negatively associated with self-regulatory fatigue in elderly patients with coronary artery disease, which was consistent with the findings of Zhang et al.³² The possible reason for this is that health empowerment emphasizes patient-centeredness and helps individuals to discover and develop their inner potential and increase their control over the disease, ensuring persistence in treatment.³³ Studies³⁴ demonstrated that patients autonomously involved in self-health management experience less impact on self-depletion than those supervised to perform. Thus, it was not difficult to find that empowering patients to increase their autonomy in self-management can reduce the degree of patient self-loss. Therefore, health care providers should help patients to explore their potential to reduce their attrition. In addition, the health literacy of elderly patients with coronary artery disease was negatively associated with self-regulatory fatigue, ie, the higher the patient's health literacy level, the lower the self-regulatory fatigue. Patients with a higher level of health literacy can obtain, understand, and use health information more accurately, make correct health decisions, promote physical health, and reduce self-regulatory fatigue.

This suggests that health care professionals should use easy-to-understand language to teach patients about the disease and enhance the health literacy of patients with coronary heart disease by improving widespread health knowledge and strengthening communication with patients. Because older people may be less social, patients' families and patients should strengthen communication among themselves weekly. Health care workers should provide timely help and support, pay attention to patients' psychological changes, strengthen patients' internal drive to fight against the disease, enhance the ability to perceive empowerment, and ultimately reduce patients' self-regulation fatigue.

Limitation

This study was cross-sectional, lacking dynamic observation of variables, and should be supplemented by future longitudinal studies. The study was conducted only in a tertiary care hospital in Jinzhou city, and the representativeness of the sample size needs to be further improved. A multicenter, large-sample survey study can be conducted in the future.

Conclusion

Our study identifies several factors associated with self-regulatory fatigue in Chinese older patients and elucidated the relationship among them. It provided a basis for future targeted intervention strategies. Medical practitioners should focus on the assessment of self-regulatory fatigue in patients with coronary artery disease and strengthen the psychological construction of patients with coronary artery disease to reduce the level of self-regulatory fatigue.

Ethical Considerations and Consent Statement

This study conformed to the standards of the Declaration of Helsinki. Ethical approval was granted by the Ethics Committee of Jinzhou Medical University (No. JZMULL2022028). Patients signed informed consent in this study.

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Disclosure

The authors report no conflicts of interest in this work.

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