

RESEARCH ARTICLE

Influencing factors of care dependence in patients with coronary heart disease after percutaneous coronary intervention—A cross-sectional study

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Abstract

Aim: Care dependence has been scarcely investigated in coronary heart disease patients after percutaneous coronary intervention. This study aimed to investigate the association between frailty, self-efficacy, combined effects of frailty and self-efficacy, mental health, and care dependence in coronary heart disease patients after percutaneous coronary intervention.

Design: Cross-sectional study.

Methods: Data from 400 patients after percutaneous coronary intervention were collected from 2017–2020. Logistic regression model and mediating analysis were used to identify the association between frailty, self-efficacy, combined effects of frailty and self-efficacy, and care dependence.

Results: Patients with frailty and self-efficacy tended to have severe care dependence symptoms. There was no correlation between frailty symptoms, self-efficacy, and care dependence in patients without symptoms of anxiety or depression. But in patients with anxiety or depression symptoms, there is a strong correlation between frailty symptoms, lower self-efficacy, and care dependence. Mental health played an inhibitory effect on frailty and care dependence.

KEYWORDS

anxiety, care dependence, depression, frailty, percutaneous coronary intervention, self-efficacy

Juan Guo and Youyou Chen contributed equally to this paper.

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1 | INTRODUCTION

Coronary heart disease (CHD), as a main disease that causes disability and death (Fan et al., 2021), is a type of cerebrovascular and cardiovascular disease caused by atherosclerosis (Wang et al., 2021). Stroke or myocardial infarction will occur if the plaque becomes unstable and ruptures. Currently, CHD is the global leading cause of death and results in 18 million deaths per year (Ahmed et al., 2020). Percutaneous coronary intervention (PCI) is a minimally invasive procedure and is recommended for subacute and acute coronary heart disease, including all ST-elevation myocardial infarction (STEMI) (Lee et al., 2021; Silalahi et al., 2021). However, patients with coronary heart disease after PCI still need long-term self-care after discharge from the hospital.

2 | BACKGROUND

Care dependence referred to one being dependent on someone for something and is also described as the nurse–patient relationship, which results from a person's decrease in self-care and simultaneous increase in dependence on nursing care (Piredda et al., 2020). Care dependence as the central to nursing was associated with increased mortality risk in elderly persons (Piredda et al., 2015). Increased care dependence may affect patient social environment, overall health status, prevalent clinical conditions, physical function, and use of health-care resources (Schulz et al., 2019). Previous studies also showed that good self-care and self-management ability are key factors in reducing the recurrence rate and risk of sudden death (Jiang et al., 2020). In addition, the patient's readmission rate is also closely related to poor compliance with medications taken at home and limited self-management ability after discharge from the hospital (Kwok et al., 2020).

Frailty is a key intermediate status of the aging process, which has a multidimensional and multisystem nature and is related to a variety of health-related adverse outcomes, including disability, falls, hospitalizations, mortality, dementia, and Alzheimer's disease (Dibello et al., 2021). Frailty has been identified as a risk factor for mortality in patients who have undergone PCI (Tse et al., 2017) and is also considered to be closely related to prognosis and quality of life of patients with cardiovascular disease (Tanaka et al., 2021) and increases the daily expenditure of patients (Gao et al., 2021). Self-efficacy is the major concept of social cognitive theory raised by Albert Bandura. According to this theoretical framework, expectations of personal efficacy determine whether coping behaviour will be initiated, how long it will be sustained, and how much effort will be expended in the face of obstacles and aversive experiences (Bandura, 1977). He pointed out that self-efficacy is influenced by four important sources of information: vicarious experience, performance accomplishments, physiological information, and verbal persuasion (van der Bijl & Shortridge-Baggett, 2001). Self-efficacy is defined as the degree of an individual's confidence in his ability to mobilize cognitive resources, motivation, and behaviour to perform an important task (such as chronic disease management). Studies have already found that the higher patients' self-efficacy, the better able they

are to face the disease with a healthy attitude, and the more confident they are in the fight against their disease and the face of adversity (Liu et al., 2018; Sangruangake et al., 2017). However, the combined effect of self-efficacy and frailty on care dependence is rare. Therefore, the authors introduced combined scores to investigate the role played by two or more different effectors on care dependence. Studies have shown that patients who receive PCI tend to have a reduction in the level of mental health (Brostow et al., 2019; Sipötz et al., 2013). Mental health has also been found to be closely correlated with care dependence (Geurtzen et al., 2018) and self-efficacy in admitted patients (Liu et al., 2018; Sivakumar & Susila, 2021). The negative emotions in CHD patients after PCI are closely related to self-efficacy (Liu et al., 2018). However, studies on the association between frailty, self-efficacy, mental health, and care dependence in patients with coronary heart disease after PCI are rare.

Furthermore, gender (Park et al., 2020), age, body-mass index, course of disease, accompanying chronic diseases, complications occurring after surgery, the lesioned blood vessels, the degree of vascular disease (Head et al., 2018), region (Sabatine et al., 2021), and sleep quality (Zhu, Liu, et al., 2021; Zhu, Lu, et al., 2021) were also important covariates that may affect the CHD patient mortality rate. Education level, household income, and self-care agency were the influencing factors of care dependence (Li et al., 2017). Therefore, gender, age, residence, education level, and course of disease, whether accompanied by chronic diseases, payment manner of the medical expenses, someone taking care of you during hospitalization, postoperative sleep quality, the lesioned blood vessels, the degree of vascular disease, BMI, and complications occurring after surgery, were regarded as the covariates.

Studies on the combined effect of frailty and self-efficacy on care dependence are rare. How frailty and self-efficacy affect the level of care dependence in CHD patients after PCI is still not clear. Compared with the previous studies that investigated the influencing factors of care dependence in patients with CHD after PCI, this study focused on the combined effect of frailty and self-efficacy on care dependence. Moreover, this study investigated the mediating effect of mental health on frailty and care dependence, thus providing the theoretical basis for reducing the care dependence level.

3 | METHODOLOGY

3.1 | Study design

This cross-sectional study was conducted between January 2017 and December 2020.

3.2 | Study setting

Suzhou Hospital of Anhui Medical University, a large three-A hospital, located in Suzhou City, Anhui Province, China. Nearly 150 patients typically undergo PCI every year in this setting.

3.3 | Sampling calculation

The sample size was calculated as 10 times greater than that of the research variable (Velentgas et al., 2013). A total of 36 variables and 400 participants were involved in this study.

3.4 | Inclusion & exclusion criteria

The inclusion criteria were as follows: (a) clearly diagnosed with CHD confirmed by the World Health Organization/International Cardiology guidelines from October 1997 by cardiologists; (b) with an indication for PCI with criteria of Yan (2010); (c) successfully received PCI; (d) had a clear consciousness; (e) volunteered to participate in this study.

The exclusion criteria were as follows: (a) patients who successfully received PCI but suffered from mental illness or motor dysfunction, accompanied by other serious organic diseases or chronic diseases that affected the patient's self-care ability; (b) patients aged below 18 or over 90; (c) accompanied with serious complications such as arrhythmia and cardiac tamponade within 24 hr after PCI.

3.5 | Population

The cluster sampling method was used to investigate the influencing factors of care dependence in patients with CHD after PCI. All the CHD patients who received PCI in this hospital between January 2017 and December 2020 were invited to participate in this study. A total of 443 participants were invited to participate in this study, and 400 participants provided valid questionnaires and were then included in this study for statistical analysis. The average age of the 400 subjects in this study was (66.2 ± 10.4) years, including 268 men and 132 women. The average age of men was (64.9 ± 10.8) years and the average age of women was (68.9 ± 9.0) years.

3.6 | Data collection

All the patients were invited to participate in this study after undergoing the procedure while still in hospital. Without an understanding of the data collection instruments, only their basic information (including names, gender, and age) and the WeChat account (their own or their family members) were then acquired from their medical records after their informed consent was obtained. At a minimum of 30 days after patients were discharged from the hospital, when they came to the hospital and received reexamination, the questionnaires were then distributed and collected by trained nurses in the waiting room of the doctor. During the questionnaire filling period, there was only one patient and one nurse in the waiting room of the doctor. Others who did not come to the hospital 30 days at a minimum were given electronic questionnaires via WeChat and completed

them under the supervision of family members. All the scales used in this study were included in one questionnaire, and time taken to complete the questionnaire was limited to 30 min.

3.7 | Instruments

The general questionnaire is a demographic form created to gather information about the sample. The basic information that may be associated with care dependence was included in the questionnaire. The content includes patient's gender (male, female), age, residence (rural, urban), education level (junior high school or below, high school or above), course of disease, and accompanying chronic diseases (yes or no), payment manner of the medical expenses (fully self-supporting, partly self-supporting, fully reimbursed), someone taking care of you during hospitalization (yes, no), postoperative sleep quality (good, poor), the lesioned blood vessels (anterior descending branch, circumflex branch, right coronary artery, ≥ 2 branches), the degree of vascular disease ($<70\%$, $70\%–79\%$, $80\%–89\%$, $90\%–100\%$), BMI (normal, overweight, or obese), and complications occurring after surgery (yes, no).

The Care Dependency Scale (CDS) was developed by Dijkstra et al. (1996) and aimed to assess the level and needs of dependency in patients with dementia and disabled patients. The Chinese Version of Care Dependency Scale adopted in this study was translated by Zhang et al. (2014). The CDS includes 15 items that were used to evaluate the following 15 abilities: avoidance of danger, body posture, body temperature, continence, communications, contact with others, daily activities, day/night patterns, eating and drinking, getting dressed and undressed, hygiene, learning activities, mobility, recreational activities, and sense of rules and values. All items are marked on a five-point Likert scale, and responses were ranged from 1–5, referring to completely dependent, largely dependent, partly dependent, mostly independent, and completely independent, respectively. Total scores ranged from 15 to 75. The total score can be divided into five grades: <25 represents completely dependent, 25–44 represents largely dependent, 45–59 represents partly dependent, 60–69 represents mostly independent, and >69 represents completely independent. In this study, patients who scored >44 were treated as highly care-independent, and those who scored ≤ 44 were treated as highly care-dependent. This scale has been validated in different populations and is found to be easy to use and quick to complete (Juárez-Vela et al., 2020). This scale also has shown good construct validity in the Chinese population which established by Zhang et al. (2014). The Cronbach's alpha coefficient was 0.953 in the current study.

The self-efficacy status of patients with coronary heart disease was determined by using the Cardiac Self-efficacy Scale which was developed by Sullivan et al. (1998) and translated by Zhang et al. (2018). This scale contains 16 items and is evaluated under on a 5-point Likert scale. Each item ranges from 0 (not at all confident) to 4 (completely confident), with lower scores indicating a lower level of cardiac self-efficacy (Zhang et al., 2018).

Since the scale does not have a clear cut-off point standard for high self-efficacy and low self-efficacy, the 25th percentile (P25) was used as the cut-off point in this study. Therefore, patients who scored 15 or lower than 15 were treated as having lower self-efficacy. The Cardiac Self-efficacy Scale could be divided into two subscales, control symptoms and maintain function, and the Cronbach's alpha was 0.90 and 0.87, respectively. The Cardiac Self-efficacy Scale is a cardiac-specific self-efficacy instrument, and the validity and reliability values were 0.83 and 0.90 for the total scales, respectively (Zhang et al., 2018).

Patient frailty was evaluated by the Tilburg Frailty Indicator (TFI; Gobbens et al., 2010). The TFI consists of two parts: Part A and Part B. Part A contains 10 items, which were used to identify the determinants of frailty. Part B contains 15 questions, which were related to the main components of frailty and used to determine whether a person was frail. Only TFI Part B was adopted in this study. All of the items are yes/no questions (0 for No and 1 for Yes). TFI Part B scores range from 0 to 15, and the ranges of the scores on physical, psychological, and social frailty are 0 to 8, 0 to 4, and 0 to 3, respectively (Gobbens et al., 2020). A score of 5 or higher indicates the occurrence of frailty syndrome. The Cronbach's alpha coefficient was 0.705 in the current study. The criterion validity values of physical phenotype and frailty index were 0.87 and 0.86, respectively (Zhang et al., 2020).

The Hospital Anxiety and Depression Scale (HADS) was adopted to assess the psychological status of patients with coronary heart disease. The scale was developed by Zigmond and Snaith (1983) and can be used for screening anxiety and depression symptoms of patients in general hospitals. The scale contains 14 items, seven items are used to assess depression symptoms and seven items are used to assess anxiety symptoms. Each item scored on a four-point (0–3) response category, and the total scores ranged from 0 to 21 for depression and 0 to 21 for anxiety. A score of 0 to 7 was regarded as the normal range, a score of 8–10 suggested the presence of the respective state, a score of 11 or higher indicated the probable presence of the mood disorder, and a score of 11–21 represented clear symptoms. In this study, those with a score of 8 or above were considered to have symptoms of anxiety or depression, and a score of 7 or below represented no symptoms (Annunziata et al., 2020). Both HADS-anxiety subscale and HADS-depression subscale showed good criterion-related validity. The Cronbach's alpha coefficient of the scale in the current study is 0.914.

To evaluate the combined effects of frailty and self-efficacy, combined scores were calculated. Patients without frailty and with high self-efficacy were scored as 0, those with frailty and high self-efficacy were scored as 1, those without frailty and with low self-efficacy were scored as 1, and those with frailty and low self-efficacy were scored as 2.

3.8 | Ethics

This study involved human subjects were conducted according to the provisions of the Declaration of Helsinki (as revised in Brazil

2013) and was approved by the Institutional Review Board of University (approval number: 2019025). Written informed consent was obtained from all study participants, and their anonymity was preserved.

3.9 | Data analysis

The standard multiple imputation method was used to address the 653 missing data of the 400 subjects. Data entry was performed by EpiData 3.1 software, and SPSS 24.0 was used for statistical analysis.

Independent samples *t*-test was used for continuous variables to compare the mean of age and disease course of patients with coronary heart disease. Chi-square test was used for categorical variables to examine the association between sex, residence, education level, combined with chronic disease, payment method of medical costs, some else taking care of during hospitalization, postoperative sleep quality, severity of coronary artery disease, BMI, combined with postoperative complications, combined with anxiety symptoms, combined with depression symptoms, combined with anxiety or depression symptoms, frailty, self-efficacy, and care dependence. Variables that significantly associated with care dependence were then included in the subsequent logistic regression model.

The logistic regression model (Sperandei, 2014; Tripepi et al., 2008) with OR was used to identify the association between frailty, self-efficacy, the combined effects of frailty and self-efficacy, and care dependence. Covariates of sex, age, and course of disease were adjusted for multiple comparisons because they were significantly associated with care dependence. Furthermore, another logistic regression model with OR was performed to analyse the association between sex, age, course of disease, frailty, self-efficacy, and care dependence under different mental state levels.

Taking the frailty symptoms as the independent variable, with anxiety or depression symptoms (mental health problems) as the mediating variable, and care dependence as the dependent variable to build a mediating effect model to investigate the direct and indirect effects of frailty symptoms on care dependence.

$p < .05$ was considered to be statistically significant. Odds ratios (ORs) with 95% confidence intervals (95% CIs) were calculated for risk factors independently associated with care dependence in this population.

4 | RESULTS

In total, 443 participants were enrolled in this study, 412 questionnaires were returned, and the questionnaire response rate was 93.0%. A total of 268 men and 132 women provided valid questionnaires and were then included in this study for statistical analysis. The questionnaire validity rate was 97.1%.

4.1 | Distribution of care dependence

Table 1 shows the distribution of care dependence in patients with coronary heart disease after PCI. The results indicated that 23 (17.4%) women and 28 (10.4%) men were care-dependent. The average age of patients with coronary heart disease after PCI with and without care dependence was (69.5 ± 11.2) years and (65.7 ± 10.2) years, respectively. The age of patients with care dependence was higher than that of patients without care dependence ($p < .05$). The average course of patients with care-dependent patients was (76.0 ± 69.2) months, which was higher than that of patients without care-dependence (55.6 ± 58.7 months; $p < .05$). In addition, 16.1% of patients with anxiety symptoms showed care dependence, and 16.5% of patients with depressive symptoms showed care dependence, both of which were significantly higher than those without anxiety symptoms or without depressive symptoms ($p < .05$). A total of 16.7% of patients with frailty symptoms showed care-dependence, which was higher than that of patients without frailty symptoms (7.8%; $p < .05$). A total of 31.7% of patients with low self-efficacy were care-dependent, which was higher than those with high self-efficacy (4.3%; $p < .05$).

4.2 | Association between frailty, self-efficacy, and care dependence in patients with coronary heart disease after PCI

The logistic regression analysis showed that there was no significant correlation between the patient's sex, age, course of disease, and care dependence. Participants who scored low on frailty (OR: 0.116, 95% CI: 0.037–0.363) or high on self-efficacy (OR: 0.054, 95% CI: 0.018, 0.167) were less likely to be care-dependent. Patients who only scored low on frailty or high on self-efficacy were less likely to be care-dependent (OR: 0.067, 95% CI: 0.009, 0.534). Moreover, participants who scored low on frailty and high on self-efficacy were less likely to be care-dependent (OR: 0.003, 95% CI: 0.001, 0.028). The results are shown in Table 2.

4.3 | Association between frailty, self-efficacy, and care dependence in patients with coronary heart disease after PCI with different levels of mental health

As the results in Table 1 show that patients with anxiety symptoms showed a higher level of care dependence, those with depression symptoms had a higher level of care dependence, but no significant difference was found between patients with anxiety or depressive symptoms and patients without anxiety and depressive symptoms. To rule out the influence of mental health, the authors treated patients with anxiety or depression symptoms as subgroups and then analysed the influence of frailty and self-efficacy on care dependence. The results showed that there was no correlation between frailty

symptoms, self-efficacy, and care dependence in patients without symptoms of anxiety or depression. However, in patients with anxiety or depression symptoms, participants who scored low on frailty (OR: 0.018, 95% CI: 0.002, 0.170) or high on self-efficacy (OR: 0.021, 95% CI: 0.007, 0.063) were less likely to be care-dependent. Results may suggest that mental health does not directly affect the patient's care dependence but may indirectly affect care dependence level by affecting patients' frailty and self-efficacy symptoms. The results are shown in Table 3.

4.4 | Analysis of the mediating effect of mental health in frailty and care dependence in coronary heart disease after PCI

The authors used the frailty symptoms as the independent variable, with anxiety or depression symptoms (mental health problems) as the mediating variable and care dependence as the dependent variable to investigate the direct and indirect effects of frailty symptoms on care dependence. Table 4 and Figure 1 show that the mediating effect of mental health problems was -0.421 (-3.630×0.116), which accounted for 112.9% ($-3.630 \times 0.116 / (-0.373) \times 100\%$) of the total effect and referred to the inhibitory effect. Similarly, the authors tested the mediating effect of mental health problems on self-efficacy and care dependence, and results showed no mediating effects existed.

5 | DISCUSSION

This study investigated the influencing factors of care dependence in patients with coronary heart disease after PCI based on this 400 patients involved cross-sectional study. Results showed that there were strong correlations between frailty symptoms, low self-efficacy, and care dependence in patients with anxiety or depression symptoms, and frail and low self-efficacy had a combined effect on care dependence of patients after PCI.

Self-care ability is closely related to patient quality of life (Zhu, Liu, et al., 2021; Zhu, Lu, et al., 2021), and patients themselves play the main role in their daily management. The good self-management ability may help patients to reduce the incidence of postoperative complications (Zhao & Wang, 2022). However, the self-care ability of patients after PCI is not optimistic, and they are highly dependent on others. To reduce the incidence of complications during the rehabilitation of patients at home and reduce the level of care dependence of patients, it is important to investigate the influencing factors of care dependence.

This study found that 17.4% of women and 10.4% of men showed care dependence, and the proportion of care dependence on women was significantly higher than that of men. Furthermore, elderly patients also have relatively higher levels of care dependence. Wen also found that gender, age, and education level are important factors that affect the level of care dependence of patients

TABLE 1 Distribution of care dependence [n (%)/M ± SD]

Variables	Total	Care dependence		t/ χ^2	p
		Yes	No		
Sex					
Male	268 (67.0)	28 (10.4)	240 (89.6)	3.869	.049
Female	132 (33.0)	23 (17.4)	109 (82.6)		
Age (years old)	66.2 ± 10.4	69.5 ± 11.2	65.7 ± 10.2	2.426	.016
Residence					
Rural	184 (46.0)	19 (10.3)	165 (89.7)	1.800	.180
Urban	216 (54.0)	32 (14.8)	184 (85.2)		
Education level					
Junior high school and below	310 (77.5)	44 (14.2)	266 (85.8)	2.581	.108
High school and above	90 (22.5)	7 (7.8)	83 (92.2)		
Course (month)	58.2 ± 60.5	76.0 ± 69.2	55.6 ± 58.7	2.260	.024
Combined with postoperative complications					
Yes	212 (53.0)	32 (15.1)	180 (84.9)	2.228	.135
No	188 (47.0)	19 (10.1)	169 (89.9)		
Payment method of medical costs					
Self-supporting	4 (1.0)	1 (25.0)	3 (75.0)	0.545	.460
Partially or fully reimbursement	396 (99.0)	50 (12.6)	346 (87.4)		
Someone else taking care of you during hospitalization					
Yes	392 (98.0)	50 (12.8)	342 (87.2)	0.000	1.000
No	8 (2.0)	1 (12.5)	7 (87.5)		
Postoperative sleep quality					
Good	310 (77.5)	36 (11.6)	274 (88.4)	1.601	.212
Bad	90 (22.5)	15 (16.7)	75 (83.3)		
Severity of coronary artery disease					
<70%	190 (47.5)	32 (16.8)	158 (83.2)	5.213	.153
70%–79%	91 (22.8)	9 (9.9)	82 (90.1)		
80%–89%	57 (14.3)	4 (7.0)	53 (93.0)		
90%–100%	62 (15.5)	6 (9.7)	6 (90.3)		
BMI					
Normal	213 (53.3)	33 (15.5)	180 (84.5)	3.081	.079
Overweight or obese	187 (46.7)	18 (9.6)	169 (90.4)		
Combined with chronic diseases					
Yes	23 (5.7)	0 (0.0)	23 (100.0)	3.566	.057
No	377 (94.3)	51 (13.5)	326 (86.5)		
Combined with anxiety symptoms					
Yes	223 (55.7)	36 (16.1)	187 (83.9)	5.217	.022
No	177 (44.3)	15 (8.5)	162 (91.5)		
Combined with depression symptoms					
Yes	212 (53.0)	35 (16.5)	177 (83.5)	5.731	.017
No	188 (47.0)	16 (8.5)	172 (91.5)		
Combined with anxiety or depression symptoms					

TABLE 1 (Continued)

Variables	Total	Care dependence		t/ χ^2	p
		Yes	No		
Yes	245 (61.2)	37 (15.1)	208 (84.9)	3.144	.076
No	155 (38.8)	14 (9.0)	141 (91.0)		
Frailty					
Yes	221 (55.3)	37 (16.7)	184 (83.3)	7.075	.008
No	179 (44.7)	14 (7.8)	165 (92.2)		
Self-efficacy					
Low	123 (30.8)	39 (31.7)	84 (68.3)	57.380	<.001
High	277 (69.3)	12 (4.3)	265 (95.7)		

TABLE 2 Association between frailty, self-efficacy, and care dependence in patients with coronary heart disease after PCI

Groups	n (%) / M \pm SD	β value	Wald value	OR (CI 95%)	p value
Sex					
Male	28 (54.9)	1.00			
Female	23 (45.1)	-0.397	1.153	0.672 (0.326, 1.388)	.283
Age (years old)	69.5 \pm 11.2	-0.035	3.349	0.965 (0.929, 1.003)	.067
Course (month)	76.0 \pm 69.2	-0.002	0.493	0.998 (0.993, 1.003)	.482
Frailty					
Yes	37 (72.5)	1.00			
No	14 (27.5)	-2.151	13.736	0.116 (0.037, 0.363)	<.001
Self-efficacy					
Low	39 (76.5)	1.00			
High	12 (23.5)	-2.911	25.944	0.054 (0.018, 0.167)	<.001
Combined effects of frailty, self-efficacy					
2	26 (51.0)	1.00			
1	24 (47.0)	-2.696	6.527	0.067 (0.009, 0.534)	.011
0	1 (2.0)	-5.822	25.944	0.003 (0.001, 0.028)	<.001

after PCI (Wen, 2016). Elderly patients may have a longer course of CHD, accompanied by many concomitant diseases and poor somatic function, resulting in a higher level of care dependence. In addition, elderly patients may have old-fashioned ideas, poorer learning ability, and relatively poor mastery of nursing knowledge, which also increases the patient's level of care dependence. Furthermore, a previous study found that due to personality and other reasons, female patients tend to have a higher level of self-care ability after surgery than males (Wen, 2016). However, this study showed that the level of care dependence in females is higher than that of males. This may be because the average age of female patients in this study was higher than that of males. Furthermore, body-mass index, course of disease, accompanied with other chronic diseases, and the degree of vascular disease (Head et al., 2018) were also found to be important factors that may affect the patient mortality rate after PCI, but they were not associated with patient care dependency level in this study.

Self-efficacy is an essential tool for managing behaviour and health outcomes. Patients who have higher self-efficacy tend to be

better able to face the disease (Sangruangake et al., 2017), especially in patients with chronic diseases (Marconcin et al., 2021). For example, self-efficacy may influence cancer patients' pain management ability (Vilardaga et al., 2022), and low self-efficacy cancer patients may be vulnerable to psychological morbidity (Howell et al., 2022). A study found that improving PCI patients' self-efficacy level through external intervention would play an important role in their home care (Zhao & Wang, 2022). This study showed the similar results.

Frailty is the key intermediate status of the aging process, which has been identified as a risk factor for mortality in patients after PCI (Tse et al., 2017) and is closely related to the quality of life and prognosis of patients with cardiovascular disease (Niessen et al., 2017). Frailty has been found to be correlated with a variety of health-related adverse outcomes (Dibello et al., 2021) and was identified as a risk factor for mortality in patients who have undergone PCI (Tse et al., 2017). Frailty is also considered to be closely related to the prognosis and quality of life of patients with cardiovascular disease (Tanaka et al., 2021) and increases the daily expenditure of patients

TABLE 3 Association between frailty, self-efficacy, and care dependence in patients with coronary heart disease after PCI with different levels of mental health

Groups	Without anxiety or depression symptoms				With anxiety or depression symptoms			
	β value	Wald value	OR (CI 95%)	<i>p</i> value	β value	Wald value	OR (CI 95%)	<i>p</i> value
Sex								
Male	1.00				1.00			
Female	0.219	0.133	1.244 (0.385, 4.018)	.283	-1.140	4.104	0.320 (0.106, 0.964)	.018
Age	0.005	0.015	1.005 (0.932, 1.084)	.903	-0.037	2.194	0.964 (0.917, 1.012)	.139
Course	-0.002	0.122	0.998 (0.989, 1.008)	.727	0.000	0.041	0.999 (0.993, 1.006)	.839
Frailty								
Yes	1.00				1.00			
No	0.953	0.693	2.594 (0.275, 24.468)	.405	-4.035	12.225	0.018 (0.002, 0.170)	<.001
Self-efficacy								
Low	1.00				1.00			
High	-19.565	0.000	-	.997	-3.886	19.444	0.021 (0.007, 0.063)	<.001

TABLE 4 Mediation analysis ($n = 400$)

Variable	Care dependence						With mental health problems		
	Path c			Path c' and b			Path a		
	β	SE	<i>t</i>	β	SE	<i>t</i>	β	SE	<i>t</i>
Frailty	-0.373	0.136	-2.738*	0.049	0.154	0.317	0.116	0.010	12.120**
With mental health problems	-	-	-	-3.630	0.689	-5.266**	-	-	-

* $p < .01$, ** $p < .001$.

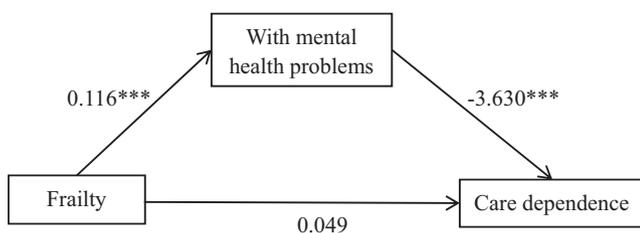


FIGURE 1 Results of mediating effect of mental health in frailty and care dependence in coronary heart disease after PCI. Note: *** $p < .001$

(Gao et al., 2021). This study also found a negative association between frailty and care dependence.

Frailty can be interpreted as a decrease in the individual's physiological level, while low self-efficacy can be interpreted as a decrease in the individual's psychological level of self-management. Therefore, frailty or low self-efficacy will lead to an increase in the care dependence level of patients with coronary heart disease after PCI. This study found that patients who without frailty or with a higher level of self-efficacy are less tend to have care

dependence. In addition, patients who had a with higher level of self-efficacy and without frailty at the same time (who had lower combined scores) tended to have a lower level of care dependence than those with only high self-efficacy or without frailty. Combined scores have been widely used to investigate the role played by two or more different effectors (Xie et al., 2019), and the data processing is easy. To investigate the combined effect of frailty and self-efficacy on care dependence in patients with coronary heart disease after PCI.

Mental health as an essential effector is closely correlated with care dependence. Geurtzen et al. (2018) found that patients who receive psychological treatment can be dependent on their treatment; the professional mental health care can increase dependency. Similarly, the authors found that among patients with anxiety or depression, those with frailty and low self-efficacy were more dependent on nursing care. It is suggested that the

patient's mental health status also has a greater impact on care dependence of patients after PCI. Furthermore, mental health is closely correlated with frailty (Batko-Szwaczka et al., 2020). Being one or more positive frailty criteria was positively correlated with depression. The frailty phenotype could also reflect mental health status. The authors further performed the mediating analysis, taking frailty symptoms as the independent variable, with anxiety or depression symptoms as the mediating variable, and care dependence as the dependent variable to investigate the direct and indirect effects of frailty symptoms on care dependence and found that mental health had an inhibitory effect on frailty and care dependence.

6 | CONCLUSION

The self-care ability of patients after PCI is not optimistic. This study found that 17.4% of women and 10.4% of men showed care dependence. Female and older patients, patients with frailty symptoms, anxiety or depression symptoms, and patients with low self-efficacy tended to have higher scores of care dependence of patients after PCI. There were strong correlations between frailty symptoms, low self-efficacy, and care dependence in patients with anxiety or depression symptoms, indicating that mental health had an inhibitory effect on frailty and care dependence. Frail and low self-efficacy have a combined effect on care dependence of patients after PCI. Enhancing patient self-efficacy and improving frailty symptoms and mental health would be conducive to reducing the care dependence rate.

7 | RECOMMENDATIONS FOR NURSING PRACTICE

The self-care ability of coronary heart disease patients after PCI is not optimistic. The authors found that patients with frailty and low self-efficacy have a higher level of care dependence than those with only frail or low self-efficacy. Mental health status also has a greater impact on care dependence of patients after PCI. In the process of treatment, we not only need to improve patient's self-efficacy and frailty symptoms but also need to focus on the patient's psychological state. Timely and necessary psychological treatment should be given to patients with mental illnesses. Furthermore, the key implication is that nurses should assess for frailty and self-efficacy as they evaluate patients. Because these assessment instruments are easy to use, perhaps some policy should be changed to include them.

8 | LIMITATION

A major limitation of this study is that there is no premeasure, so no idea of whether self-efficacy and frailty are prior to intervention.

Patients involved in this study were only from one hospital, which was the second limitation of this study. However, the population was not small, and the results from this study can provide a reference for future studies. Another limitation was that the data were collected over a 4 year period, but this limitation may not introduce bias because the results showed no association between age and care dependence.

AUTHOR CONTRIBUTIONS

Juan Guo: data curation, formal analysis, investigation, and original draft; Youyou Chen: formal analysis and investigation; Yu Dai: funding acquisition and investigation; Qin Chen: methodology validation, and review & editing; Xiyong Wang: funding acquisition, methodology validation, and review & editing.

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This study involved human subjects were conducted according to the provisions of the Declaration of Helsinki (as revised in Brazil 2013) and was approved by the Institutional Review Board of Suzhou Hospital Affiliated to Anhui Medical University (approval number: 2019025). Written informed consent was obtained from all study participants, and their anonymity was preserved.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

DATA AVAILABILITY STATEMENT

All the data used to support the findings of this study are available from the corresponding author upon request.

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