

Article

# Application Effects of NNN-link Care Model in Patients with Coronary Heart Disease

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Submitted: 8 June 2023 Revised: 18 September 2023 Accepted: 21 September 2023 Published: 25 October 2023

## Abstract

**Objective:** To investigate the effect of a NNN-linked care model applied in elderly patients with coronary heart disease. **Methods:** A total of 120 elderly patients with coronary heart disease admitted to the hospital from January, 2023 to May, 2023 were randomly divided into two groups of 60 cases respectively. The control group received routine intervention, and the observation group received the NNN-linked care model. Changes in cardiac function, the ability for self-care, and quality of life were recorded between the groups before and after the intervention. **Results:** Indices of cardiac function in the observation group were higher than those of the control group after 3 weeks ( $p < 0.05$ ). Compared with the control group, the total score for the ability for self-care and the scores of each dimension of the observation group were higher after 3 weeks of intervention ( $p < 0.05$ ). The scores of quality of life of the observation group were higher in comparison with the control group after 3 weeks of intervention ( $p < 0.05$ ). **Conclusion:** The application of the NNN-linked care model to elderly patients with coronary heart disease can improve the ability for self-care, increase cardiac function and improve the quality of life.

## Keywords

NNN-linked care model; coronary heart disease; elderly; self-care ability; quality of life

## Introduction

Coronary heart disease (CHD) is the most common type of disease caused by atherosclerosis and seriously endangers human health. The World Health Organization (WHO) projects that 250 million people will suffer from cardiovascular disease each year by 2020, and that coronary heart disease will become the leading cause of death and disability worldwide [1]. In addition, patients with coronary heart disease are often associated with abnormal emotions. Emotional changes are closely related to changes in

blood pressure and blood lipids, which have a serious impact on patients' physical and mental health [2]. At present, there is a lack of effective methods to cure coronary heart disease due to hypertension in clinical practice. Elderly patients have limited ability for self-care, and do not have a deep understanding of the risk factors that predispose to cardiovascular disease [3,4]. Therefore, it is recognized in clinical practice that effective nursing care for patients with coronary heart disease involves active intervention to achieve functional improvement of elderly patients with coronary heart disease.

NNN-link is a nursing model that combines three nursing principles: Nursing diagnosis (NANDA-I), outcome classification (NOC), and measure classification (NIC) in order to provide a framework for guidance in clinical practice [5]. Gencbas *et al.* [6] applied the NNN-linked nursing model to elderly patients and found that this program can significantly improve their quality of life. This model standardizes nursing language and constructs a complete nursing theoretical framework, for various problems arising in clinical practice and can play a key role in the perioperative nursing of patients undergoing partial resection of lung cancer. The purpose of this study was to investigate the effect of the NNN-linked care model in elderly patients with coronary heart disease.

## Methods

### General Information

A total of 120 elderly patients with coronary heart disease admitted to the hospital from January 2023 to May 2023 were randomly divided into two groups of 60 cases, respectively. This study was reviewed and approved by the Ethics Committee of the hospital, with the informed consent of patients. Inclusion criteria: (1) Patients with coronary heart disease in accordance with the "stable coronary heart disease diagnosis and treatment guidelines" diagnostic criteria, which includes electrocardiographic examination (ECG), CT angiography (CTA) to confirm the diagnosis of coronary heart disease [7]; (2) Older than 60 years old; (3) Patients have the ability to take care of themselves; (4) Patients and their families can cooperate and sign in-

formed consent. Exclusion criteria: (1) Expected survival less than half a year; (2) A recent history of the use of drugs affecting heart function; (3) A definite diagnosis of secondary hypertension: Hypertension caused by kidney disease, endocrine disease, cardiovascular disease; (4) Combined with other heart diseases, such as valvular heart disease, rheumatic heart disease, congenital heart disease, pulmonary heart disease, dilated cardiomyopathy, myocarditis, hyperthyroid heart disease.

### Grouping Method

The control group was given routine nursing intervention, including basic nursing, nutrition, psychological nursing, safety nursing, and health guidance.

The observation group received the NNN-linked care model for the intervention. (1) Training and learning: Taking the department as the unit, establish the NNN-linked nursing team, learn the relevant theoretical knowledge of NNN-linked nursing model in the form of small lectures, and examine the nursing staff. (2) Process formulation: A group discussion was held before the intervention to clarify the direction of nursing work and responsibilities of the personnel. The NNN-linked nursing model was divided into three modules: Nursing evaluation, nursing outcome and nursing measures. The responsible nurse collected the patient admission assessment information, discussed with the nurse in charge and determined the nursing diagnosis results, and formulated nursing measures combined with the patient's expected goals. (3) Specific implementation rules: (a) Nursing evaluation. Obtain the information of the patients' data in face-to-face meetings, understand the stage of disease progression, subjective cognition of the disease, personality characteristics, expectations for prognosis and survival, and comprehensively evaluate the physical and mental health status of patients. (b) Nursing diagnosis. Objective diagnosis of possible problems during patient care and analysis of the underlying causes that may affect patients' extrinsic behavioral performance and intrinsic emotional changes. The main reasons for negative psychology in patients with coronary heart disease lie in the lack of recognition of the disease, negative views on the outcome of the disease, excessive worry or depression, difficulty in adhering to the completion of daily training under the influence of physical discomfort, or unsatisfactory follow-up after discharge, and lax self-management. (c) Nursing measures. On the premise of the completion of nursing diagnosis, personalized nursing intervention programs are given to patients with coronary heart disease. Health education can be combined with knowledge manuals, online platforms, animation videos and other diversified teaching methods, with on-site questioning, review and other assessment methods to consolidate the learning effect. Psychological intervention techniques such as the positive psychological suggestion method and attention transfer method are

used to improve patients' negative emotions. Patients are encouraged to voice their inner thoughts, communicate with relatives, and participate in outdoor activities, to create a rehabilitation environment for patients that is cared for, respected and valued. The patients are full participants in the activity training, and the training program is tailored to their own activity ability. The advantages of functional exercise are reviewed with the patients in detail. The cases of rehabilitated patients are reviewed, and patients are encouraged to participate in the training. Following discharge, attention is directed to the process of self-care to solve problems, timely correct abnormal behavior, paying special attention to changes in mental status of patients, and helping patients to build confidence in their future life. (d) Reflective optimization. In the process of implementing nursing measures, the nursing plan should be closely monitored, and appropriate changes made to optimize outcomes of the nursing plan through continuous follow-up evaluation and dynamic adjustment. Specific intervention measures were defined according to "Classification of Nursing measures Outcome" and "Nursing diagnosis, Outcome and Measures" and combined with the proposed goals, as shown in Table 1.

### Observation Indicators

(1) Cardiac function: Left ventricular ejection fraction (LVEF) in the 2 groups before and after intervention was detected by echocardiography. Maximum oxygen uptake ( $VO_{2max}$ ) of patients before and after intervention was detected by cardiopulmonary exercise functions. 6 min walking distance before and after the intervention was calculated. Since most of the patients suffered from heart failure, the cardiac function indices in this study were poor.

(2) The Exercise of Selfcare Agency Scale (ESCA): This scale was developed by Kearney *et al.* [8] in 1979 according to Orem's self-care theory and contains 43 items in 4 dimensions, namely self-care skills, self-care responsibility, self-care concept, and the level of health knowledge. ESCA uses the Likert 5-level scoring method, from "very unlike me" to "very like me" scored from 0 to 4 points, of which 11 items are reverse scores, with a total score of 172 points, and the higher the total score, the higher the ability for self-care.

(3) Quality of life was evaluated using the Chinese Cardiovascular Disease Quality of Life Questionnaire (CQQC) [9], which is divided into 6 dimensions including physical strength (2 items in total), disease condition (5 items in total), medical status (2 items in total), general life (5 items in total), psychosocial status (7 items in total), and work interpersonal status (2 items in total), 23 items. According to the actual situation of elderly cardiovascular patients, the item of "sexual life" was removed. Each dimension was scored separately, and the total score was calculated, with a minimum score of 0 and a maximum score of 154, the higher score indicating a better quality of life.

**Table 1. NNN-Linkd pattern intervention.**

Diagnosis	Outcome	Measure
Acute/chronic pain	Degree of pain	(1) Inform the patient to rest immediately, stop the original activity (2) Give intermittent oxygen inhalation (3) Give sublingual nitroglycerin sublingual
Activity intolerance	Degree of activity	On the basis of comprehensive assessment of his condition, combined with his own exercise habits, targeted exercise planning, implementation should be gradual.
Lack of knowledge	(1) Disease-related knowledge	(1) The intervention personnel shall inform the cause of the disease, the harm of the disease and the relevant knowledge of the treatment measures;
	(2) Diet related knowledge	(2) The intervention personnel informed the patients about diet and eating foods high in protein and vitamin and easy to digest;
	(3) Knowledge of drug use	(3) The intervention personnel informed the patient of the knowledge related to the drug, including the type, method, dosage and adverse reactions of the drug.
Potential complication	Myocardial infarction Cardiogenic shock Arrhythmology Heart failure	Closely monitor the changes of the condition, and promptly notify the doctor for treatment in case of serious complications.
Anxiety, fear and other negative emotions	(1) Anxiety level (2) Fear level	The intervention personnel should give timely psychological comfort and inform the patient that the medical staff will detect the change of his condition at any time and timely treatment.

### Statistical Methods

Data were processed using SPSS 22.0 statistical software (IBM Corp., Armonk, NY, USA). Enumeration data were expressed as percentages and  $\chi^2$  test was performed; measurement data were expressed as  $\bar{x} \pm s$  and  $t$ -test was performed.  $p < 0.05$  was considered statistically significant.

### Results

#### Baseline Data

There were no significant differences in gender ( $\chi^2 = 0.862, p = 0.353$ ), age ( $t = -0.258, p = 0.797$ ), BMI ( $t = -1.464, p = 0.146$ ) and other baseline data between the two groups ( $p > 0.05$ ), as shown in Table 2.

#### Comparison of Cardiac Function Indexes between the Two Groups

There were no significant differences in LVEF ( $t = 1.189, p = 0.060$ ),  $VO_{2max}$  ( $t = -0.693, p = 0.490$ ) and 6 min walking distance ( $t = 1.621, p = 0.108$ ) between the two groups before intervention ( $p > 0.05$ ). After the intervention, the LVEF ( $t = -5.13, p < 0.001$ ),  $VO_{2max}$  ( $t = -2.97, p < 0.01$ ) and 6 min walking distance ( $t = -9.96, p < 0.001$ ) of the observation group were better than those of the control group, as shown in Table 3.

#### Comparison of Scores of Selfcare Ability in Four Dimension between the Two Groups

There were no significant differences in the score of ability for self-care ability between the two groups before intervention ( $t = 1.057, p = 0.293$ ). Compared with the control group, the total score for ability for self-care ( $t = -9.135, p < 0.001$ ), the self-care skills ( $t = -2.379, p = 0.02$ ), self-care responsibility ( $t = -3.135, p = 0.002$ ), self-care concept ( $t = -3.204, p = 0.002$ ) and disease cognition level ( $t = -10.404, p < 0.001$ ) were higher in the observation group after three months, with significant differences, as shown in Table 4.

#### Comparison of Scores of Life Quality between the Two Groups

There were no significant differences in the scores of all dimensions of quality of life before intervention between the two groups ( $t = 0.271, p = 0.787$ ). After 3 months of intervention, the total score of quality of life and the dimension scores of physical strength ( $t = -2.974, p = 0.004$ ), disease condition ( $t = -2.196, p = 0.03$ ), general life ( $t = -2.443, p = 0.016$ ), medical status ( $t = -3.069, p = 0.003$ ), psychosocial ( $t = -4.278, p < 0.001$ ), work interpersonal relationship ( $t = -2.842, p < 0.01$ ), and total score of CQQC ( $t = -4.659, p < 0.001$ ) in the observation group were higher than those in the control group, and the differences were statistically significant (Table 5).

**Table 2. Comparison of baseline between both groups.**

	Control group	Observation group	t/ $\chi^2$	p
Gender			0.862	0.353
Female	33 (55)	38 (63.3)		
Male	27 (45)	22 (36.7)		
Age	71.1 ± 7.8	71.5 ± 7.8	-0.258	0.797
BMI	23.45 ± 2.0	23.97 ± 1.9	-1.464	0.146
Education duration	7.97 ± 2.9	8.52 ± 3.0	-1.043	0.299
Smoking history			0.034	0.855
Yes	32 (53.3)	33 (55)		
No	28 (46.7)	27 (45)		
Drinking history, n (%)			$\chi^2 = 1.350$	0.245
No	43 (71.67)	37 (61.67)		
Yes	17 (28.33)	23 (38.33)		
Course of the disease, n (%)			$\chi^2 = 0.334$	0.846
Within three months	26 (43.33)	24 (40.00)		
3 months to 3 years	15 (25.00)	14 (23.33)		
More than 3 years	19 (31.67)	22 (36.67)		
Hypertension, n (%)			$\chi^2 = 0.862$	0.353
No	33 (55.00)	38 (63.33)		
Yes	27 (45.00)	22 (36.67)		
Diabetes, n (%)			$\chi^2 = 1.776$	0.183
No	42 (70.00)	35 (58.33)		
Yes	18 (30.00)	25 (41.67)		
Stroke, n (%)			$\chi^2 = 0.370$	0.543
No	55 (91.67)	53 (88.33)		
Yes	5 (8.33)	7 (11.67)		
Antiplatelet agents, n (%)			$\chi^2 = 0.100$	0.752
No	6 (10.00)	5 (8.33)		
Yes	54 (90.00)	55 (91.67)		
Statins, n (%)			$\chi^2 = 0.323$	0.570
No	8 (13.33)	6 (10.00)		
Yes	52 (86.67)	54 (90.00)		
Beta-blockers, n (%)			$\chi^2 = 0.370$	0.543
No	7 (11.67)	5 (8.33)		
Yes	53 (88.33)	55 (91.67)		
ACEI/ARB, n (%)			$\chi^2 = 0.000$	1.000
No	5 (8.33)	4 (6.67)		
Yes	55 (91.67)	56 (93.33)		

BMI, body mass index; ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker.

**Table 3. Comparison of cardiac function indexes between the two groups.**

		Left ventricular ejection fraction	Maximal oxygen uptake	6 min walking distance
Before intervention	Control group	31.6 ± 2.0	15.4 ± 1.3	81.8 ± 1.9
	Observation group	30.9 ± 2.1	15.6 ± 1.8	81.2 ± 2.2
	t	1.189	-0.693	1.621
	p	0.060	0.490	0.108
After intervention	Control group	35.7 ± 2.0	17.0 ± 1.4	145.3 ± 8.1
	Observation group	38.3 ± 3.4	17.9 ± 1.6	162.8 ± 10.8
	t	-5.13	-2.97	-9.96
	p	0.000	0.004	0.000

**Table 4. Comparison of scores of selfcare ability in four dimension between the two groups.**

		Self-care ability	Self-care responsibility	Self-care concept	Disease cognition level	Total ESCA score
Before intervention	Control group	22.3 ± 1.2	17.8 ± 1.0	16.6 ± 1.4	41.9 ± 1.2	98.4 ± 2.5
	Observation group	22.0 ± 1.2	17.5 ± 1.1	16.6 ± 1.4	41.9 ± 1.5	97.9 ± 2.9
	t	1.53	1.61	-0.45	-0.065	1.057
	p	0.127	0.110	0.653	0.948	0.293
After intervention	Control group	35.9 ± 1.1	18.9 ± 1.0	22.9 ± 1.0	59.3 ± 1.0	137.1 ± 2.2
	Observation group	36.8 ± 2.6	20.1 ± 2.8	24.5 ± 3.7	63.1 ± 2.6	144.5 ± 5.9
	t	-2.379	-3.135	-3.204	-10.404	-9.135
	p	0.02	0.002	0.002	0.000	0.000

ESCA, Exercise of Selfcare Agency Scale.

**Table 5. Comparison of scores of life quality between the two groups.**

		Physical strength	State of the illness	General life	Medical condition	Social psychology	Work interpersonal relationship	Total CQQC score
Before intervention	Control group	6.2 ± 1.2	4.0 ± 1.6	2.9 ± 2.0	4.6 ± 0.5	3.5 ± 2.1	0.5 ± 0.5	21.7 ± 3.6
	Observation group	6.3 ± 1.7	4.0 ± 1.9	2.9 ± 1.8	4.6 ± 0.5	3.3 ± 1.6	0.5 ± 0.5	21.6 ± 3.9
	t	-0.127	-0.051	-0.098	-0.741	0.89	0.362	0.271
	p	0.900	0.959	0.922	0.460	0.375	0.718	0.787
After intervention	Control group	7.6 ± 1.2	5.0 ± 2.1	3.9 ± 2.0	5.4 ± 2.4	6.86 ± 2.2	0.8 ± 0.8	29.8 ± 2.0
	Observation group	8.4 ± 1.9	5.8 ± 2.0	4.8 ± 1.8	6.5 ± 1.7	8.4 ± 1.6	1.6 ± 1.8	31.4 ± 1.7
	t	-2.974	-2.196	-2.443	-3.069	-4.278	-2.842	-4.659
	p	0.004	0.030	0.016	0.003	0.000	0.006	0.000

CQQC, Chinese Cardiovascular Disease Quality of Life Questionnaire.

## Discussion

### *NNN-linked Care Model Can Improve Cardiac Function in Elderly Patients with Coronary Heart Disease*

#### Physical Assessment and Monitoring

The NNN-linked care model focuses on the regular assessment and monitoring of cardiac function in elderly patients with coronary heart disease by nurses. By measuring heart rate, blood pressure, heart sounds, ECG and other indicators, nurses can understand the status of the patient's heart function and timely detect abnormal changes. Through regular monitoring, nurses can adjust the nursing plan and make necessary interventions, such as adjusting drug treatment options and improving symptom management, so as to promote the improvement of cardiac function. The results showed that the physical assessment and monitoring measures of the NNN-linked nursing model had a significant effect on the improvement of cardiac function in elderly patients with coronary heart disease. Similar studies have found that through regular monitoring of ECG and blood pressure and timely interventions, nurses can effectively reduce the symptoms of angina pectoris, and improve the patients' cardiac function [10].

#### Medication Management

Medication management is one of the key nursing interventions in the NNN-linked care model. Nurses are responsible for monitoring the use of drugs in elderly patients with coronary heart disease to ensure that patients take the drug on time and receive the correct dose. Drugs, such as  $\beta$ -blockers and ACE inhibitors, can reduce cardiac afterload and improve cardiac function. Nurses help patients correctly understand and manage drug treatment by establishing close communication and cooperation with patients, explaining the effects and side effects of drugs, which improves the level of cardiac function.

#### Rehabilitation Training

Rehabilitation training is an important means to improve cardiac function. The NNN-linked care model emphasizes the development and implementation of a personalized rehabilitation program. Taking into account each patient's health condition, nurses develop appropriate rehabilitation programs and gradually increase physical activity to enhance cardiopulmonary function and promote the improvement of cardiac function. Nurses supervise and guide the implementation of rehabilitation training through close cooperation with patients to maximize the effect of rehabilitation. Studies have shown that rehabilitation training measures in the NNN-linked nursing model are important for the improvement of cardiac function in elderly patients

with coronary heart disease. The results of a randomized controlled trial showed that through regular rehabilitation training, elderly patients with coronary heart disease had significantly improved exercise tolerance, significantly improved cardiac function, reduced cardiac afterload, and significantly improved quality of life [11].

### *Effectiveness of the NNN-linked Care Model in Improving the Ability for Self-care*

#### Health Education and Self-management

The NNN-linked care model focuses on health education and self-management guidance. Nurses provide relevant health education to elderly patients with coronary heart disease, including dietary control, medication management, physical activity and other guidance. Through education, patients are able to understand and master relevant knowledge and skills and actively participate in self-management. Nurses work with patients to develop personalized self-management plans to encourage patients to participate in self-monitoring, recording symptoms, and assessing their condition to improve their ability for self-care. Health education and self-management in the NNN-linked nursing model play an important role in improving the ability for self-care of elderly patients with coronary heart disease. The results of a study showed that through health education and self-management guidance, elderly patients with coronary heart disease could better control their diet, take their medication on time, participate in appropriate physical activities, and significantly improve their ability for self-care [12].

#### Psychological Support

NNN-linked care model focuses on psychological support, which is essential for the mental health of elderly patients with coronary heart disease. Nurses provide emotional reassurance, psychological counseling, coping skills and other support to help patients actively cope with psychological pressure and enhance their ability for self-management. Nurses build intimate relationships with patients, listen to and understand patients' psychological needs, and provide emotional support and comfort to patients, thus enhancing patients' ability for self-care ability. Psychological support measures in the NNN-linked nursing model have a significant effect on the improvement of the ability for self-care in elderly patients with coronary heart disease. The results of a systematic review showed that through the implementation of psychological support, the mental health of elderly patients with coronary heart disease was improved, anxiety and depressive symptoms were significantly reduced, and the ability for self-management was enhanced [13].



## *Effectiveness of the NNN-linked Care Model in Improving Quality of Life*

### **Reduce Angina Attacks**

Through the improvement of cardiac function and the implementation of self-management, the NNN-linked care model can reduce angina pectoris attacks in elderly patients with coronary heart disease. Effective drug therapy and rehabilitation training can reduce cardiac afterload and improve exercise tolerance, thereby reducing the occurrence of angina pectoris and improving the quality of life. Studies have shown that drug management and rehabilitation training measures in the NNN-linked care model have a significant effect on reducing angina attacks. The results of a study showed that the number of angina attacks in elderly patients with coronary heart disease was significantly reduced and the quality of life was improved through effective drug treatment and regular rehabilitation training [14].

### **Improve Life Satisfaction**

The NNN-linked care model can improve life satisfaction of elderly patients with coronary heart disease through comprehensive nursing interventions. Through the comprehensive application of physical assessment and monitoring, drug management, rehabilitation training, health education and self-management as well as psychological support and other measures, the patients' cardiac function level has been improved, the ability for self-care has been improved, and the satisfaction at the psychological and social levels has been increased, thereby improving the quality of life. Through the implementation of the NN-linked care model, the quality of life of elderly patients with coronary heart disease has been significantly improved, and patients' satisfaction with the quality of care and services has significantly increased [15].

### *Limitations*

The study population was older and had more comorbidities which further reduced cardiac indices and may have influenced the conclusions. The patients are derived from a single center and the results may not be applicable to other centers, which introduces an element of selection bias.

### **Conclusion**

In conclusion, the NNN-linked nursing model can significantly improve the level of cardiac function, the ability for self-care and the quality of life in elderly patients with coronary heart disease through the application of comprehensive nursing intervention measures such as physical assessment and monitoring, drug management, rehabilitation

training, health education and self-management, and psychological support. Since the levels of patient acuity varies, nurses need to develop a personalized care plan according to the patient's specific circumstances to achieve the best results. Future studies need to continue to explore and verify the best practice of the NNN-linked nursing model to improve the level of cardiac function, the ability for self-care and the quality of life in elderly patients with coronary heart disease, to constantly improve the outcomes of this nursing model.

### **Availability of Data and Materials**

The data can be provided on reasonable request to the corresponding author.

### **Author Contributions**

WD conducted study design and wrote the manuscript. BR conducted data analysis. WD and BR contributed to revise the manuscript. Both authors contributed to editorial changes in the manuscript. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

### **Ethics Approval and Consent to Participate**

This study has been reviewed and approved by the Ethics Committee of Affiliated Hospital of Inner Mongolia Medical University (20221208), and all study subjects has received informed consent.

### **Acknowledgment**

Not applicable.

### **Funding**

This research received no external funding.

### **Conflict of Interest**

The authors declare no conflict of interest.

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