



## Original Article

# Modifying Stressors Using Betty Neuman System Modeling in Coronary Artery Bypass Graft: a Randomized Clinical Trial

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## ABSTRACT

**Introduction:** Coronary artery disease (CAD) is one of the major causes of mortality all over the world. In this relation, coronary artery bypass grafting (CABG) is one of the most important treatments for CAD patients. However, it leads to a lot of stress in the patient. The aim of this study was to use the Neuman model to moderate the stressors in patients undergoing coronary artery bypass graft.**Methods:** This study was a randomized clinical trial of two groups performed on patients admitted to the coronary artery bypass graft; and the study completed with 64 patients. The intervention was performed by the researcher according to the format of the Neuman Model, which included the investigation of the stressors, and the determination of the goals and strategies for the actions. Intrapersonal, interpersonal, and extra personal factors were evaluated using a Revised Cardiac Surgery Stressor Scale (RCSSS). The intervention program was designed by the researcher based on prevention levels using scientific resources. The collected data were analyzed in SPSS ver. 13 using descriptive and inferential statistics.**Results:** Before the intervention, the mean score of the stressors was not significantly different between the two groups. But immediately after the intervention and before discharging the intervention group, it was significantly less than the control group.**Conclusion:** Using a Neuman-based program as an effective and low-cost intervention can moderate the stressors and reduce the stress of patients awaiting coronary artery bypass graft. This theory can be a good guide to offering the roles needed to provide health services in the community.**Citation:** Akhlaghi E, Babaei S, Abolhassani Sh. Modifying stressors using Betty Neumann system modeling in coronary artery bypass graft: a randomized clinical trial. J Caring Sci 2020; 9 (1): 13-9. doi:10.34172/jcs.2020.003

## Introduction

Cardiovascular diseases are the most common cause of death in the world.<sup>1</sup> Coronary artery bypass (CABG) is one of the most common treatments for patients with coronary artery disease. According to the American Heart Association (AHA) in 2015, there are about 400,000 CABGs in the United States per year.<sup>2</sup> In Iran, as a developing country, CABG has increased over the past decade. According to the latest report from the Tehran Heart Center, 78.8% of adult heart surgeries were CABG.<sup>3</sup>

Although cardiac surgery is a vital treatment, it is considered by many patients as stressful, unwanted and life-threatening experience, associated with fear and anxiety affecting several aspects of the patient's personal life.<sup>4</sup> Factors that raise concerns about coronary artery bypass are known as stressor.<sup>5</sup>

According to different studies, pre-operative stressors for these patients are pre-operative waiting times,<sup>6</sup> psychological responses such as fear of death, need for surgery, fear of MI during pre-operative waiting, fears from anesthesia, recovery process, defects in health, and economic and financial issues.<sup>7</sup> Nurses play an important role in the emotional and psychological preparation of the patient in the pre-operative period of cardiac surgery.

Therefore, it is really important to seek ways to improve the quality of nursing care.<sup>8</sup> There are several

methods for managing stress in nursing: mental counseling sessions, showing educational films, visiting patients from previously undergone surgery, playing pre-operative music, and making patient familiar with the staff and operating room equipment. These measures have been taken to reduce stress before surgery in different countries.<sup>9</sup> Because nurses in clinical settings spend more time with the patient, they are in the best position to relieve stress through non-drug therapies.<sup>10</sup>

One of these methods is the Neuman System Model (NSM) that emphasizes stressors and responses to them.

This theory has been developed as a comprehensive training model and a framework for organizing nursing knowledge since 1970.<sup>11</sup> The unique focus of this model on the health system is related to environmental stressors and stress response.<sup>12</sup> Betty Neuman model is an open model that examines proper function in stressful situations or at the time of the patient's response.<sup>12</sup> This model introduces the patient as a system of sustainable interactions with inter, intra, and extrapersonal stressors.

Existing stresses are able to attack an individual defense line unless the patient is protected by a flexible defense line.<sup>13</sup>

The Neuman system model is based on a person's relationship with and response to stress. The three key concepts in Neuman's theory include stress, homeostasis,

and patient perception. The role of the nurse is to focus on the factors influencing the individual's response to stress and protect the patient against the relevant risk factors.<sup>14</sup> The main objective of nursing in this model is to evaluate patients in terms of achieving stability through the acquisition and preservation of health. The nurse creates the relationship between the patient, the environment, and health and establishes a sustainable system. This system considers patient and nurse's understanding of patient care. Due to the patient's stability and his health outcome, it is necessary to evaluate the stressors perceived by the nurse and the patient. With the progress of collaboration between the nurse and the patient and with their mutual understanding, they can eliminate their different understandings and make a constructive relationship.

The outcome of such a partnership is complementary to a joint care plan that can be implemented on the basis of a clear objective.<sup>5</sup> Neuman considers nurses as active contributors.<sup>15</sup> It should be kept in mind that theories in the nursing profession are developed to be used in clinical practices. Developing and reviewing theories opens up new approaches to quality care and challenges the current care practice.<sup>16</sup> Nursing is both a practical discipline and a science based on professional knowledge; therefore, to create new practical approaches, establishing the foundation of knowledge is one of the requirements.<sup>17</sup> Nurses must first be trained and provided with nursing theories and models. Then, they can improve the symptoms and complications of coronary artery bypass graft, and their care will be effective. The researcher observes that the emotional complications impaired the patient's emotional exertion and delayed their recovery. Additionally, according to the researchers' experiences, a simple nursing intervention cannot solve the problems. Furthermore, based on previous studies, a general consideration is needed to fill the gap in the intervention using the Neuman system model.

Given the limited studies on Neuman theory based on clinical trial in Iran. Most of the past studies that have worked on theories have been a case study, qualitative or descriptive, that is not as well as randomized clinical trials. According to the importance of holistic care and three levels of prevention in developing countries, which are principles of the Newman model, the researcher attempted to answer the question about the probable effect of a care program based on the Betty Neuman system of stressors in patients undergoing coronary artery bypass grafting. The aim of this study was to examine the effect of Betty Neuman model on the stressors in patients undergoing coronary artery bypass graft.

## Materials and methods

The present study was a randomized clinical trial that was approved by the Vice-Chancellor of Ethics of Research and Technology of Isfahan University of Medical Sciences (IR.MUI.REC.1396.3.838). It was also

registered in the Iranian clinical trial center with the code IRCT2018011603897N1. The required sample size with 95% confidence and test power of 0.8 strength was measured in two groups of 32 controls and intervention, including a total of 64 people. Convenience sampling was done and allocation of subjects to the control and intervention groups was randomly assigned among the patients who were waiting for coronary artery bypass graft at the teaching hospital in 2018. The method of randomization is to write letters A and B on cards with equal numbers. Then, each of the patients who has been admitted to the study is asked to take one of the cards. Patients who take the A card allocated into the intervention group, and patients who take the B card allocated into the control group.

Inclusion criteria to the study included full consciousness, an age range of 30 to 70 years, hospitalization at least one day before the surgery, and mastery of the Persian language. Exclusion criteria were the lack of cooperation of the patient at each stage of the study and the emergency condition of the patient. Data were collected using a Revised Cardiac Surgery Stressors Scale (RCSSS). Cardiac Surgery Stressors Scale (CSSS) was developed by Carr and Powers in 1986.<sup>18</sup> White in 1998, adding six items to CSSS introduced RCSSS<sup>19</sup> which has been used in this study. The RCSSS included 37 questions. The questionnaire consisted of two parts; the first part included personal and social information, and the second part including RCSSS cases involved three subgroups, intrapersonal stressors including 11 phrases, interpersonal stressors including 9 phrases, and extrapersonal stressors including 17 phrases. The items were ranked according to the level of concern of the participants on the Likert scale from 0 to 4 where 0 shows lack of worries, 1 very low worries, 2 low worries, 3 relative worry, and 4 worries. The lowest score of 0 means that there is no stressor, and the maximum score of 148 refers to the highest stressor factor. Grading scores from 0 to 37 indicates very low stressors, 38 to 74 shows low stressors, 75 to 110 indicates the existence of relatively stressful factors, with 111 to 148 displaying stressful factors. The reliability of this questionnaire was calculated, using Cronbach's alpha coefficient (patient=0.81), (nurse= 0.93) method in Parvan *et al.*, studies<sup>5,20</sup> in Iran. For the purpose of this study, the control group and the intervention group were selected by referring to the cardiology center and preparing a list of candidates for coronary artery bypass graft. The researcher then explained the goals of the study to the eligible patients individually. After obtaining the patients' informed and written consent for participation in the research, the personal data questionnaire was completed, using an interview. Then, the stressors of coronary artery bypass surgery were completed RCSSS. Patients who had had a level of education to answer the questions were asked to complete the questionnaire. Otherwise, the completion of the questionnaire was carried out in the form of a structured interview beside the patient's bed. It took each patient 20 to 30 minutes to

complete the questionnaire. The questions were asked in a way that was understandable for the patients. For the intervention group, the pre-operative day care program was designed by the researcher based on the Betty Neuman Model. First, the potential and actual stressor factors and intrapersonal, interpersonal, and extra personal factors were examined using RCSSS. Then, proper goals and strategies were identified through using the questionnaire and determining the level of stressors. If the stressors were not available, interventions were conducted at the first level of prevention. Furthermore, the influence of stressors on the natural defence line was reduced by decreasing the probability of confrontation with stressors and strengthening the defence line. At first, all stressors were considered as potential, and people were at the initial prevention level. After determining the perceived stressors of the patient by using RCSSS (patient)<sup>20</sup> at the time of admission, if the patient was conceived of the stressors, immediately RCSSS (nurse)<sup>5</sup> was given to the nurse responsible for the patient and completed until the end of the shift. This was carried out to determine the stressors that the patient was facing. The nurse perception was considered as one of the steps of the Neuman model in relation to the patient's stressors. The intervention was performed on the basis of the study and considering the patient and nurse's understanding of the actual stressors for the patient at the second level of prevention. These interventions were performed to reduce the identified stressors. At the second level of the prevention, the natural and the flexible defensive lines that were injured interfered. The intervention was aimed at strengthening the internal defence lines in order to reduce the reaction. Preoperative reassessment of the patient was done using RCSSS (nurse) and, if there were stressors, intervention continued in the third level prevention. The third level prevention was provided through Benson relaxation technique. A care program was performed based on the Neuman system model in one or two consecutive sessions of 45-60 minutes prior to the first and second level prevention. The first session was debated on the first day of admission in the morning shift (at 8-12), and the second session in the evening (at 16-17) or night shifts (at 20-22).

The conversations were carried out individually and on the patient's bedside face to face after a favorable atmosphere had been created between the patient and the researcher. The contents of the sessions included introducing and expressing the purpose of the research, explaining in simple terms coronary artery anatomy, preoperative cardiac surgery, operating room and ICU, heart surgery, postoperative care (bathing, activities at home, diet, taking medication), the role of proper nutrition in reducing stress and anxiety, reassurance in the hospital and operating room environment, intubation in the mouth, chest tube, urinary catheter, etc. This was done in a first-time prevention based on the Neumann system model. At the end of the first session, there was no meaningful booklet on the issues presented. The Chi-square test showed that there was no significant

difference between the two groups in the distribution of patients' gender and cardiac catheterization. With the placement of people in the second level, the intervention was designed to reduce stressors perceived by the nurse and the patient.

Contents of sessions based on prevention levels were as follow:

**First Session:**

- In patients in the first prevention and at the time of admission.
- Introduce yourself and express the purpose of the research.
- An explanation of coronary anatomy, preoperative cardiac surgery, operating room and ICU, post ICU cardiac surgery, post-operative care and instructions (bathing, activities at home, diet, taking medication), the role of proper Nutrition in relieving stress and anxiety, and reassurance in the hospital environment and the operating room.

**Second Session:**

- In patients in the secondary prevention and in the second shift after admission.
- Discussion and clarification of issues.
- Intervention according to the needs and actual stressors detected by the patient and the nurse and based on Neuman Stressors.
- Intrapersonal (awareness of the rehabilitation phase, home care, routine care in the intensive care unit and other areas, surgery awareness, time back to ward, duration of exercise, awareness of the therapeutic and nutrition therapy).
- Interpersonal (description of hospital therapy procedures, psychological support, and relation with patients, and provide Information about medications)
- Extra personal (providing information on insurance and paying for expenses and talking to the healthcare sector and referring patients to charities, creating a quiet environment and reducing noise, staying in the ICU, injection instruction, training in connection with tubes and patient's chest tube, a tutorial on catheter showing the patient with connections).

**Third Session:**

- In patients with the third prevention and in the post-operative stage.
- Promote relaxation responses by implementing Benson's relaxation method.

At the third prevention level, Benson's relaxation method was performed after the surgery. This technique is a form of relaxation that, with a comfortable position and closure of the eyes, all the muscles in the body gradually relax from the feet to the face.<sup>21</sup> This research is the result of a master thesis in nursing and approved by the Isfahan University of Medical Sciences with the code (396838).

**Results**

This randomized clinical trial was completed with participation of 64 patients who were candidates for coronary artery bypass graft in two equal groups of patients in the intervention group was 48 to 70 and 33 to 69 years in the control group. Most of the participants in the intervention group were in type 1 and type 2 intervention and control (Figure 1). The age range of the

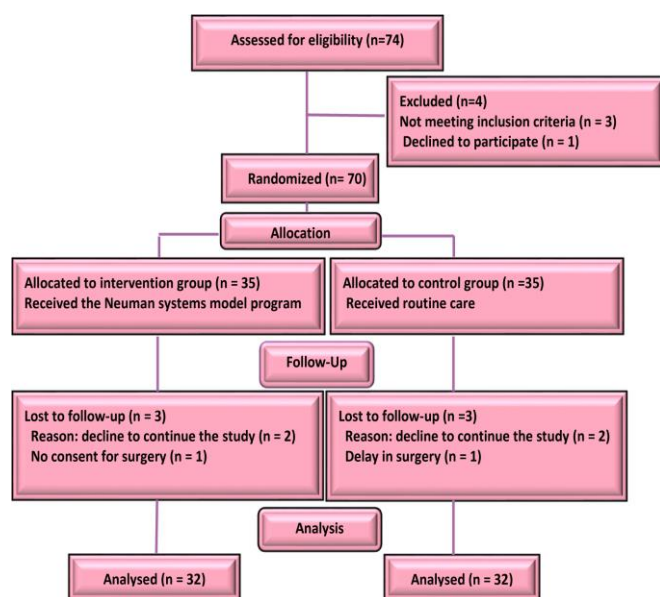


Figure 1. Flow chart of the study

prevention, and only 16% were in type III prevention. Of the total 32 patients in each group, there was no significant difference between variables in the control and intervention groups. Independent t-test showed that there was no significant difference between mean age, the number of previous hospitalizations, time of the most recent hospitalization, and the number of previous surgeries. Chi-square test showed that there was no significant difference between the two groups in sex distribution and cardiac catheterization.

The Chi-square test with likelihood ratio also indicated that the distribution of marital status was not significantly different between the two groups.

Additionally, Fisher's exact test showed that there was no significant difference in the distribution of religious beliefs between the two groups. The frequency of heart surgery in family history was similar in the two groups.

The Mann-Whitney test showed that there was no significant difference in family income, education level and duration of previous hospitalizations between the two groups ( $P > 0.05$ ). The mean score of stressors before the intervention was not significantly different between the two groups ( $P = 0.59$ ), but immediately after the intervention and before discharge in the intervention group, it was significantly less than that of the control group ( $P \leq 0.001$ ) (Table 1).

Table 1. Comparison of the mean score of stressors between the two groups

Variable	Group		P (t-test)
	Intervention Mean(SD)	Control Mean(SD)	
Before the intervention	45.23(21.64)	49.05(23.68)	0.59(0.54)
After the intervention	25.84(12.64)	48.90(20.04)	0.001*(3.45)
Before discharge	24.87(12.86)	52.49(18.81)	<0.001*(3.87)

SD: Standard deviation,\*statistically significant

There was no significant difference in the score of intrapersonal and extra personal stressors before the intervention ( $P > 0.05$ ), but immediately after the intervention and before discharge in the intervention group, it was significantly less than that of the control group ( $P < 0.05$ ).

There was no significant difference between the mean score of interpersonal stressors before the intervention and before discharge between the two groups ( $P > 0.05$ ), yet it was significantly less than that of the control group immediately after the intervention in the intervention group, ( $P < 0.05$ ) (Table 2).

The total mean score of stressors as well as intrapersonal, interpersonal, and extra personal stressors of the patients, from the nurses' viewpoint, was significantly higher than that of the patients' viewpoint ( $P < 0.05$ ).

An independent t-test showed that the total mean score of stressors as well as the intrapersonal, interpersonal, and extra personal stressors of the patients, was significantly higher from the nurses' viewpoint, as compared with the patients' viewpoint ( $P < 0.001$ ) (Table 3).

Table 2. Comparison of the mean score of intrapersonal, interpersonal, and extrapersonal stressors between the two groups

Variable	Group		P (t-test)
	Intervention Mean(SD)	Control Mean(SD)	
<b>Intrapersonal</b>			
Before intervention	16.14(8.84)	15.28(8.15)	0.73(0.34)
After intervention	7.78(4.53)	15.82(9.61)	0.001*(3.66)
Before discharge	7.54(3.81)	15.04(8.87)	0.001*(3.37)
<b>Interpersonal</b>			
Before intervention	8(3.81)	8.57(4.39)	0.77(0.30)
After intervention	6.12(3.77)	8.49(3.25)	0.048*(2.13)
Before discharge	6.96(3.04)	8.68(3.71)	0.16(1.82)
<b>Extra personal</b>			
Before intervention	23.08(9.50)	22.93(12.59)	0.96(0.005)
After intervention	13.84(6.51)	24.46(14.62)	0.002*(3.32)
Before discharge	12.39(6.84)	24.84(14.72)	0.001*(3.58)

SD: Standard deviation,\*statistically significant

Table 3. Comparison of the total mean score of stressors and intrapersonal, interpersonal, and extra personal stressors of patients between their viewpoints and nurses' point of view

Score of stressors	Nurses Mean(SD)	Patients Mean(SD)	P-value(t-test)
Intrapersonal	26.04(4.58)	16.14(8.84)	<0.001*(5.63)
Interpersonal	16.30(6.40)	8(3.81)	<0.001*(5.03)
Extra personal	38.16(6.72)	23.08(9.50)	<0.001*(7.33)
Total score	80.57(14.93)	45.23(21.64)	<0.001*(7.60)

SD: Standard deviation,\*statistically significant

## Discussion

The results of this study showed the positive effect of using Neuman's care program on adjusting the level of stressors in patients undergoing coronary artery bypass graft. Various resources state that pressure on people leads to different reactions. Some people are better off than others in coping with pressures and they can manage the militancy of the environment while some others are completely indifferent to psychological



pressures due to their individual traits and characteristics. That means, in tension, they will not be able to cope with the pressure. Characteristics such as age, sex, health status, exercise patterns, and even food affect people's responses in stressful situations.<sup>22</sup> The knowledge derived from the integration of theory and clinical practices can be effective in improving the quality of care and can lead to dynamic and scientific care. Therefore, it is essential to evaluate and update applied models to ensure that the core concepts of the models are consistent with the philosophy and current nursing activity.

A study has shown that the functional and psychological status of the patients worsens when they enter the cardiac surgery waiting list.<sup>23</sup> The results of this study showed that the mean age of the patients in the intervention group was 60.72 years old while in the control group, it was 57.23 years old. Older age is one of the risk factors for atherosclerosis and coronary artery disease, and also increases the risk of coronary artery disease, and consequently, the need for surgery increases.<sup>24,25</sup> In most studies, the age of coronary artery disease for patients requiring CABG is reported to be over 55 years old.<sup>26,27</sup> Most of the patients in this study were married males with low income and mostly illiterate or with elementary education. The risk factors for coronary artery disease include age and sex (which is higher in men than women due to female hormones, and more often in menopause), lifestyle, socioeconomic status.<sup>27</sup> Moreover, marriage, due to the sense of responsibility, especially in men, increases the pre-operative stress.

In this study, patients identified extra personal factors as the most stressful ones. Based on the Neuman model, the prevention and management plans were designed to reduce and modify these factors. Thus, immediately after the intervention and before discharge in the intervention group, the results were significantly lower than those in the control group. In the face of life-threatening events such as illnesses, adaptive strategies play an important role in providing physical and mental health. Diagnosis of stressors in patients undergoing open heart surgery is very important for nurses because it helps them prioritize interventions and implement effective methods.<sup>9</sup>

Neuman introduces prevention as one of the most important nursing interventions to protect the patient.

The nursing goal in this model is to strengthen the defence lines, to develop the patient's resistance, and to improve the health and the ability to cope with it.<sup>5,14</sup> The important point in providing nursing care is at the level of prevention. The primary prevention objective is to prevent tension agents from penetrating into defensive lines by reducing confrontation with stress and reinforcement of the defence lines. The second type of prevention increases wellness and reduces stress. In the secondary prevention, the goal is to maintain the level of compatibility.<sup>17,23</sup> A study examined the viewpoints of patients with open heart surgery toward the stressors

and strategies to modify them. The results showed that the perception of the patients from intrapersonal stressors was more than interpersonal and extrapersonal stressors, and the most important way to moderate the stressors was the assurance of the nurse by giving consistent care and offering postoperative pain relief.<sup>28</sup>

Khatiban et al.,<sup>13</sup> showed that using Neuman model to collect data and identify different types of stress in nurses leads to the improvement of care process, proper understanding of patient tensions, and finally, proper care. Providing family care based on three levels of prevention, identification, and acceptance of intrapersonal, interpersonal and extrapersonal problems is very important for patients and their families.

The results of this study are consistent with the results of the study of the application of Neuman theory in nursing anesthesia. The use of Newman system model reduced the anxiety of people who were awaiting surgery.<sup>29</sup> It can be said that the use of nursing theories, such as Neuman theory in nursing care, is negligible. One of the strengths of this clinical trial study was to work with a large number of samples. Most of the studies that have worked on theories have been of case study type. For instance, Knight studied the effectiveness of the Neuman model on a multiple sclerosis patient, and its results reported favorable effects.<sup>30</sup> Ross and Bourbonnai also examined the efficacy of this model in patients with myocardial perfusion.<sup>31</sup> The evaluation of stressors and nurses and the patients' understandings of these stressors are different from each other. Nurses should be able to accurately assess the patient's stress level so as to offer proper care services and to focus on effective nursing interventions. High-quality nursing care directly depends on the nurse's ability to understand the weaknesses, strengths, problems, and characteristics of the patients.<sup>32</sup>

Therefore, nurses who emphasize this point can be effective. The identification of stressors in coronary artery bypass grafting patients, especially those stressors associated with stress and anxiety, is very important for nurses as it helps them prioritize and implement effective interventions. Cooperation between patients who have coronary artery bypass grafts and nurses caring for them can have positive outcomes during work. The mutual understanding between the nurse and the patient will help the patient's recovery. Lack of understanding may delay the patient's recovery process. The Neuman theory also emphasizes the importance of the patient-nurse relationship with regard to the nursing care.<sup>32</sup>

In current study, the total mean score of stressors and intrapersonal, interpersonal, and extrapersonal stressors of the patients, from the nurses' viewpoint, was significantly higher than that of the patients' viewpoint ( $P < 0.05$ ). Independent t-test showed that the total mean score of stressors and intrapersonal, interpersonal, and extrapersonal stressors of the patients, from the nurses' viewpoint, was significantly higher than that of the patients' viewpoint ( $P < 0.05$ ). These results were similar to the results reported by Parvan et al., which according

to the total mean score of RCSSS, nurses' perception of stressors was significantly higher than the patients' 2.38 (0.56) vs. 1.65 (1.44).<sup>5</sup>

According to the Neuman theory, the real position of nurses in care is in health, treatment, and rehabilitation levels.<sup>29</sup> In the current system, nurses in hospitals provide care at the second level, namely, treatment to patients and their activities are limited to other prevention levels as well as other service delivery in the community. Unfortunately, very limited studies have investigated the effect of the intervention in care programs based on the Neuman model.

Since Neuman's vision is community-based, this theory can be a good guide for nursing community services. Nursing theories in patient care can help us improve patient care standards, reduce nursing care costs, and improve patient quality of life.<sup>33</sup> The limitation of this study was to exchange information between control and intervention group participants, which was prevented as far as possible.

### Conclusion

The findings of this study can provide valuable guidance to nurses for beneficial effects in adjusting patients' anxiety and stressors and reducing postoperative complications. Given the applicability of this model, it is suggested that in future studies, the barriers of implementing a care plan based on Betty Newman's model be considered from the perspective of nurses.

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### Ethical issues

None to be declared.

### Conflict of interest

The authors declare no conflict of interest in this study.

#### Research Highlights

##### What is the current knowledge?

Nursing care in Iran is usually provided at the second level of prevention, and the activities of nurses at other levels of community-based prevention and care, based on the Newman theory, are very limited and nursing theories, especially the Betty Newman model, are rarely used in bed.

##### What is new here?

Nursing care based on the Betty Newman model can reduce stressors in patients undergoing cardiac surgery.

### Author's contributions

Study conception and design: EA, SB; Data collection: EA; Data analysis and interpretation: EA, SB; Drafting of the article; EA, SB, ShA; Critical revision of the article: SB, ShA

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