

Original Article

Analysis of factors influencing cardiovascular surgical nurses' emergency response capabilities, self-efficacy, and coping strategies

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Abstract: Objectives: To investigate the emergency response capabilities of cardiovascular surgical nurses, analyze their correlation with self-efficacy and coping styles, and summarize targeted intervention measures. Methods: A total of 243 cardiovascular surgical nurses from comprehensive tertiary Grade A hospitals in Jiangsu Province were selected using convenience sampling from October to November 2023. Participants were surveyed using a general information questionnaire, an emergency response capability assessment scale for operating room nurses, a general self-efficacy scale, and a simplified coping style scale. Results: The total scores were 114.77 ± 12.39 for emergency response capability, 2.69 ± 0.58 for self-efficacy, 2.02 ± 0.54 for positive coping style, and 1.16 ± 0.53 for negative coping style. Pearson correlation analysis showed that emergency response capability was positively correlated with self-efficacy and positive coping styles and negatively correlated with negative coping styles (all $P < 0.05$). Optimal scaling regression analysis indicated seven factors: age, years of work, professional level, title, self-efficacy, positive coping style, and negative coping style, which could explain 39.0% of the variation in emergency response capability (all $P < 0.05$). Conclusions: The emergency response capabilities of cardiovascular surgical nurses are moderately high and closely related to their self-efficacy and coping styles. Emergency rescue training for cardiovascular surgical nurses should aim at enhancing self-efficacy and positive coping styles by, for example, setting clear training goals, focusing on individual differences, fostering of active learning, and stimulating their intrinsic motivation to enhance their emergency response capabilities. These changes will lead to more organized and efficient cardiovascular surgical emergency work.

Keywords: Cardiovascular surgical nurse, nurse emergency response capability, self-efficacy, coping strategies, survey analysis

Introduction

Emergency response capabilities enable a nurse's ability to promptly and accurately identify changes in patients' conditions, provide rational analysis and judgment, and utilize their proficient skills to make crucial decisions in emergencies [1]. Cardiovascular surgery is characterized by its specialized nature, fast pace, and high risks [2], all of which lead to various unexpected events during the perioperative period [3], such as sudden cardiac arrest before surgery, aortic dissection during arterial catheterization, gastrointestinal bleeding ca-

used by esophageal ultrasound, ventricular fibrillation, malfunctions of the heart-lung machine and its accessories, and cardiac rupture. Compared with nurses in other specialties, it is particularly important for those specializing in cardiovascular surgery to keenly observe changes in patients' conditions, react promptly and correctly in emergencies, and possess comprehensive specialized knowledge in emergency care [4].

To build emergency response capabilities, nurses must change their behaviors, and such behavioral changes must be based on knowl-

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edge and learning with correct beliefs and a positive attitude as driving forces [5]. In emergencies, nurses need to demonstrate confidence and decisiveness, requiring not only rich nursing knowledge and skills but also the ability to maintain cognition and action under pressure. An individual's confidence and belief in their ability to successfully complete work in unfamiliar, unpredictable, and stressful situations is also known as self-efficacy [6]. Research has also shown that adopting positive coping strategies, for instance, the cognitive and behavioral approaches individuals take when facing stressful situations and events [7], including problem- and emotion-focused coping, can help individuals reduce their negative stress responses [8].

Currently, there is limited research on the factors influencing cardiovascular surgical nurses' emergency response capabilities both domestically and internationally. Therefore, this study aimed to explore the correlation between self-efficacy and coping strategies and the emergency response capabilities of cardiovascular surgical nurses, aiming to provide insights to enhance their emergency response capabilities and improve the level of emergency care for patients undergoing cardiovascular surgeries.

Subjects and methods

Research subjects

There are 55 comprehensive Grade III Class A hospitals that perform cardiovascular surgeries in Jiangsu Province, with approximately 340 cardiovascular surgical nurses. This cross-sectional study used convenience sampling to select cardiovascular surgical nurses from these hospitals as research subjects from October to November 2023. We included individuals from this population who (1) were formally employed or contract-based nursing staff, (2) had more than 3 months of work experience in the cardiovascular surgery department, and (3) provided informed consent to participate. We excluded operating room nurses on maternity or sick leave. According to Kendall's rough estimation method [9], the sample size should be 5-10 times the total number of study variables; depending on the dropout rate, the sample size should be further increased by 10%-20%. Based on our literature review and the use of scales in this study, we identified 15 variables.

Considering a 20% sample loss rate, the minimum sample size was determined to be 168 cases. Ultimately, this study included 243 participants. This study was approved by the Ethics Committee of Nanjing First Hospital.

Research tools

(1) General Information Questionnaire. This questionnaire was designed by the researchers and includes items such as age, education level, years of nursing experience, skill level, professional title, and participation in emergency training. (2) Cardiovascular Surgical Nurse Emergency Response Capability Assessment Scale. This scale, developed by Lu Ying et al. in China [10], consists of 27 items across five dimensions. Scores for each item range from 1 to 5 on a Likert scale, and the total score is 27-135. The total scores for the five dimensions are 11-55 for emergency management capability, 5-25 for critical condition observation capability, 4-20 for rapid-response capability, 4-20 for emergency handling capability, and 3-15 for theoretical knowledge reserve. A higher score indicates a higher overall level of clinical emergency response capability or stronger ability in the corresponding dimension. The Cronbach's α coefficient for this questionnaire in the study was 0.924. (3) General Self-Efficacy Scale. The Chinese version of the General Self-Efficacy Scale (GSES), developed by Schwarzer and translated by Wang Caikang et al. [11], was used in this study. This scale applies to various populations, including nursing staff, and consists of 10 items rated on a 4-point Likert scale (1= completely incorrect, 2= somewhat correct, 3= mostly correct, 4= completely correct). The overall score was obtained by summing the scores of the 10 items and dividing by 10. A higher score reflects better self-efficacy, indicating an individual's positive subjective judgment of their ability to cope effectively with difficulties or setbacks. Scores below 2 indicate low self-efficacy, scores of 2-3 indicate moderate self-efficacy, and scores above 3 indicate high self-efficacy. The Cronbach's α coefficient for this scale in the study was 0.922. (4) Coping Styles. The simplified coping style scale developed by Jie Yaning et al. [12] was used. This scale is tailored to the characteristics of the Chinese population and comprises 20 items divided into two dimensions (positive and negative coping). It is suitable for

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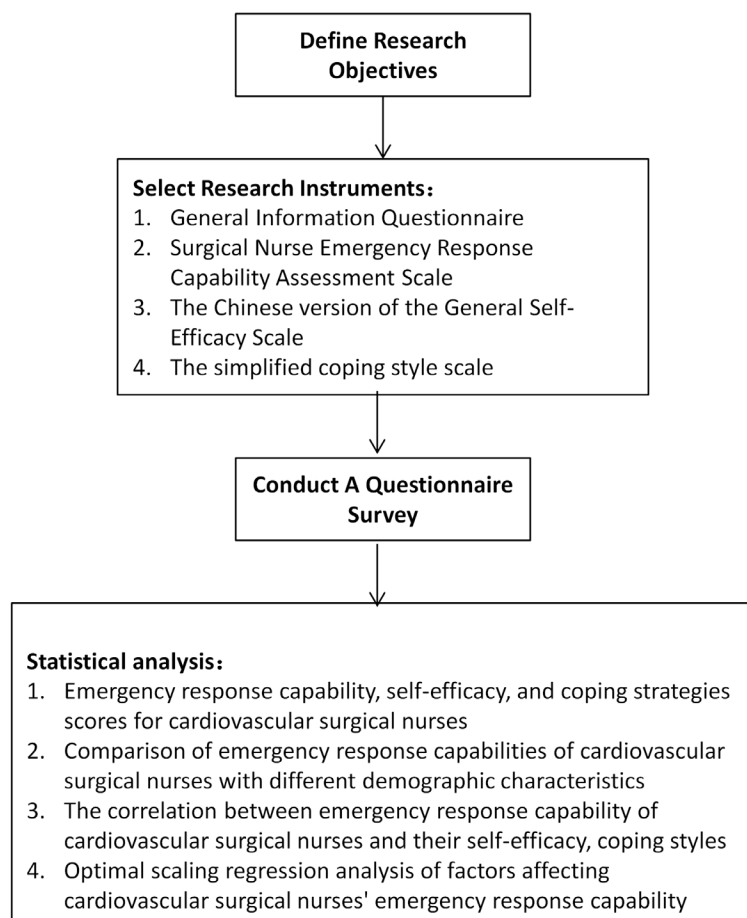


Figure 1. Research process diagram of factors affecting cardiovascular surgical nurses' emergency response capabilities.

various populations, including nursing staff. The questionnaire uses a 4-point Likert scale (0= never, 1= sometimes, 2= often, 3= always) to estimate the positive and negative coping styles, reflecting an individual's attitudes or actions when facing stressful situations. This scale demonstrates good reliability and validity, with a Cronbach's α coefficient of 0.867 in this study.

Survey method

The Cardiovascular Surgical Nurse Emergency Response Capability Assessment Questionnaire was distributed through Wenjuanxing. The principal investigator communicated with core members of the Operating Room Anesthesia Professional Committee of the Jiangsu Nursing Association to introduce the survey's purpose, significance, and completion method. Head nurses organized eligible nurses in their departments to complete the questionnaire. Informed

consent was obtained from the participants before they completed the survey. Wenjuanxing allowed for anonymous submissions, and quality control was conducted in the background to ensure that each IP address or WeChat account could only submit the questionnaire once. Submission was allowed only after the individual completed the entire questionnaire to ensure completeness and validity. Feedback on the questionnaire collection process was provided promptly to the author to ensure all survey forms were completed. After collecting the questionnaires, two researchers checked and cleaned the data, manually removing invalid questionnaires. Details of the research process diagram are described in **Figure 1**.

Statistical methods

Statistical analysis was conducted using SPSS 22.0 software. Frequencies and percentages were used to describe discrete data. Continuous data following a normal distribution

were described using the mean \pm standard deviation. Pearson correlation analysis was employed to examine the relationship among the cardiovascular surgical nurses' emergency response capabilities, self-efficacy, and coping strategies. The significance level was set at $\alpha=0.05$.

Results

We distributed 252 questionnaires. After excluding invalid questionnaires with excessively short completion time and systematically patterned responses, 243 valid questionnaires were collected, resulting in an effective response rate of 96.4%.

Emergency response capabilities, self-efficacy, and coping strategies scores

The scores for emergency response capabilities, self-efficacy, and coping strategies of car-

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Table 1. Scores of cardiovascular surgical nurses in cardiovascular emergency response capability, self-efficacy, and coping strategies (n=243)

Category	Score
Emergency response capability	114.77±12.39
Theoretical knowledge reserve	12.51±1.70
Critical condition observation capability	20.74±2.50
Rapid-response capability	18.14±2.06
Emergency handling capability	17.32±2.05
Emergency management capability	46.06±6.04
Self-efficacy	2.69±0.58
Coping Strategies	
Active coping style	2.02±0.54
Passive coping style	1.16±0.53

Cardiovascular surgical nurses were evaluated (Table 1). The average score for emergency response capabilities among the 243 respondents was 114.77±12.39. The self-efficacy score was 2.69±0.58, reflecting a moderate level. The self-efficacy scores of cardiovascular surgical nurses are presented in Table 2. The cardiovascular surgical nurses in this study scored higher in emergency rescue ability compared with nurses in other operating rooms reported in previous studies [10, 13].

Comparison of emergency response capabilities among nurses stratified by demographic characteristics

This study revealed significant differences ($P < 0.05$) in emergency response capability scores among cardiovascular surgical nurses of different ages, job titles, years of work experience, and skill levels. However, there were no significant differences ($P > 0.05$) in the emergency response capability scores based on educational background or whether the respondent had participated in emergency response training (Table 3).

Correlation between emergency response capability and self-efficacy, coping styles

We found a positive correlation between self-efficacy and the emergency response ability scores of cardiovascular surgical nurses. The emergency response scores were positively correlated with positive coping scores ($P < 0.01$) and negatively correlated with negative coping scores ($P < 0.05$). The correlation be-

tween the emergency response capabilities of cardiovascular surgical nurses and their self-efficacy and coping styles is shown in Table 4.

Optimal scaling regression analysis of factors affecting emergency response capabilities

We conducted an optimal scaling regression analysis using the total emergency response capability score as the dependent variable. The independent variables included age, years of work experience, skill level, job title, self-efficacy, positive coping style, and negative coping style. The variables were assigned values as follows: age (<30=1, 30-39=2, 40-49=3, ≥50=4), years of nursing experience (<6=1, 6-10=2, 11-15=3, 16-20=4, >20=5), skill level (N1 and below =1, N2=2, N3=3, N4 and above =4), and job title (nurse or below =1, head nurse =2, deputy senior nurse or above =3).

The analysis revealed that these seven statistically significant factors together accounted for 39.0% of the variance in cardiovascular surgical nurses' emergency response capabilities (adjusted $R^2 = 0.39$). Nurses demonstrated greater emergency response capabilities when they were aged 40 and above, had over 20 years of work experience, held N3 level or higher job titles, possessed high self-efficacy, and scored high in positive coping and low in negative coping.

Furthermore, the collinearity diagnostic results showed that the tolerance values were all greater than 0.174 (tolerance > 0.1), indicating an absence of collinearity issues among the variables (Tables 5 and 6).

Discussion

Emergency response capabilities

In this study, the emergency response capability score of the cardiovascular surgical nurses was 114.77±12.39, which is slightly above average and higher than those of operating room nurses (110.95±13.09) reported by Lu Ying et al. [10] and anesthesia nurses (108.36±15.62) reported by Wen Yi et al. [13]. There are several possible explanations for this result: (1) Theoretical knowledge. Cardiovascular surgery is characterized by its strong specialization, fast pace, and high surgical risk [2]. Compared with nurses in other specialized

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Table 2. Self-efficacy scores of cardiovascular surgical nurses (n=243)

Item	Score	Ranking
I can always solve problems if I try my best	3.18±0.66	1
If I make the necessary effort, I can definitely solve most difficult problems	2.93±0.76	2
I can calmly face difficulties because I trust my ability to handle issues	2.91±0.74	3
When trouble arises, I can usually think of ways to deal with it	2.88±0.67	4
When faced with a problem, I can usually find several solutions	2.77±0.71	5
With my intelligence, I am sure I can handle unexpected situations	2.71±0.79	6
I am confident that I can effectively deal with any unexpected events	2.55±0.80	7
I can handle anything that happens to me with ease	2.44±0.81	8
Even if others oppose me, I can still find a way to achieve what I want	2.40±0.78	9
For me, sticking to ideals and achieving goals is a piece of cake	2.14±0.91	10

Table 3. Comparison of cardiovascular surgical nurses' emergency response capabilities by demographic characteristics (n=243)

Group	Size	Emergency Response Capability Assessment	F/t	P-value
Age				
20-29 years	81	111.40±13.25	6.874	.001
30-39 years	109	115.08±10.99		
40 years and older	53	119.28±12.44		
Highest education level				
Vocational school	2	103.00±36.77	.004 (Significance of Levene's Test)	.335 (Significance Test of Welch's t-test)/.683 (Significance of Brown-Forsythe [B] Test)
Associate's degree	22	111.32±14.39		
Bachelor's degree	217	115.09±11.86		
Master's degree or above	2	129.50±7.78		
Job title				
Nurse and Nursing Instructor	133	112.77±12.86	3.902	.021
Chief Nursing Instructor	92	117.15±11.42		
Deputy Director and above	18	117.33±11.58		
Skill level				
N1 and below	64	110.05±13.69	5.658	.001
N2	98	115.03±12.21		
N3	65	118.69±9.91		
N4 and above	16	116.13±11.90		
Years of work experience				
0-5	57	110.16±14.24	4.923	.001
6-10	73	113.67±10.70		
11-15	54	115.63±12.21		
16-20	19	119.26±9.61		
20 and above	40	120.05±11.48		
Emergency response training				
No	33	113.06±14.83	-.852	.395
Yes	210	115.04±11.98		

operating rooms, cardiovascular surgical nurses need to have a more comprehensive theoretical knowledge base. In addition to basic

CPR knowledge and skills, knowledge of electrocardiograms, the effects and most severe adverse reactions of commonly used rescue

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Table 4. Correlation coefficient (r) between the emergency response capabilities of cardiovascular surgical nurses and their self-efficacy and coping styles (n=243)

Variable	Self-efficacy	Positive coping style	Negative coping style
Emergency response capability	.563**	.357**	-.129*

**Correlation is significant at the 0.01 level (two-tailed). *Correlation is significant at the 0.05 level (two-tailed). Note: All P<0.05.

Table 5. Optimal scaling regression analysis of factors influencing cardiovascular surgical nurses' emergency response capabilities

Independent variable	Standard coefficient		Degrees of freedom	F value	P-value
	Beta	Estimation of standard error with self-sampling (1,000)			
Age	-0.367	0.179	3	4.209	0.006
Years of work experience	0.498	0.143	4	12.116	0.000
Skill level	-0.138	0.089	2	2.393	0.094
Job title	0.069	0.080	2	0.757	0.470
Self-efficacy	0.494	0.063	1	62.059	0.000
Positive coping strategies	0.118	0.059	1	3.966	0.048
Negative coping strategies	-0.147	0.058	1	6.479	0.012

Table 6. Optimal scaling regression of cardiovascular surgical nurses' emergency response capabilities and related variables

	Correlation			Significance	Tolerance	
	Zero-order	Partial	Part		After transformation	Before transformation
Age	0.112	-0.258	-0.202	-0.097	0.304	0.207
Years of work experience	0.259	0.344	0.278	0.303	0.312	0.174
Skill level	0.062	-0.112	-0.085	-0.020	0.381	0.231
Job title	0.075	0.055	0.042	0.012	0.369	0.310
Self-efficacy	0.566	0.476	0.410	0.658	0.689	0.689
Positive coping strategies	0.353	0.126	0.096	0.098	0.663	0.672
Negative coping strategies	-0.133	-0.188	-0.145	0.046	0.967	0.960

Note: In the model, R=0.652, R²=0.425, adjusted R²=0.390, F=12.057, P<0.001.

drugs, airway management techniques, and other basic theoretical knowledge of operating room emergency care, these nurses also need to be familiar with cardiovascular surgical anatomy and procedures. (2) Emergency response. Cardiovascular surgical nurses have to perform emergency treatments that go beyond common operations, such as external defibrillation [14]. They also need to have a basic understanding of all emergency equipment and procedures, such as intra-aortic balloon pump catheters, cardiopulmonary bypass, extracorporeal membrane oxygenation (ECMO), left ventricular assist devices (LVAD), and various cardiovascular surgical instruments and equipment principles

and usage related to life support. (3) Non-technical abilities. Clinical emergency comprehensive abilities can be divided into seven categories: theoretical knowledge, individual skill operation, clinical thinking and decision-making, role allocation and information transmission, communication, leadership, and teamwork. Excluding theoretical knowledge and individual skill operation, the remaining five categories are defined as non-technical abilities [15, 16]. Cardiovascular surgical nurses provide proactive care by preparing emergency supplies, managing supplies during surgery to avoid incidental leaving of surgical items in the body cavity, and assisting doctors in quickly

dealing with intraoperative emergencies to ensure high-quality surgical assistance. Studies have shown that proactive care involves implementing intervention measures against potential risk factors to reduce stress reactions, negative emotions, and complications and improve clinical treatment outcomes [16, 17]. Nurses should optimize the layout of rescue materials between surgeries [18], participate in rescues with anesthesiologists and surgeons with a reasonable division of labor, and demonstrate management abilities during the emergency response process to make rescue work more orderly and efficient. These factors may be more closely related to the self-evaluation indicators of cardiovascular surgical nurses compared with surgical nurses in other specialties.

Factors influencing emergency response capabilities

This study found that age and years of nursing experience are among the factors affecting the emergency response capabilities of cardiovascular surgical nurses. As age and years of experience increase, nurses accumulate more clinical experience from surgeries and develop a heightened awareness of emergency response, leading to improved emergency response capabilities. This finding is consistent with a survey on the clinical emergency response capabilities of cardiac nurses [19]. The present study shows that cardiovascular surgical nurses with the title of Associate Chief Nurse had the highest emergency response capability scores. To attain promotion to this title, nurses need to pass knowledge assessments and demonstrate relevant research capabilities based on their learning and thinking abilities. Thus, the title of Associate Chief Nurse requires excellent learning and thinking abilities, which are crucial factors in one's emergency response capability. Our study results also indicate that there was no statistically significant difference in emergency response capability scores by educational background or whether the respondents participated in emergency rescue training. This finding deviates from previous research results on nurses' emergency response capabilities [10, 13, 19, 20]. Regardless of the country, nursing programs do not specifically offer cardiovascular surgical nursing courses. Individuals with different educational backgrounds start at the same level when entering the operating room, which may explain why

educational background does not have a statistically significant impact on emergency response capability scores. Through emergency rescue training in the operating room, nursing staff learn about emergency response procedures, contingency plans, and various responsibilities during emergencies, enhancing their sensitivity to emergency events and increasing their willingness and confidence to actively participate in emergency response. The lack of a significant difference in emergency response capabilities between cardiovascular surgical nurses who did and did not receive emergency rescue training in this study may suggest that the quality and content of the training programs vary, leading to differences in training effectiveness. Some training programs may not directly enhance emergency response capabilities, or nurses may not fully apply the knowledge and skills learned during training in practical scenarios. Additionally, due to variance in individual learning styles and application capabilities, emergency rescue training may not have the same impact on every participant: some nurses may demonstrate strong emergency response capabilities without training, whereas others may require more training.

Self-efficacy is an internal, future-oriented belief based on an individual's perception of their abilities rather than their actual performance. It is common for individuals to either overestimate or underestimate their abilities, which can impact their goal-setting and the direction of their efforts [6, 21]. In this study, the cardiovascular surgical nurses showed a moderate level of self-efficacy. The highest-scoring items in the survey were "I can always solve problems if I try my best" and "I can solve most difficult problems if I put in the necessary effort". These results indicate that cardiovascular surgical nurses generally possess an intrinsic belief in their ability to face emergency challenges and a willingness to make an effort to learn and overcome difficulties. On the other hand, the lowest-scoring items were "Persisting towards ideals and achieving goals is effortless for me" and "With my intelligence, I can handle unexpected situations". These results suggest that cardiovascular surgical nurses may underestimate their abilities and lack perseverance when facing challenging situations. Further analysis revealed a positive

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correlation between the respondents' emergency response skills and self-efficacy scores. Self-efficacy can influence the level of effort cardiovascular surgical nurses put into handling emergencies during surgery. Nurses with higher levels of self-efficacy demonstrate more determination and perseverance when facing problems [22], enabling them to quickly assess emergencies, integrate available resources, and actively participate in cardiovascular surgical emergencies. Conversely, nurses with low self-efficacy may experience high psychological pressure accompanied by negative emotions, such as tension and anxiety, when coordinating cardiovascular surgical emergencies, leading to decreased enthusiasm for learning emergency-related knowledge and affecting their collaboration in cardiovascular surgical emergency care. Our results highlight the importance of self-efficacy in influencing cardiovascular surgical nurses' emergency response capabilities, with a significant correlation coefficient of 0.658. When developing training programs for cardiovascular surgical nurses' emergency response capabilities, trainers can enhance self-efficacy by providing opportunities such as past experiences, role modeling, and verbal persuasion. By recognizing that improving self-efficacy can lead to improved practical behaviors, trainers can stimulate nurses' intrinsic motivation and enhance their self-efficacy and emergency response capabilities, so they can ultimately showcase their comprehensive abilities during emergencies [23]. This outcome will improve both the organization and efficiency of cardiovascular surgical emergency work.

Coping strategies are the cognitive and behavioral approaches individuals take when faced with stressful situations or events (e.g., sudden surgical accidents or emergencies in this study). They play a harmonizing role in health and job satisfaction, acting as a bridge between self-efficacy and knowledge, attitudes, and behaviors in emergencies [24]. This study demonstrates a positive correlation between the emergency response capabilities of cardiovascular surgical nurses and their positive coping strategies scores. Adopting a positive coping approach helps learners maintain intrinsic motivation, effectively and proactively solve work-related issues, and view every emergency as a learning and personal growth opportunity

[7, 25]. Nurses who use positive coping strategies actively seek solutions to problems, are more willing to anticipate and intervene in emergencies, and can handle relationships among team members appropriately within the cardiovascular surgical emergency team. They exhibit flexibility in thinking, can quickly assess nursing issues and interventions, and are willing to try new methods and equipment to address emergencies - e.g., by learning about the principles and usage of various life support-related equipment in cardiovascular surgery, such as ECMO and LVAD. Our study also reveals that the emergency response capabilities of cardiovascular surgical nurses are negatively correlated with their negative coping strategies scores. A lack of adequate coping strategies among nurses can lead to an inability to handle clinical work positively [26]. Nurses with a negative coping approach tend to avoid or evade clinical nursing problems. Most of their emergency nursing tasks are completed under pressure from other team members, leaving them in a state of anxiety or depression or with other negative emotions. Nurses with a negative coping approach are also easily distracted by trivial and complex clinical issues, making it difficult for them to establish a sense of professional pride. Training facilitators should encourage and guide cardiovascular surgical nurses who employ negative coping strategies to enhance their emergency response capabilities through effective training methods.

The limitation of this study lies in the fact that it only used data from cardiovascular surgical nurses in tertiary hospitals in Jiangsu Province to assess their emergency response capabilities. It remains to be further validated whether the research findings are equally applicable to cardiovascular surgical nurses in different medical institutions.

Summary

In this study, the respondents to the cross-sectional survey exhibited above-average emergency response capabilities but moderate self-efficacy. We found that the respondents' self-efficacy and coping strategies were closely related to their performance in emergencies. High self-efficacy and positive coping strategies may help improve nurses' adaptability and

task efficiency in emergency scenarios. Our results suggest that training programs for cardiovascular surgical nurses' emergency response capabilities should emphasize not only professional knowledge and skill development but also the cultivation of psychological qualities and coping strategies. With sufficient knowledge, individuals tend to think positively during problem-solving, leading to an increase in self-efficacy, and, ultimately, the adoption of positive coping strategies. Thus, when faced with emergencies at work, the nurses can respond calmly with self-confidence and create a virtuous cycle. Future research could further focus on the self-efficacy and coping strategies of cardiovascular surgical nurses in emergencies.

Disclosure of conflict of interest

None.

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