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Research Paper

Research on the relationship between nurses' emergency public health response capacity and workplace resilience: A cross-sectional study

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ABSTRACT

Objective: This study aimed to investigate the factors influencing nurses' ability to respond to public health emergencies and understand the relationship between nurses' ability to respond to emergencies and workplace resilience.

Methods: A cross-sectional study of 361 nurses from military hospitals was conducted from January 18 to September 6, 2022, using an online survey. The Infectious Diseases Emergency Response Capacity (IDERC) questionnaire and the Workplace Resilience Scale (WRS) were utilized, and sociodemographic information was also collected. Data were analyzed using descriptive statistics and frequency analysis. Differences between groups were identified by one-way analysis of variance, and linear regression was used to analyze the main factors influencing the infectious emergency response capacity.

Results: The average infectious emergency response capacity score on the IDERC questionnaire and workplace resilience, measured by WRS, were 4.01 ($SD = 0.76$) and 3.85 ($SD = 0.71$), respectively, on a scale of 1–5, indicating high performance. Factors such as degree of education, nurses' service years and experience in epidemic prevention participation were found to be the main influencing factors of the score of IDERC. The level of workplace resilience showed a positive correlation with the capacity to respond to infectious disease, the score of WRS and the service year accounted for 63.6% of the variance in emergency response capabilities.

Conclusion: The results indicate an urgent need to strengthen the training of nurses with lower degree of education, shorter service years, no prior work, or no experience of epidemic prevention participation, and hospitals should also prioritize improving nurses' workplace resilience through targeted interventions, enhancing their abilities in infectious disease prevention, preparation, first aid, and subsequent critical patient care.

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What is known?

- Nurses have good resilience levels, which has a positive impact on improving work efficiency and enhancing work conditions.
- The resilience of nurses in the workplace is different from the concept of nurse resilience.

What is new?

- This study measured the workplace resilience levels of nurses in military hospitals using a specialized workplace resilience scale for healthcare professionals rather than traditional resilience scales.
- The study findings revealed a relationship between nurses' workplace resilience and their ability to respond to sudden major infectious disease outbreaks.

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1. Introduction

Public health emergencies present significant challenges to the health of the international public. Among these emergencies, the outbreak of a severe infectious disease, characterized by rapid disease progression and prolonged duration, poses immense difficulties for medical responses and care [1]. Healthcare providers have played a crucial role in combating viruses and promoting human health [2]. However, the persistent nature of epidemics has highlighted the contradiction between the increasing number of patients and the inadequate number of healthcare providers, particularly during the Ebola virus and Severe Acute Respiratory Syndrome-coronavirus 2 (SARS-CoV-2) outbreaks [3,4]. China has implemented a nationwide medical staff support model, including military medical personnel, to address this issue, and it has proven to be effective. However, numerous cases of infections among medical staff increase the psychological pressure on nurses and make nursing work more challenging. Throughout the two-year epidemic, respiratory tract infection viruses have undergone multiple mutations. Additionally, during the winter season, the frequency of respiratory tract infections increases significantly, leading to a sharp increase in the number of outpatient and emergency patients [5]. Nursing staff works on the frontline, where they risk exposure to infections while playing a crucial role in managing respiratory tract infectious disease events. Thus, it is necessary to understand the capacity of military healthcare personnel to respond to major public health emergencies to effectively train nurses to respond to current and future respiratory and other infectious disease outbreaks.

Nurses have developed certain abilities and gained experience in emergency responses through recent public health emergencies, such as outbreaks. However, high levels of stress can lead to fatigue and burnout among nursing staff, hindering the development of their public health emergency response abilities. Additionally, the pressure associated with these emergencies poses a challenge for managers in terms of retaining skilled nursing staff. The high turnover rates and burnout among nurses are prominent issues in the healthcare industry, imposing a significant burden on hospital financial management and patient care quality, and the pandemic further exacerbated this burden. Compared to other healthcare professions, nurses often experience the highest levels of work stress and hardship due to their frontline involvement in infectious disease response. Without timely intervention, this can potentially lead to physical and mental disorders [6,7]. Therefore, finding appropriate ways to enhance the well-being of nurses has become an urgent task for healthcare leadership.

Resilience is considered a protective factor that helps nurses actively cope with work stress and achieve positive outcomes. Nurses with high resilience have demonstrated lower burnout and better adaptability to adversity [8]. However, traditional resilience research has mainly focused on personal psychological characteristics and paid little attention to nurses' dynamic adaptation to workplace adversity [9]. Workplace resilience can be understood as a dynamic process that includes personal, interpersonal, and environmental factors, as well as emotional, cognitive, and behavioral self-regulation processes. These processes aid in adapting to adverse events and thereby maintain health and function [10,11]. The early stages of the pandemic highlighted the workplace as a major source of stress for nurses, suggesting that enhancing resilience and implementing workplace interventions can yield better results. Implementing interventions in the workplace has also been proven to be cost-effective. From a managerial perspective, focusing on workplace resilience is more targeted, and workplace-based resilience management strategies may be more economical, while also enhancing the ability to respond to public health

emergencies within the workplace. Therefore, this study aims to explore the mechanisms through which workplace resilience influences nurses' coping abilities during infectious disease emergencies.

2. Methods

2.1. Ethics approval

The study was approved by the Ethics Committee of the Navy Military Medical University, and consent was obtained from all participants. We clearly stated on the front page of the questionnaire that the survey was anonymous and assured participants that their privacy would not be disclosed. Therefore, by successfully submitting the questionnaire, we obtained the consent of the nurses to participate in our investigation.

2.2. Participants

This cross-sectional survey of 361 nurses from military hospitals was conducted from January 18 to September 6, 2022. Convenience sampling was used to draw nurses from eight military hospitals. The inclusion criteria were 1) being a regular employee of the hospital (including military and civilian nurses) and 2) having had a public health event experience. The sample size calculation method was based on a sample-to-item ratio of not less than 5-to-1, preferably reaching 10-to-1. Additionally, a certain sample loss rate is taken into account. Initially, a total of 450 questionnaires were distributed, and eventually 361 valid questionnaires were collected [12].

2.3. Data collection

The questionnaire was administered online through WeChat to nurses working in various departments, including the emergency department, infectious disease department, intensive care unit (ICU), and other departments. The project leader contacted the department head nurse before distributing the questionnaire. An online questionnaire was sent to eligible individuals, inviting them to participate in the study after they had provided consent.

2.4. Instruments

The research questionnaire was comprised of demographic information, the Infectious Diseases Emergency Response Capacity (IDERC) questionnaire, and the Workplace Resilience Scale (WRS). The IDERC questionnaire was developed by the corresponding author and was utilized consistently throughout this study. The developer was also granted approval to use the WRS.

2.4.1. The IDERC questionnaire

The IDERC questionnaire was developed by Ting et al. [13] and used by Song et al. [14]. It is a 36-item self-reported tool that assesses the infectious disease emergency response capacity of medical personnel. The questionnaire is structured into three parts: prevention, preparation, and emergency response capabilities. Each part has secondary items that further elaborate on the specific aspects. For instance, the prevention section covers basic knowledge of infectious diseases through three questions. The preparation section includes two secondary items: emergency plans, laws, and regulations, with a total of four questions. The emergency response comprised six secondary items: surveillance, reporting, clinical response, public health response, risk communication, and emergent infectious disease disposal, totaling 28 questions. The participants were asked to rate their mastery of knowledge or technology

for each of the 36 questions on a score of 1–5, where 1 was strongly unfamiliar, and 5 was strongly familiar. The total score ranged from 36 to 180, with higher scores indicating higher capacity. Cronbach’s α coefficient for this questionnaire was reported to be 0.987, indicating good reliability and validity. The IDERC questionnaire has been widely used in China.

2.4.2. The workplace resilience scale

The WRS, developed by Mallak et al. [11], is a 20-item instrument designed to measure individual resilience in the workplace. It consists of four dimensions: active problem-solving, team efficacy, confident sense-making, and bricolage. Each of the four factors showed evidence of internal consistency (Cronbach’s α : 0.77–0.83). The participants were asked to rate how they felt over the past month for each of the 20 items on a 5-point Likert-type scale ranging from 1 to 5, where 1 was not true at all, 2 was rarely true, 3 was sometimes true, 4 was often true, and 5 was true nearly all the time. The overall resilience score was computed by averaging the scores from each of the four factors or by finding the average score across all 20 items. In this study, we calculated only the total resilience level to explore its relationship with the infectious disease emergency response capacity. The WRS was translated and tested for reliability and validity prior to this study, with a Cronbach’s α coefficient of 0.956 in this study indicating good reliability.

2.5. Statistical analysis

The authors used the well-established online questionnaire survey platform “Questionnaire Star” to create the questionnaire. Then, we shared the questionnaire link through WeChat to conduct their research. The data were exported from the Google form directly into an SPSS spreadsheet, ensuring accuracy and ease of analysis. Demographic variables were assessed using descriptive statistical analyses and frequency distributions. Measures of central tendency, such as the mean and standard deviation, were used to

describe individual Likert items, individual IDERC dimension scores, and the overall IDERC total score. WRS scores were also examined. Correlations between participant characteristics, WRS scores (independent variables), and total IDERC Individual dimension scores (dependent variable) were performed. Use Linear regression to analyze the influencing factors of the score of IDERC. Statistical significance was established at a *P*-value of less than 0.05.

3. Results

3.1. Demographics

A total of 361 questionnaire responses were received (Table 1). Most participants (88.6%) were female. The average age of the participants was 28.86 ± 6.73 years, with an average of 7.81 ± 6.79 years of service. A significant portion of participants (44.9%) had fewer than five years of service. In terms of education, 54.8% of participants were undergraduates, 44.3% had completed junior college or below, and only 0.8% held a master’s degree or above. More than half of the participants (56.2%) were unmarried, and 62.6% did not have children. Most of the nurses (79.7%) held junior titles. The largest proportion (65.7%) came from the emergency departments, followed by 6.4% from ICUs, 9.4% from the infectious disease departments, and 18.5% from others. Of note, approximately 77.6% of participants had previous experience with infectious disease emergency drills or response work.

3.2. Infectious disease emergency response capacity

The nurses’ IDERC score was 4.01 ± 0.76 . Table 2 shows the mean scores of secondary entries under the three categories of prevention, preparation, and emergency response. The mean scores of all items ranged from 3.73 to 4.20. The mean score of the prevention category was 4.00, that of the preparation category was 3.90, and the mean score of the response category was 4.01. The nurses’

Table 1
Demographic characteristics of the participants (n = 361).

Demographic Characteristics	Classes	Number	Frequency (%)
Gender	Female	320	88.6
	Male	41	11.4
Age (years)	≤25	144	39.9
	> 25–≤35	162	44.9
	35–≤45	47	13.0
	> 45	8	2.2
Degree of education	Junior college or below	160	44.3
	Undergraduate	198	54.8
	Master degree or above	3	0.8
Service years	≤3	104	34.2
	> 3 – ≤ 7	77	25.3
	> 7 – ≤ 10	44	14.5
	> 10	79	26.0
Marital status	Unmarried	203	56.2
	Married	154	42.7
	Divorced	4	1.1
Children	No	226	62.6
	Yes	135	37.4
Work department	Emergency	245	68.3
	ICU	26	7.2
	Infectious disease	34	9.5
	Other departments	54	15.0
Professional ranks and titles	Junior	287	79.7
	Intermediate	69	19.1
	Senior	5	1.4
Epidemic prevention participation	Yes	280	77.6
	No	81	22.4

Note: “Epidemic prevention participation” means those who were selected to work in frontline positions for infectious disease responses or had participated in emergency medical team drills for infectious disease outbreaks.

Table 2
The score of Infectious Diseases Emergency Response Capacity questionnaire items ($n = 361$).

Items	Mean ± SD
Prevention capability	4.00 ± 0.83
Basic knowledge	4.00 ± 0.83
Preparation capability	3.90 ± 0.86
1. Emergency plan	3.84 ± 0.89
2. Laws and regulations	3.95 ± 0.89
Emergency rescue capability	4.01 ± 0.76
1. Surveillance	3.73 ± 0.97
2. Report	3.98 ± 0.95
3. Clinical response	4.20 ± 0.79
4. Public health response	4.02 ± 0.81
5. Risk communication	3.85 ± 0.87
6. Emergent infectious disease response	3.88 ± 0.86
Total average	4.01 ± 0.76

response capacity was found to be higher than their prevention ($P < 0.001$) and preparation capacities ($P < 0.001$).

3.3. WRS levels

Table 3 presents the WRS items and their corresponding mean scores, which ranged from 3.64 to 3.98. Specifically, the active problem-solving dimension had a mean score of 3.81 ± 0.76 , the team efficacy dimension had a mean score of 3.81 ± 0.78 , the confident sense-making dimension had a mean score of 3.86 ± 0.73 , and the bricolage dimension had a mean score of 3.90 ± 0.77 . In summary, the nurses demonstrated a workplace resilience level of 3.85 ± 0.71 .

3.4. Correlation between nurses' IDERC, demographic characteristics and WRS

Table 4 presents the nurses' capacity to respond to infectious disease emergencies, including prevention, preparation, response, and overall ability according to different demographics. One-way ANOVA was employed to examine the differences between

various demographic classes. The results indicated significant variations in prevention capacity according to age ($F = 3.210, P = 0.023$), level of education ($F = 4.116, P = 0.017$), years of service ($F = 4.816, P = 0.003$), marital status ($F = 3.570, P = 0.029$), having children ($F = 7.188, P = 0.008$), professional titles ($F = 5.322, P = 0.005$), and participation in epidemic prevention exercises ($F = 15.231, P < 0.001$). Prevention capacity showed significant differences according to the level of education ($F = 3.167, P = 0.043$) and participation in epidemic prevention exercises ($F = 13.558, P < 0.001$). Similarly, response capacity demonstrated significant differences in the level of education ($F = 3.138, P = 0.045$), years of service ($F = 3.775, P = 0.011$), and participation in epidemic prevention activities ($F = 17.796, P < 0.001$). Finally, the overall capacity of nurses to respond to infectious disease emergencies displayed significant variations in degree of education ($F = 3.311, P = 0.038$), years of service ($F = 3.979, P = 0.008$), and participation in epidemic prevention activities ($F = 17.796, P < 0.001$).

Additionally, we also conducted a correlation analysis to explore the relationship between the scores of WRS and IDERC (Table 5). The results revealed that nurses' WRS scores were positively associated with each dimension of IDERC: prevention capability ($r = 0.797, P < 0.01$), preparation capability ($r = 0.729, P < 0.01$), and emergency response capability ($r = 0.791, P < 0.01$).

This study used the statistically significant variables in the single-factor analysis as independent variables, and use the IDERC score as the dependent variable to perform stepwise linear regression analysis. The results found that the score of WRS and service years, was influential factors for IDERC, explaining 63.6% of the dependent variables (Table 6).

4. Discussion

The pandemic in 2020 and the current concentrated outbreak of respiratory infections have posed long-term threats to international health. Nurses made unprecedented efforts to contain and mitigate the pandemic. However, as the Infectious Disease Model suggests, achieving a complete resolution of the epidemic is challenging, and the current A/B epidemic is proof [15]. Therefore,

Table 3
The score of Workplace Resilience Scale items ($n = 361$).

Items	Mean ± SD
Overall score	3.85 ± 0.71
Active problem-solving	3.81 ± 0.76
1. I enjoy improvising solutions to problems.	3.82 ± 0.82
2. I take delight in solving difficult problems.	3.74 ± 0.92
3. I consider many feasible solutions when solving a problem.	3.86 ± 0.84
Team efficacy	3.81 ± 0.78
4. Team goals guide my individual actions.	3.95 ± 0.88
5. I show confidence in decisions affecting my team.	3.71 ± 0.95
6. I discuss team member roles with my team members.	3.68 ± 0.94
7. I understand my team's overall goals.	3.92 ± 0.88
Confident sense-making	3.86 ± 0.73
8. I approach new situations with confidence.	3.93 ± 0.86
9. I try to make sense of the situation when it becomes chaotic.	3.96 ± 0.85
10. I know what resources to access.	3.88 ± 0.86
11. I openly share information with others.	3.77 ± 1.05
12. I can perform the roles of my other team members.	3.98 ± 0.86
13. I have access to the resources I need.	3.63 ± 0.86
14. I have the knowledge needed to do my job.	3.89 ± 0.83
Bricolage	3.90 ± 0.77
15. I exercise creativity when under extreme pressure.	3.86 ± 0.84
16. When the situation becomes chaotic, I am able to make sense of the situation.	3.86 ± 0.87
17. When the situation becomes chaotic, I approach the situation as a challenge.	3.90 ± 0.87
18. When the situation becomes chaotic, I get a renewed focus on the problem.	3.92 ± 0.84
19. I take calculated risks when the situation calls for it.	3.90 ± 0.84
20. When the situation becomes chaotic, I take time to reflect on next steps.	3.93 ± 0.85

Table 4
The IDERC categories according to different demographic characteristics (n = 361).

Demographic characteristics	Classes	IDERC			
		Prevention	Preparation	Response	Total
Gender	Female	3.96 ± 0.84	3.76 ± 0.91	3.93 ± 0.76	3.93 ± 0.75
	Male	4.00 ± 0.82	3.91 ± 0.85	4.02 ± 0.76	4.03 ± 0.76
	F	0.093	1.242	0.487	0.572
	P	0.761	0.266	0.486	0.450
Age (years)	≤25	3.86 ± 0.87	3.83 ± 0.90	3.92 ± 0.81	3.92 ± 0.80
	> 25 – ≤ 35	4.03 ± 0.82	4.03 ± 0.75	3.92 ± 0.83	4.04 ± 0.75
	> 35 – ≤ 45	4.25 ± 0.65	4.20 ± 0.61	4.01 ± 0.83	4.22 ± 0.60
	> 45	4.25 ± 0.66	4.06 ± 0.71	4.00 ± 0.79	4.08 ± 0.70
	F	3.210	0.577	1.715	1.893
	P	0.023	0.630	0.164	0.130
Degree of education	Junior college or below	3.88 ± 0.87	3.83 ± 0.88	3.92 ± 0.80	3.93 ± 0.80
	Undergraduate	4.10 ± 0.78	3.97 ± 0.83	4.08 ± 0.71	4.10 ± 0.71
	Master's degree or above	3.44 ± 0.69	2.92 ± 0.14	3.38 ± 0.19	3.39 ± 0.22
	F	4.116	3.167	3.138	3.311
	P	0.017	0.043	0.045	0.038
Service years	≤3	3.87 ± 0.86	3.83 ± 0.91	3.88 ± 0.81	3.89 ± 0.81
	> 3 – ≤ 7	3.95 ± 0.81	3.93 ± 0.83	4.05 ± 0.73	4.06 ± 0.73
	> 7 – ≤ 10	3.91 ± 0.78	3.72 ± 0.79	3.82 ± 0.69	3.83 ± 0.69
	> 10	4.29 ± 0.64	4.10 ± 0.78	4.20 ± 0.63	4.21 ± 0.63
	F	4.816	2.473	3.775	3.979
	P	0.003	0.062	0.011	0.008
Marital status	Unmarried	3.90 ± 0.88	3.85 ± 0.92	3.95 ± 0.81	3.95 ± 0.81
	Married	4.13 ± 0.72	3.97 ± 0.78	4.09 ± 0.67	4.10 ± 0.67
	Divorced	3.92 ± 0.92	3.89 ± 0.64	3.44 ± 0.52	3.90 ± 0.64
	F	3.570	1.410	1.616	1.755
	P	0.029	0.245	0.200	0.174
Children situation	No	3.91 ± 0.87	3.86 ± 0.90	3.96 ± 0.80	3.97 ± 0.80
	Yes	4.15 ± 0.71	3.95 ± 0.78	4.08 ± 0.67	4.10 ± 0.67
	F	7.188	0.885	2.114	2.417
	P	0.008	0.347	0.147	0.121
Work department	Emergency	4.01 ± 0.79	3.92 ± 0.82	4.03 ± 0.72	4.01 ± 0.71
	ICU	3.74 ± 0.98	3.52 ± 0.92	3.72 ± 0.90	3.70 ± 0.90
	Infectious disease	3.87 ± 0.92	3.81 ± 0.97	4.01 ± 0.89	3.97 ± 0.89
	Other departments	4.16 ± 0.82	4.07 ± 0.88	4.19 ± 0.76	4.17 ± 0.76
	F	1.808	2.590	2.210	2.314
	P	0.145	0.053	0.087	0.076
Professional titles	Junior	3.93 ± 0.84	3.87 ± 0.86	3.99 ± 0.78	3.97 ± 0.78
	Intermediate	4.26 ± 0.70	4.00 ± 0.86	4.12 ± 0.67	4.12 ± 0.67
	Senior	4.40 ± 0.55	4.05 ± 1.12	4.49 ± 0.47	4.43 ± 0.51
	F	5.322	0.768	1.733	1.840
	P	0.005	0.465	0.178	0.160
Epidemic prevention participation	Yes	4.09 ± 0.79	3.98 ± 0.83	4.11 ± 0.73	4.09 ± 0.73
	No	3.69 ± 0.87	4.09 ± 0.73	3.72 ± 0.79	3.70 ± 0.78
	F	15.231	13.558	17.513	17.796
	P	<0.001	<0.001	<0.001	<0.001

Note: Data are Mean ± SD. IDERC = Infectious Diseases Emergency Response Capacity.

Table 5
Correlation analysis of the relationship between the scores of nurses' WRS and IDERC.

Items		IDERC score			
		Prevention	Preparation	Response	Total
WRS score	r	0.797	0.729	0.791	0.793
	P	<0.001	<0.001	<0.001	<0.001

Note: IDERC = Infectious Diseases Emergency Response Capacity. WRS = Workplace Resilience Scale (WRS).

nurses must be prepared to face a current pandemic as well as future public health emergencies. In China, military hospitals have always played a crucial role in responding to public health emergencies, such as Ebola and SARS-CoV-2, by sending medical teams to the frontline. Thus, our study aimed to investigate the capacity of military nurses to respond to infectious disease emergencies and the factors that influence this capacity.

In our study, 361 nurses completed an online survey. Their self-assessments indicated that nurses' ability to respond to public

health emergencies is at a high level (4.01 ± 0.76), especially in regard to possessing basic skills, such as hand hygiene, disposal of medical waste, and wearing and removing personal protective equipment, consistent with previous studies [14,16]. The high competence of military nurses may be the result of increased attention given to infectious disease emergencies in the medical service system, particularly after the 2003 SARS outbreak. Additionally, nurses' ability to deal with infectious diseases significantly improved during the respiratory tract infection pandemic. Our survey revealed that 77.6% of the nurses were directly involved in preventing infections and responding to infected patients. However, nurses themselves are at an increased risk of infection both within and outside the workplace. Kambhampati et al. [6] reported that most healthcare professionals hospitalized during the epidemic in nursing-related occupations (36.3%). Therefore, necessary precautions must be taken to minimize the potential for nurses' infection.

Univariate analysis showed that the degree of education, service years, and epidemic prevention participation affected IDERC scores, indicating that undergraduate nurses with longer service years and

Table 6
Linear Regression Analysis for IDERC-related factors.

Items	B	SE	t	P	LLCI	ULCI
Constant	0.996	0.184	5.266	< 0.001	0.607	1.326
Degree of education	-0.102	0.056	-1.810	0.071	-0.213	0.008
Service years	0.055	0.024	2.284	0.023	0.008	0.103
Epidemic prevention participation	-0.104	0.063	-1.657	0.099	-0.227	0.019
The score of WRS	0.830	0.038	21.948	< 0.001	0.756	0.904

Note: $R^2 = 0.636$; SE = standard error, LLCI = low limit of confidence interval, ULCI = upper limit of confidence interval. IDERC = Infectious Diseases Emergency Response Capacity. WRS = Workplace Resilience Scale.

experience in epidemic prevention have a stronger ability to respond to public health emergencies, consistent with the findings of Li and Song [14,17]. However, the results of linear regression analysis showed that the degree of education and epidemic prevention participation did not affect IDERC scores, suggesting that further exploration is needed in the future. Ideally, all frontline nurses during emerging infectious disease outbreaks should be experienced senior nurses, but this is not always feasible. In our survey, most nurses (34.21%) had fewer than three years of service. Thus, nursing managers should recognize that young nurses may lack some experience in emergency response, despite being the main workforce in the nursing team. Therefore, appropriate training must be provided for new entry-level nurses. Nurses who have previously participated in infectious disease emergency drills or response work had a higher ability to respond to public health emergencies, consistent with Yang et al.'s findings [18].

Resilience, as a protective factor, enables nurses to actively adapt to stressors and adversity and has been proven to effectively buffer the negative impact of workplace stress and provide support for nurses [19]. However, most researches have focused solely on individual psychological resilience, neglecting the importance of workplace resilience, which encompasses not only individual-level psychological resilience but also team efficacy. Previous studies on workplace resilience were mostly limited to conceptual research or cross-sectional surveys, and the development of effective interventions has not been thoroughly explored. The main goal of our study was to explore the workplace resilience of military nurses and its impact on their ability to respond to infectious disease emergencies. We found that military nurses exhibited moderate levels of workplace resilience (3.85 ± 0.71), which is consistent with other studies [20].

The level of workplace resilience is positively correlated with nurses' ability to respond to infectious disease emergencies. Workplace resilience accounted for 63.6% of the change in nurses' ability to respond to infectious disease emergencies, providing a new perspective for interventions that are more convenient and affordable for managers to implement [11,21]. Of the different dimension scores, the bricolage represented by "When under extreme pressure, I still take time to try new methods" received the highest score. This reflects the willingness of nurses to seek ways to cope with adversity, showing a spirit of hard work and perseverance but with a slightly passive attitude. However, workplace resilience is focused more on interactions between individuals and teams in the workplace environment, as well as the ability to proactively solve problems than individual resilience, and corresponds to the other three dimensions of the workplace resilience scale: active problem-solving, team efficacy, and self-confidence levels, whose scores were relatively lower. These findings indicate that nurses need help changing their traditional passive problem-solving mindset, improving their coping abilities from a team perspective, and fostering a confident attitude. Previous interventions for nurse resilience often involved taking nurses away

from the workplace to participate in activities such as sports and yoga, which were complex, time-consuming, and expensive [15]. The findings of this study suggest that leaders can take portable and timely intervention measures, such as rationalizing team collaboration and optimizing team structures.

5. Limitations

This study focused only on the relationship between the emergency response capacity of nurses in public health emergencies and workplace resilience. However, the specific mechanisms of their interactions were not further elucidated. The convenience sampling method used in this study may have limited the generalizability of the research findings. Further research should be conducted at multiple locations/sites and use longitudinal methods.

6. Implication to clinical nursing

The insights gained from this study underscore the importance of utilizing specialized tools, such as the WRS tailored for healthcare professionals, to accurately assess the resilience level of nurses in hospital settings. Traditional resilience scales may not fully capture the nurses' resilience in the clinical environment, where nurses often face unique occupational stressors and demands. By identifying the specific factors that contribute to workplace resilience, nursing administrators and policymakers can develop targeted interventions to bolster the ability of nurses to cope with and adapt to challenging situations, such as sudden outbreaks of major infectious diseases. Understanding the link between nurses' workplace resilience and their capacity to manage emergency public health is crucial for improving clinical outcomes. This knowledge can guide the implementation of resilience-building programs and support systems that not only enhance nurses' well-being but also ensure a robust and responsive healthcare workforce. Such initiatives can improve workplace efficiency and the overall enhancement of working conditions, ultimately contributing to better patient care and healthcare system preparedness for future public health emergencies.

7. Conclusion

Given the pivotal role of the military in addressing public health emergencies, military nurses often face immense pressure and are at the forefront of response efforts. While previous studies mainly focused on the relationship between personal psychological resilience and emergency response capabilities, this study placed greater emphasis on the workplace environment of nursing staff. Workplace resilience encompasses teamwork levels built upon personal resilience, aligning more closely with the current working model of nursing staff. This study investigated the ability of military hospital nurses to respond to infectious disease emergencies and

explored the relationship between workplace resilience and their response capabilities. It also aimed to examine the connection between workplace resilience and public health emergencies, taking into account a previous resilience perspective. The findings indicated that nurses with extensive service years and prior experience in first aid or response exercises tended to have better coping abilities in such situations. The study also revealed a positive correlation between workplace resilience and nurses' ability to respond to infectious disease emergencies. The results suggest that enhancing the workplace resilience of nurses could be an effective measure to support current and future epidemic responses.

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CRediT authorship contribution statement

Wenwen Shi: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Project administration. **Chen Qiu:** Conceptualization, Investigation, Resources, Data curation, Writing - review & editing, Supervision. **Yifan Zhang:** Formal analysis, Investigation, Resources, Data curation, Writing - review & editing. **Yixin Wang:** Conceptualization, Methodology, Validation, Formal analysis, Writing - review & editing. **Li Gui:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Writing - review & editing, Supervision, Project administration. The authors agree to be responsible for all aspects of the research work and ensure the investigation and resolution of the accuracy or research integrity of any part of the paper.

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declaration of competing interest

The author(s) declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ijnss.2024.06.007>.

References

- [1] Kang LY, Jing WZ, Liu J, Liu M. Trends of global and regional aetiologies, risk factors and mortality of lower respiratory infections from 1990 to 2019: An analysis for the Global Burden of Disease Study 2019. *Respirology* 2023;28(2): 166–75. <https://doi.org/10.1111/resp.14389>.
- [2] Skoglund K, Ahlman E, Mallin S, Holmgren J. Intensive care nurses' experiences of caring for patients during the COVID-19 pandemic based on an analysis of blog posts. *Nurs Crit Care* 2024;29(1):40–8. <https://doi.org/10.1111/nicc.12931>.
- [3] Shaw A, Flott K, Fontana G, Durkin M, Darzi A. No patient safety without health worker safety. *Lancet* 2020;396(10262):1541–3. [https://doi.org/10.1016/S0140-6736\(20\)31949-8](https://doi.org/10.1016/S0140-6736(20)31949-8).
- [4] Nantsupawat A, Wichaikhum OA, Abhichartbitutra K, Sadarangani T, Poghosyan L. The relationship between nurse burnout, missed nursing care, and care quality following COVID-19 pandemic. *J Clin Nurs* 2023;32(15–16): 5076–83. <https://doi.org/10.1111/jocn.16761>.
- [5] Dzau V, Yadav P. The influenza imperative: we must prepare now for seasonal and pandemic influenza. *Lancet Microbe* 2023;4(4):e203–5. [https://doi.org/10.1016/S2666-5247\(23\)00013-7](https://doi.org/10.1016/S2666-5247(23)00013-7).
- [6] Kambhampati AK, O'Halloran AC, Whitaker M, Magill SS, Chea N, Chai SJ, et al. COVID-19-Associated hospitalizations among health care personnel - COVID-NET, 13 states, march 1–may 31, 2020. *MMWR Morb Mortal Wkly Rep* 2020;69(43):1576–83. <https://doi.org/10.15585/mmwr.mm6943e3>.
- [7] Sierra-García E, Sosa-Palanca EM, Saus-Ortega C, Ruiz-Hontangas A, Juárez-Vela R, Gea-Caballero V. Modulating elements of nurse resilience in population care during the COVID-19 pandemic. *Int J Environ Res Publ Health* 2022;19(8):4452. <https://doi.org/10.3390/ijerph19084452>.
- [8] Wei H, Roberts P, Strickler J, Corbett RW. Nurse leaders' strategies to foster nurse resilience. *J Nurs Manag* 2019;27(4):681–7. <https://doi.org/10.1111/jonm.12736>.
- [9] Connor KM, Davidson JRT. Development of a new resilience scale: the connor-davidson resilience scale (CD-RISC). *Depress Anxiety* 2003;18(2):76–82. <https://doi.org/10.1002/da.10113>.
- [10] Delgado C, Roche M, Fethney J, Foster K. Workplace resilience and emotional labour of Australian mental health nurses: results of a national survey. *Int J Ment Health Nurs* 2020;29(1):35–46. <https://doi.org/10.1111/inm.12598>.
- [11] Mallak LA. Hrsg. Workplace resilience. *WOR* 2016;54:237–9. <https://doi.org/10.3233/WOR-162345>.
- [12] Al-Subaihi AA. Sample size determination. Influencing factors and calculation strategies for survey research. *Saudi Med J* 2003;24(4):323–30. <https://doi.org/10.1002/0471667196.ess2329>.
- [13] Ting K, Chen C, Yan H, Jingjing L, Yixin W, Li G. Construction of core response competence index system for infectious disease emergencies among medical staff. *Chin J Nurs* 2018;53(4):461–6. <http://doi.org/10.3761/j.issn.0254-1769.2018.04.017>.
- [14] Li HD, Dong SJ, He L, Wang R, Long SY, He FM, et al. Nurses' core emergency competencies for COVID-19 in China: a cross-sectional study. *Int Nurs Rev* 2021;68(4):524–32. <https://doi.org/10.1111/inr.12692>.
- [15] Scudellari M. How the pandemic might play out in 2021 and beyond. *Nature* 2020;584(7819):22–5. <https://doi.org/10.1038/d41586-020-02278-5>.
- [16] Song S, Li XY, Bell SA, Yang XJ, Zhang WY, Shanghai C. Emergency response: a cross-sectional study of core competencies for nurses regarding major infectious disease outbreaks. *J Emerg Nurs* 2021;47(6):902–13. <https://doi.org/10.1016/j.jen.2021.04.010>.
- [17] Cao J, Zhang L, Xi H, Lu X, Chu D, Xie M, et al. Providing nursing care to Ebola virus disease patients: China Ebola Treatment Unit experience. *J Glob Health* 2015 Dec;5(2):020301. <https://doi.org/10.7189/jogh.05.020301>.
- [18] Yang Y, Chen N, Cheng MW, Chen C, Zhou HN, Wang ZX, et al. Perceptions among medical staff in community health centres of coping capacity regarding infectious disease epidemics: a cross-sectional study in Shanghai, China. *Int J Gen Med* 2021;14:1251–61. <https://doi.org/10.2147/IJGM.S295310>.
- [19] Manomenidis G, Panagopoulou E, Montgomery A. Resilience in nursing: the role of internal and external factors. *J Nurs Manag* 2019;27(1):172–8. <https://doi.org/10.1111/jonm.12662>.
- [20] Jo S, Kurt S, Bennett JA, Mayer K, Pituch KA, Simpson V, et al. Nurses' resilience in the face of coronavirus (COVID-19): An international view. *Nurs Health Sci* 2021;23(3):646–57. <https://doi.org/10.1111/nhs.12863>.
- [21] Andersen S, Mintz-Binder R, Sweatt L, Song HX. Building nurse resilience in the workplace. *Appl Nurs Res* 2021;59:151433. <https://doi.org/10.1016/j.apnr.2021.151433>.