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Relationship Between Resilience, Emergency Response Capacity, and Occupational Stressors of New Nurse During the Re-outbreak of COVID-19 in China

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Original Research

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Abstract

Objectives: The emergency response capacity of nurses is quite important during the COVID-19 epidemic. This study aimed to determine the relationship of resilience with emergency response capacity and occupational stresses during COVID-19 re-outbreak.

Methods: This is a cross-sectional study that involved 241 new nurses. Questionnaires (including demographic characteristics and self-report questionnaires) were sent via QR code and used to conduct an online survey of new nurses. Resilience, emergency response capacity, and occupational stressors were measured using questionnaires.

Results: Mean resilience score was 62.68 ± 14.04, which corresponds to a moderate level. Age, marital status, and work experience were significantly associated with resilience ($P = 0.037$, $P = 0.046$, $P = 0.011$) and emergency response capacity ($P = 0.018$, $P = 0.045$, $P < 0.000$). Total score and 3 dimensions of resilience were positively correlated with emergency response competency questionnaire and 3 dimensions ($P < 0.01$). Total scores of the nurse job stress scale and patient care dimension were negatively correlated with resilience scores ($P < 0.05$). Resilience played a partial mediating role in occupational stressors and emergency response capacity, and mediating effect accounted for 45.79% of the total effect.

Conclusions: The nursing superintendent must pay more attention to the resiliency of new nurses to reduce occupational stressors and improve emergency response capacity while helping new nurses cope with COVID-19 re-outbreak.

The re-outbreak of COVID-19 in China has occurred as of the written date (January 19, 2021). Globally, at the beginning of January, 2021, the WHO reported that there have been more than 90 million confirmed cases of COVID-19 including 2 million deaths, and the United States is the most infected country, with the number of infections reaching 20 million.[1] A new variant of the coronavirus called B.1.1.7 has been found in Britain, the transmission capacity of which is about 70% higher than that of the original strain.[2] As of January, 19, 2021, there are 2215 confirmed cases in China, including 4 high-risk areas and 78 medium-risk areas.[3]

We know that in the COVID-19, nurses provided accurate medical diagnosis and treatment for patients, effectively preventing the spread of the epidemic.[4] Meanwhile, in China,[5] Italy,[6] France,[1] and many other countries,[7–11] it is now well known from a variety of studies that the crisis of COVID-19 has caused more pressure on nurses and is harmful to their mental health (i.e., resistance to the negative effects of pandemic fatigue, sleep quality, and job contentment). Furthermore, the State of World Nursing Report (SOWN) (WHO, 2020) pointed out that before COVID-19, there was a shortage of nearly 6 million nurses.[12] However, the epidemic has undoubtedly exacerbated this contradiction, and 35.9% of the medical personnel showed no willingness to work during the COVID-19 pandemic.[13] To solve the shortage of nurses, it is important to recruit nursing staff.

Most of the new nursing staff are students who have just entered nursing positions after graduation and lack work experience and professional skills. Due to the complexity of nursing work, new nurses will face various pressures in clinical work. A comprehensive review of 21 articles[14] confirmed that new nurses feel low to moderate stress, mainly due to heavy workload and lack of professional nursing skills. During the COVID-19 pandemic, the content of the job of nurses has become more complicated and difficult, and greater requirements will be placed on the comprehensive competence of nurses. In other words, it will seriously affect the confidence and practice safety of new nurses. Therefore, for new nurses, it is crucial to cultivate the capacity to overcome the various adverse effects that caused by the COVID-19.

Resilience is defined as the capacity to overcome and adapt in the face of adversity; when coping with stress and other adversities, resilience allows people to recover and adapt to the

environment, avoid serious psychological and behavioral problems, and maintain a positive state.[15] Resilience plays an important role when people face stress.[16] Resilience is an important element for nurses in adapting to physical and mental damage in nursing services.[17] Among medical staff, resilience has been shown to play a beneficial role in reducing job burnout and workload.[18] During the re-outbreak of COVID-19, it is crucial to improve the capacity of new nurses to respond to emergency events to ensure the safety and quality of nursing. At present, there is a lack of special investigation reports on resilience, emergency response, and occupational stress[19] (a pattern of reaction that occurs when workers face job demands that do not match their knowledge, skills, or abilities and challenge their coping skills) of new nurses, such as fear of meeting COVID-19 patients and concerns about unfamiliar nursing knowledge. We proposed a hypothesis that when occupational stressors stimulate nurses, their resilience and emergency response capacity will reduce or improve the stimulation caused by the epidemic, therefore maintaining their mental health. Therefore, some protective measures and occupational stress stimuli are important factors in maintaining the mental health of nurses. In this process, resilience might serve as a moderator of the direct association between occupational stressors and emergency capacity. Therefore, the purpose of this article is to explore the resilience of new nurses during the re-outbreak of COVID-19 in China and its relationships with emergency response capabilities and occupational stressors.

Methods

Study Design and Inclusion Criteria

Study design

This study was a web-based cross-sectional survey. It was conducted using an online questionnaire among new nurses in January, 2021 at XXXXXX hospital. The questionnaire mainly included the characteristics of new nurses and items related to COVID-19-associated stressors.

Inclusion criteria. New nurses who had signed employment agreements; at the first year of work in this hospital; and volunteered to participate in this study.

Participants. According to the formula to calculate the limited population sample size in cross-sectional studies, the minimum sample size calculated was 228 people when controlling for the type I error of 0.05, the allowable error of 0.01, the sample rate of 0.05, and the effective population of 260. This study involved 260 potential new nurses and a total of 241 nurses completed the questionnaires (valid) before January 2021, with an effective response rate of 92.69%. The final participants involved were more than the minimum sample size; therefore, the sample size was appropriate. Of the participants, 228 (94.61%) were females and 13 (5.39%) were males; 124 (51.45%) were junior college nurses and 112 (46.47%) were undergraduate nurses, and 5 (2.07%) were graduate nurses. More than half (51.04%) of the new nurses did not have work experience.

Ethical approval. This study was approved by the Ethics Committee of The First Affiliated Hospital of Chongqing Medical University. All participants provided written informed consent and approved this study.

Measurement tools. A demographic form, the Connor-Davidson Resilience Scale (CD-RISC), the Nurse Job Stress Scale (NJSS), and the Emergency Response Competence Questionnaire (ERCQ) were used to measure the information of the participants. The demographic form was used to collect information on age, sex, education experience, marital status, and work experience from the respondents.

CD-RISC. The Connor-Davidson Resilience Scale (CD-RISC)[20] was developed by Connor and Davidson in 2003 and is used to assess resilience. It consists of 25 items, including 5 dimensions: individual capacity, tolerance of negative emotions, acceptance of change, sense of control, and spiritual belief. The Cronbach's α coefficient is 0.89. In this study, we used the Chinese version scale, which was translated and modified by Yu and Zhang.[21] It consisted of 25 items and 3 dimensions, including tenacity, strength, and optimism. The scale uses a 5-point Likert scale with scores ranging from 0 to 4 that were ratings of "never," "rarely," "sometimes," "often," and "always." The score range was 0-100. Higher scores indicate higher resilience. The Cronbach's α coefficient was 0.91.

NJSS. NJSS[22] was developed by Li and Liu in 2000 and consists of 35 items, including 5 subscales: nursing work and specialization; workload and time assignment problem; working conditions and equipment issues; patient care; management and interpersonal relations. Each question is rated on a Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). The questionnaire Cronbach's α coefficient was 0.98. The total score was calculated by summing the response scores of all items included on the scale, with higher scores corresponding to greater occupational stress. The total Cronbach's α coefficient in this study was 0.96.

ERCQ. ERCQ[23,24] was developed by Gu et al. and has 32 items with 3 dimensions. The questionnaire was made with reference to the "core emergency response capacity index system of medical staff for infectious disease emergencies" constructed by the Chinese scholar Kan et al.[24] The emergency response capacity is the ability of medical staff to take measures to successfully mitigate the impact of natural disasters, such as COVID-19. The questionnaire Cronbach's α is 0.983, and in this study the total Cronbach's α coefficient is 0.977. The likert 5-level scoring method was used to calculate the questionnaire score. One score was completely inconsistent, 2 scores were relatively inconsistent, 3 scores were generally consistent, 4 scores were relatively consistent, and 5 scores were completely consistent. The total score ranges from 32-160, which means that the higher the score, the stronger the core emergency response capacity.

Data analyses

The statistical package SPSS (version 21.0, IBM Corp) and SPSS Amos 24.0.0 were used to analyze the data. Descriptive statistics (percentage, mean, and standard deviation) were applied to the demographic characteristics of the participants. The chi-square test was used for the comparison of qualitative variables. The *t* test was used to determine whether there were significant differences between the means of the 2groups if the distribution of the quantitative variables was normal; otherwise, we used the Mann-Whitney *U* test. For qualitative variables with more than 2categories, the analysis of variance was used for the normal distribution, and the Kruskal-Wallis test was used when the distribution did not meet the normality criterion. Bivariate correlation analysis was used to study the relationship between scale scores and resilience capacity. Finally, Amos 24.0.0 was conducted to test the mediation effect of whether resilience moderated the relationship between occupational stressors and emergency response capacity.

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Results

Nurses' Demographic and Resilience Score

The detailed characteristics of the new nurses are presented in Table 1, with the mean score for resilience, emergency response capacity, and occupational stressors. For occupational stressors, there were significant associations with education level ($F = 17.382$, $P < 0.000$). Age, marital status, and work experience were significantly associated with resilience (CD-RISC mean scores, $P = 0.037$, $P = 0.046$, $P = 0.011$) and emergency response capacity ($P = 0.018$, $P = 0.045$, $P < 0.000$). There were no statistically significant differences according to the gender of the variables in resilience, emergency response capacity, and occupational stressor score ($P > 0.05$).

Nurses' resilience, occupational stress, and emergency capacity

The CD-RISC score was moderate; the total score of the questionnaire (mean resilience) was 62.68 ± 14.04 (Tenacity factor score: 32.09 ± 7.93, strength factor score: 21.39 ± 5.53, optimism factor score: 9.20 ± 2.46). The level of occupational stressors for new nurses was 84.22 ± 14.81, the main sources of pressure of new nurses are the workload and assignment of time (average score: 2.63 ± 0.55), and the specialty and work of the nurses (average score: 2.60 ± 0.44). The emergency response capacity of the new nurses was at a low level, and the total score was 114.91 ± 21.84. Each dimension score and each item score are shown in Table 2.

Correlation between resilience, occupational stressors, and emergency capacity

Table 3 shows the correlation coefficients for each factor and the correlations of resilience with the emergency response capacity score and the occupational stressor score of the new nurses in the participants of the present study. The total score and the 3 dimensions of CD-RISC were positively correlated with the emergency response competence questionnaire and the 3 dimensions ($P < 0.01$). The total score on the nurse job stress scale and the patient care dimension were negatively correlated with the CD-RISC score ($P < 0.05$).

Identification of hypothesis model

The display of the fitting data of the hypothesis model: χ^2-DOF ratio is 2.156, the goodness-of-fit index (GFI) was 0. 938, the adjusted goodness-of-fit index (AGFI) was 0. 900, the comparative fit index (CFI) was 0. 973, the normed fit index (NFI) was 0. 952, and the root mean square error of approximation (RMSEA) was 0.069. All indices passed the test, indicating that the hypothesis model is suitable for constructing and analysis the relationship.

Resilience played a mediating effect between occupational stressors and emergency response capacity

The relationship model between resilience, occupational stressors, and the emergency response capacity of new nurses is shown in Figure 1.

Table 4 illustrates the mediating effect of resilience between occupational stressors and emergency response capacity. There was a mediating effect of resilience with the mediating effect value of -0.049 (-0.45*0.11, $P < 0.05$). The direct effect was also significant, with the effect value being -0.06 ($P < 0.05$). Therefore, resilience played a partial mediator role in occupational stressors and emergency response capacity, and the mediator effect represented 45.79% of the total effect.

Table 1. New nurses' demographic and its relationship with CD-RISC mean score

Variables	Number	Proportion (%)	CD-RISC	*t*/F	*P*-Value	Emergency response competence	*t*/F	*P*-Value	Occupational Stressors	*t*/F	*P*-Value
Gender											
Male	13	5.39	68.54±13.38	–1.607	0.108	112.77±28.14	–0.573	0.567	82.00±17.65	–1.262	0.207
Female	228	94.61	62.35±14.03			115.03±21.50			87.51±14.62		
Age											
≤20y	8	3.32	59.50±10.78	8.462	0.037	116.25±20.73	10.100	0.018	78.38±11.64	3.924	0.270
21–25y	218	90.46	62.26±13.75			113.82±21.64			87.56±14.31		
26–30y	12	4.98	64.08±13.00			122.75±16.59			86.83±23.01		
31–35y	3	1.24	96.33±3.21			159.00±1.73			87.00±19.93		
Education											
junior college	124	51.45	63.65±13.13	5.943	0.051	117.71±22.83	4.817	0.090	83.90±13.92	17.382	0.000
undergraduate	112	46.47	61.09±14.79			111.56±20.73			90.25±15.06		
Graduate	5	2.07	74.40±13.35			120.40±8.73			101.40±7.92		
Marital status											
Unmarried	226	93.78	62.20±13.69	–1.992	0.046	114.15±21.46	–2.009	0.045	87.27±14.37	–0.073	0.942
Married	15	6.22	69.87±17.48			126.33±24.94			86.33±20.96		
work experience											
Yes	118	48.96	64.86±14.48	–2.53	0.011	121.18±20.38	–4.539	0.000	85.47±14.80	–1.769	0.077
No	123	51.04	60.59±13.32			108.89±21.58			88.89±14.69		

Note: CD-RISC, Connor-Davidson Resilience Scale.

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Table 2. Score of resilience, occupational stress, and emergency ability of new nurses

Project	Item	Total score	Measurement score	The total average score
CD-RISC	25	100	62.68 ± 14.04	2.51 ± 0.56
Tenacity	13	52	32.09 ± 7.93	2.47 ± 0.61
Strength	8	32	21.39 ± 4.54	2.67 ± 0.57
Optimism	4	16	9.20 ± 2.47	2.30 ± 0.62
Emergency response ability	32	160	114.91 ± 21.84	3.59 ± 0.68
Prevention ability	3	15	10.87 ± 2.13	3.62 ± 0.71
Preparation ability	4	20	13.42 ± 3.31	3.35 ± 0.83
Rescue ability	25	125	90.62 ± 17.63	3.62 ± 0.71
Occupational Stressors	35	140	84.22 ± 14.81	2.49 ± 0.42
Nurses specialty and work	7	28	18.18 ± 3.10	2.60 ± 0.44
Work load and time assignment	5	20	13.13 ± 2.75	2.63 ± 0.55
Working conditions and resources	3	12	6.79 ± 1.66	2.26 ± 0.55
Patient care	11	44	28.49 ± 5.14	2.59 ± 0.47
Management and interpersonal relationship	9	36	20.62 ± 4.78	2.29 ± 0.53

Note: CD-RISC, Connor-Davidson Resilience Scale.

Discussion

This study focused on new Chinese nurses and their resilience, and explored the interplay between occupational stressors, resilience, and emergency response capabilities during the COVID-19 re-outbreak. Meanwhile, the influence of resilience on occupational stressors and emergency response capabilities was also evaluated. The mean resilience score of the new nurses was 62.68 ± 14.04 (tenacity factor score: 32.09 ± 7.93, strength factor score: 21.39 ± 5.53, optimism factor score: 9.20 ± 2.46), which corresponds to a moderate level. For occupational stressors, there were significant associations with education levels (such as junior college education, undergraduate education, and graduate education). Age, marital status, and work experience were significantly associated with resilience and emergency response capacity. The total score and 3 dimensions of CD-RISC were positively correlated with the emergency response competence questionnaire and 3 dimensions. The total score of the nurse job stress scale and the patient care dimension were negatively correlated with the CD-RISC score. The established hypothesis model was suitable for the construction and analysis of the relationship. Resilience played a partial mediating role in occupational stressors and emergency response capacity, and the mediating effect represented 45.79% of the total effect.

With the characteristics of high risk, high pressure, and high workload in the prevention and control work of COVID-19 in China, the emergency response capacity of nurses is vital in the response to the COVID-19 pandemic. Although nurses must provide care for patients with professional competence, the new nurse COVID-19 emergency response capabilities are multiple. Occupational stressors can lead to changes in the physiological function and psychological state of the human body and a weak capacity to work.[25] Resilience is crucial to avoid psychological and behavioral problems among nurses and maintain a positive state.[15]

The psychological resilience scores of new nurses were lower than those of other occupational adults in China, as well as nurses in developed countries;[26] this situation should be improved to combat the re-outbreak of COVID-19. This result may be related to the personality of Chinese people. Chinese people are influenced by traditional culture and have a strong sense of anxiety, which results in lower psychological resilience scores of new nurses.[27,28] Of course, further exploration and research are needed to determine

Table 3. Correlation analysis of resilience, occupational stressors, and emergency ability in new nurses

Characteristics	OS	OS1	OS2	OS3	OS4	OS5	ERA	ERA1	ERA2	ERA3	RS	RS1	RS2	RS3
OS	1													
OS1	0.867**	1												
OS2	0.840**	0.751**	1											
OS3	0.720**	0.628**	0.647**	1										
OS4	0.855**	0.647**	0.607**	0.457**	1									
OS5	0.884**	0.693**	0.664**	0.613**	0.646**	1								
ERA	−0.283**	−0.217**	−0.244**	−0.171**	−0.240**	−0.278**	1							
ERA1	−0.122	−0.038	−0.138*	−0.049	−0.126*	−0.122	0.691**	1						
ERA2	−0.238**	−0.170**	−0.203**	−0.144*	−0.236**	−0.208**	0.874**	0.634**	1					
ERA3	−0.291**	−0.232**	−0.247**	−0.178**	−0.238**	−0.291**	0.991**	0.616**	0.819**	1				
RS	−0.243**	−0.146*	−0.178**	−0.072	−0.271**	−0.239**	0.580**	0.331**	0.485**	0.587**	1			
RS1	−0.237**	−0.142*	−0.170**	−0.048	−0.281**	−0.225**	0.566**	0.312**	0.474**	0.574**	0.974**	1		
RS2	−0.266**	−0.171**	−0.205**	−0.115	−0.249**	−0.286**	0.560**	0.328**	0.453**	0.569**	0.936**	0.859**	1	
RS3	−0.131*	−0.060	−0.089	−0.041	−0.180**	−0.107	0.450**	0.274**	0.405**	0.448**	0.834**	0.749**	0.726**	1

Note: OS, occupational stressors; OS1, Nurses specialty and work; OS2, Workload and time assignment; OS3, Working conditions and Resources; OS4, Patient care; OS5, Management and interpersonal relationship; ERA, Emergency response ability; ERA1, Prevention ability; ERA2, Preparation ability; ERA3, Rescue ability; RS, resilience; RS1, Tenacity; RS2, Strength; RS3, Optimism.
*Significant at the alpha 0.05 level;
**Significant at the alpha 0.01 level.

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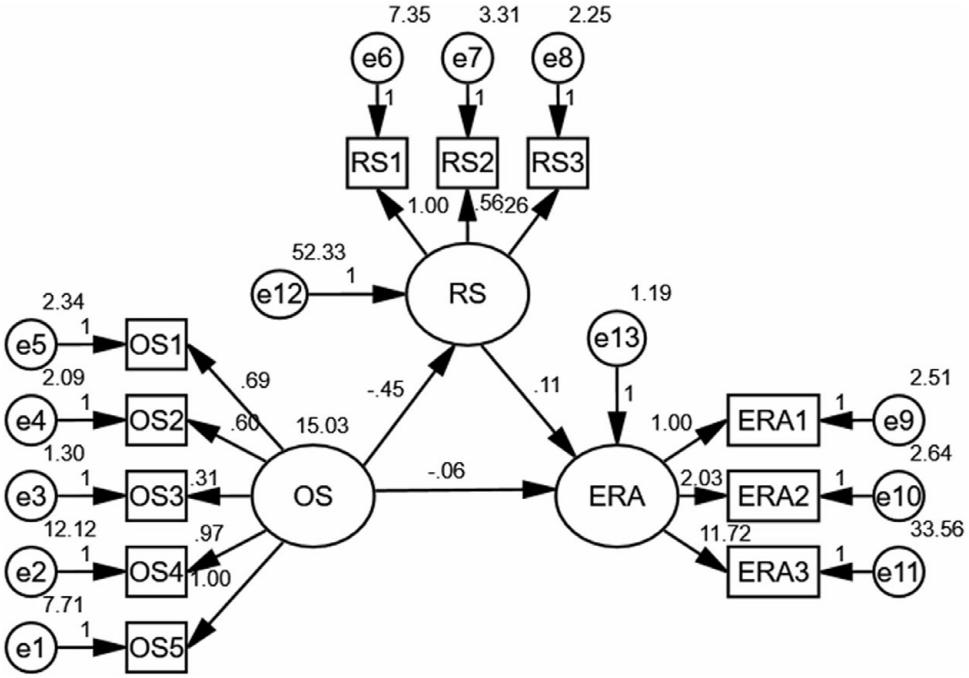

Figure 1. Path analysis of resilience, occupational stress, and emergency capacity in new nurses.
Note. OS, occupational stressors; OS1, nurses' specialty and work; OS2, workload and time assignment; OS3, working conditions and resources; OS4, patient care; OS5, management and interpersonal relationship; ERA, emergency response capacity; ERA1, prevention capacity; ERA2, preparation capacity; ERA3, rescue capacity; RS, resilience; RS1, tenacity; RS2, strength; RS3, optimism.

Table 4. Mediating effect of resilience between occupational stressors and emergency response ability

Characteristics	Estimate	SE	Bias-corrected95%CI			Effect proportion
			Lower	Upper	*P*	
Resilience IE	–0.049	0.022	–0.093	–0.007	0.022	45.79%
DE	–0.057	0.025	–0.108	–0.011	0.012	54.21%
TE	–0.107	0.032	–0.171	–0.044	0.002	

Note: IE, indirect effects; DE, direct effects; TE, total effects; SE, standardized effects.

the specific reasons why Chinese new nurses' psychological resilience score levels are lower than those of foreign countries. Babanataj et al.[29] reported that resilience scores after the training program of 5 sessions increased from 67.97 to 81.43 after the intervention, suggesting that a resilience training program for nurses is acceptable and practicable. Other schoolers[30,31] also recommended training to improve resilience. For new nurses, Chesak et al.[32] suggest that a training program named SMART, which is a person-directed approach to stress management, is feasible to improve the level of resilience; participants learn skills to develop intentional attention and reframe life experience by the SMART program. The above studies suggest that building resilience requires more than 1approach and must be tailored to the area of new nurses. Therefore, the resilience is necessary to relieve the stresses (such as physical or psychological stress, anxiety, and even depression) of the new nurse in clinics.

Stress is the psychological response of the individual after perceiving and evaluating threatening stimuli in the environment.[33] COVID-19 is transmitted primarily through respiratory droplets and close contact,[34] the emergence of which has brought unprecedented challenges to nursing staff and brought various pressures on new nurses. The main sources of pressure for the new nurses in this study are workload and time assignment, as well as nurses' specialty and work. The reason may be that with the outbreak of the epidemic, the workload of clinical nurses has increased, so that new nurses need to learn and master more operational skills and theoretical knowledge. Due to the lack of work experience and infectious disease care experience, most new nurses are more likely to lack self-confidence and psychological pressure in the face of nursing work during the epidemic. Furthermore, the attitude of Chinese people toward the pursuit of excellence in their work, fearing that they may not be able to cope with sudden outbreaks of the epidemic, is also an important factor that causes psychological pressure and stress.

In order to improve the emergency response capacity as a sword against COVID-19, it was essential to improve the capacity of nursing staff to deal with public health events and the quality of nursing in an emergency. This study showed that the total emergency response capacity score of the new nurses was 114.91 ± 21.84; the score is lower than the results of a survey of medical staff in Chongqing conducted by Gu et al.[22] The reason for this difference may be that the present survey only involved new nurses, while the

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Gu et al.'s[22] survey covered a wide range of medical staff. Overall, the emergency response capacity of the new nurses is not high, especially the preparation capacity. The reason may be that the new nurses underestimated the lethality of infectious diseases and lacked a good grasp of the points of knowledge. Furthermore, China has a large population and there are many patients who need to be cared for in hospitals when they encounter COVID-19, and the number of medical staff is relatively small, which is also one of the reasons for poor emergency response capabilities.

The most important finding of this study is the significant effects of resilience on the level of emergency response capacity of COVID-19 and occupational stressors of new nurses. According to Table 3, the scores for all dimensions of resilience are positively correlated with the emergency response capacity of nurses, which means that the higher the resilience, the stronger the emergency response capacity of the new nurse. This finding is consistent with Chen et al.'s report[35] that improving the resilience of new nurses is a good way to improve the emergency response capacity. In a previous study,[36] people who can better adapt to stress generally have better resilience, and there was a negative correlation between resilience and occupational stressors of new nurses. These previous results and our findings confirm that new nurses with strong resilience can deal with work stress calmly and recover from stress events quickly. According to Figure1, the results suggested that resilience plays a mediator role in the relationship between occupational stressors and emergency response capacity. It showed that occupational stressors can not only exert a direct effect on the emergency response capacity of new nurses, but also produce an indirect effect on the emergency response capacity through the partial mediating effects of resilience. Therefore, in the practice of improving the emergency response capacity of new nurses, the nursing superintendent should pay attention to the impact of occupational stressors on the emergency response capacity and focus on improving the emergency response capacity of new nurses with high pressure. On the other hand, the nursing superintendent should notice the impact of resilience on the emergency response capacity and develop the resilience of the new nurse to reduce the limitation of occupational stressors on the development of the emergency response capacity.

Our study had some limitations. First, due to funding and time constraints, this study only included single-center research subjects, and the results of the study need to be verified by data from a multicenter survey. Second, this study only relied on 3 scales and the potential factors of the scales may affect the results. Third, this study has not considered the validity of the instruments (CD-RISC, NJSS, and ERCQ) and the limitations of the measures. Finally, the use of self-reported measures may have limited the responses of the participants; therefore, future studies may utilize both qualitative and quantitative designs to elicit essential information from the participants.

Conclusions

This study has shown that the new nurses had a medium level of resilience and a lower level of emergency response capacity in the COVID-19 re-outbreak. The nursing superintendent must pay attention to the resilience of new nurses, reduce occupational stressors, improve emergency response capacity, and help them cope with the re-outbreak of COVID-19. This study constructed a preliminary framework that occupational stressors affect emergency response capacity, while appropriate resilience training could enhance this capacity when undergoing occupational stressors. The present findings enrich the theoretical framework for the management of the occupational stressors encountered by new nurses. Furthermore, the government and medical management departments should strengthen the training of new nurses and formulate relevant management policies and measures to enhance the emergency response capacity of new nurses to cope with occupational stress.

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