RESEARCH

The effect of perceived organizational support and ego-resilience on the relationship between occupational stressors and compassion fatigue in COVID-19 frontline nurses: a cross-sectional study in Sichuan, China

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Abstract

Aim To investigate the level of compassion fatigue among frontline nurses during the COVID-19 pandemic and to explore the relationship between occupational stressors and compassion fatigue among frontline nurses based on structural equation modelling.

Background Three years into the COVID-19 pandemic, nurses on the frontlines of the battle were overwhelmed by affective and emotional inputs while caring for patients, and they generally experienced varying degrees of psychological problems. High levels of compassion fatigue can affect nursing quality and patient safety and therefore should be taken seriously by nursing managers.

Methods A cross-sectional survey of 1432 frontline nurses in Sichuan Province, China, was conducted from January to March 2023 via convenience sampling methods. The General Information Questionnaire, the Nurses' Occupational Stressors Scale, the Ego-Resilience Scale, the Chinese version of the Compassion Fatigue Brief Scale, and the Perceived Organizational Support Scale were used to collect the data. Hypotheses were tested using structural equation models and bootstrapping methods.

Results Nurse occupational stressors had a significant direct effect on compassion fatigue (B = 2.429, $p < 0.001$). Perceived organizational support exerted a mediating effect of 11.36% between occupational stressors and compassion fatigue. In addition, ego-resilience had a moderating role in the relationship between nurses' occupational stressors and compassion fatigue, between nurses' occupational stressors and perceived organizational

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support, and between perceived organizational support and compassion fatigue. Multiple linear regression analysis revealed that the most influential dimension of occupational stressors on compassion fatigue was work-family conflict ($\beta = 0.253$, $p < 0.001$), followed by organizational issues ($\beta = 0.153$, $p < 0.001$), work demands ($\beta = 0.103$, $p < 0.001$) and difficulty taking leave ($\beta = 0.102$, $p < 0.001$).

Conclusion Nurse occupational stressors are positively associated with compassion fatigue and influence nurse compassion fatigue through the mediating effect of perceived organizational support and the moderating mechanism of ego-resilience. Managers can reduce nurses' compassion fatigue levels by reducing occupational stressors, promoting nurses' perceived organizational support, and fostering ego-resilience.

Implications for nursing management This study further integrated the external and internal factors affecting compassion fatigue and constructed a structural equation model of the mechanism of compassion fatigue in frontline nurses, which has implications for the early identification and intervention of compassion fatigue in nurses.

Keywords Occupational stressor, Compassion fatigue, Perceived organizational support, Ego-resilience, Nurse

Introduction

Coronavirus disease 2019 (COVID-19) is prevalent worldwide and has caused great concern in countries around the world [1]. The sudden outbreak of the pandemic has brought enormous prevention and control challenges to all health care workers and society. As a major stressor, it has caused psychological trauma to all health care workers to varying degrees. With the continuous progress and development of human society, people are paying increasing attention to individual mental health, especially during the COVID-19 pandemic. Not only has the mental health of patients been widely considered, but an increasing number of people have started to pay attention to the mental health of frontline medical personnel in the fight against the pandemic [2].

Frontline health workers are those who are directly involved in the prevention and treatment of COVID-19 and who have direct contact with confirmed or suspected cases. Since the beginning of 2020, China has experienced a number of epidemic spreads and outbreaks, unlike the "herd immunity" strategy dominated by Europe and the United States, China has adopted a "dynamic zero" polic. With the continuous mutation of the virus, China entered the critical period of the epidemic from the duration of the epidemic [3]. According to data from the Chinese Center for Disease Control and Prevention, in January 2023, the number of seriously ill patients in hospitals nationwide peaked at 128,000, with the number of COVID-19-infected patients in hospitals nationwide reaching a peak of 1.625 million. As the rate of COVID-19 infections continues to increase across China, the focus of pandemic prevention and control has shifted from infection prevention and control to medical treatment, placing greater importance on critical care and securing daily health care needs. Frontline health care workers are faced with very complex situations; often need to work continuously in high-intensity, high-stress, stress-filled environments; are frequently exposed to traumatic situations such as viral infections

and patient deaths; are experiencing patients' pain and helplessness; and are physically overworked, overloaded with intense work, and invested in too much empathy, increasing their likelihood of experiencing compassion fatigue [4].

Compassion fatigue, a mental health problem associated with work stress [5], has become more prominent during the pandemic. A researcher conducted a psychological questionnaire survey of medical staff working on the clinical frontline during the COVID-19 outbreak, and the results showed that with the accumulation of work stress, many medical staff were under physical, energy, and emotional overload, and most of them experienced psychological problems such as pain, anxiety, irritability, and insomnia [6]. The occurrence of these mental health problems can lead to burnout, poor work concentration, decreased work efficiency, and lower levels of team morale and can even affect the quality of care and the emergence of patient safety issues among medical staff [5]. Compassion fatigue is thought to affect the health and productivity of medical staff, which in turn affects the quality of patient care.

Over the past 3 years, frontline nurses in the fight against the pandemic, as the main force among medical workers, rushed to the forefront, faced both physical and psychological stress, played a key role in providing 24-hour bedside care for COVID-19 patients [7] and were at high risk for compassion fatigue. The results of a Chinese survey on the current situation of 1123 clinical nurses in a tertiary hospital after the outbreak showed that 83.88% experienced compassion fatigue [8]. Another study showed that 38.5% of frontline nurses experienced moderate to high levels of compassion fatigue during the second wave of the pandemic [9]. The occurrence of compassion fatigue can have a range of physical, social, emotional, spiritual, and cognitive effects on nurses, leading to physical and psychological illness, turnover, the production of medical errors, and reduced patient

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satisfaction [10], making compassion fatigue in frontline nurses worthy of the attention of nursing managers.

In recent years, especially since the outbreak of the COVID-19 pandemic, a large number of scholars have conducted studies related to compassion fatigue among frontline nurses, confirming that compassion fatigue is more common among frontline nurses than among other health care workers, and discussing the factors influencing compassion fatigue and the mechanisms of its occurrence, suggesting that the occurrence of compassion fatigue is related to empathy, burnout, empathy satisfaction, ego-resilience, guilt, and secondary traumatic stress [11]. Currently, frontline nurses working in a high-pressure and demanding environment for a long time are constantly exposed to work-related stress and sadness and are in a long-term stressful state, often facing situations such as lack of organizational support, high-intensity workload, staff shortages, and poor teamwork, and they suffer from more work stressors than other nurses.

In the three years when the epidemic has been going on, this study aimed to answer the following questions: What is the current status of compassion fatigue among nursing staff who work long hours on the front line of the pandemic response? What is the mechanism of compassion fatigue among frontline nurses?

Literature review and research framework

Figley [12] defined compassion fatigue as a series of physical, psychological, and mental disorders that occur when a helper's ability to empathize with a client is reduced due to prolonged indirect exposure to a traumatic event or stressful situation that the client has suffered. The COVID-19 pandemic was a major public health event with a surge in demand for medical resources, increased work pressure, and widespread co-occurrence of fatigue among health care workers [13]. Compared with other health care workers, frontline nurses are at the forefront of patient care and are always in contact with patients from admission to discharge; frontline nurses are the direct caregivers of COVID-19 patients and must manage their conditions while calming patients and providing emotional and social support and they are especially prone to developing various psychological problems themselves while helping people, such as anxiety, depression, insomnia, and perceived stress. Compassion fatigue not only affects nurses' motivation and work efficiency but also leads to negative emotional outbursts and psychological problems [8]. Some studies have shown [14] that the factors influencing compassion fatigue are personal factors (professional perception, health status, gender, etc.), work environment factors (working hours, workload, occupational roles, etc.), and mental health. Although various factors contribute to compassion fatigue, continuous exposure to work stressors can make nurses feel fatigued and physically and mentally exhausted, leading to attitudinal, emotional, and behavioral vulnerability and compassion fatigue, which is considered to be one of the main causes of compassion fatigue [15]. Therefore, nurse occupational stressors, as external factors, can have an impact on compassion fatigue, but their mechanism of action is not clear.

In this study, we used the Job Demands-Resources (JD-R) model [16] and conservation of resources theory (COR) [17] to explore the factors affecting compassion fatigue in frontline nurses. The JD-R model proposes that there are two paths through which work influences employees: gain and loss. The gain path refers to work resources such as job autonomy, colleague support, and supervisor guidance, which will have a positive influence on employees; the loss path refers to work demands such as workload, emotional load, and time pressure, which will have a negative influence on employees [18]. COR explains stress generation and coping with individual resources as the core mechanism. Stress occurs when people lose resources, perceive the possibility of losing resources, or do not receive the expected return after investing resources. After stress is initiated, if individuals cannot effectively stop the loss of resources and do not have the opportunity to compensate in time, the loss of resources will proceed at an accelerated rate, resulting in a loss spiral and increasing the sense of stress [17].

The relationship between occupational stressors and compassion fatigue in frontline nurses

According to JD-R theory, the division of job demands and job resources applies to various occupational settings; however, the judgement of the attributes of demands and resources mostly changes according to the situation. The COVID-19 pandemic amplified the physical, emotional, and moral stress of nurses, and the special working environment and overload made nurses prone to emotional problems, with factors such as day and night shifts making symptoms of depression, anxiety, and insomnia more pronounced [19]. According to the COR and JD-R theories, nurses will develop stress perceptions when faced with stressors, and stress as a job requirement will increase the risk of attrition effects and loss of resources for nurses. When nurses' resource attrition at work reaches the edge of their resource stock, they will experience a sense of depletion, and to preserve their existing resources, they usually do not continue to invest resources in their work, and nurses will experience a series of negative emotions to avoid stress and avoid the reduction of their resources, showing burnout, etc. In addition, the presence of negative emotions will also affect nurses' regulation of stressors; their self-adjustment, psychological perception level, empathic ability and interest in the face of the rescuer will be reduced, and

nurses will have a sense of negativity and powerlessness, leading to burnout and compassion fatigue in the work of helping people. Therefore, this study proposes the following hypothesis:

H1 Frontline nurses' occupational stressors have a positive effect on compassion fatigue.

Mediating role of perceived organizational support

According to Eisenberger, perceived organizational support (POS) is an overall perception and belief of how an organization views its contributions and cares about its interests [20] and is an assurance that employees can receive help from the organization in coping with stressful work situations. Organizational support has long been an important factor in the work environment that motivates nurses to cope effectively with stress, and high levels of organizational support as a work resource can effectively buffer nurses from the effects of coping with stressors. According to the loss path of JD-R theory, stressors such as workload and time pressure, as well as job demands, can negatively affect employees, and employees' perceived organizational support decreases. From the perspective of COR, perceived organizational support is a comprehensive perception of whether the organization supports the nurse, and the nurse effectively perceives organizational support as "resource acquisition". When the nurse is faced with excessive work demands or the presence of more stressors, the nurse is at risk of resource attrition. When faced with stressors such as exposure to risky environments and intense work, nurses will be more inclined to protect resources rather than acquire them and will be less likely to acquire them and more likely to lose them, leaving perceived organizational support as a work resource at risk of depletion and inaccessibility. Therefore, this study proposes the following hypothesis:

H2 Nurses' occupational stressors negatively affect perceived organizational support.

Existing research has suggested that empathic stress and exposure to traumatic events are prerequisites for the development of compassion fatigue, but as research has progressed, researchers have found that inadequate individual support is also a major factor. Organizational support, as a positive "work resource", is closely related to the workplace of nurses and is an important work resource for nurses in high-risk, high-load, high-intensity, high-stress situations. According to the gain path of JD-R theory, work resources such as colleague support, superior guidance, and organizational support will have a positive influence on employees. If nurses can feel support, recognition of value, and interest in their work from the organization and leaders, this will stimulate their work enthusiasm and sense of accomplishment, increase their ability to cope with stressors, handle stress, and defend themselves, and thus actively cope with problems and traumatic situations at work and reduce the compassion fatigue triggered by stressors. Therefore, this study proposes the following hypothesis:

H3 Perceived organizational support negatively affects nurses' compassion fatigue.

COR suggests that when individuals are faced with resource depletion, they will not only develop negative behaviors to avoid continuous damage to their resources but will also show a reduced ability to acquire resources, thus further falling into negative psychology and attitudes. Research has shown that establishing a good support system is an important factor in maintaining the physical and mental health of nurses. Nurses who have been exposed to various stressors for a long time have a reduced perceived organizational support, which is not conducive to nurses' proper response to various stressor situations, and they show compassion fatigue when they face trauma patients with various psychological problems such as anxiety, insomnia, and burnout such as absence from work and reduced interactions with patients. Therefore, the following hypothesis is proposed:

H4 Perceived organizational support mediates the relationship between nurses' occupational stressors and compassion fatigue.

Moderating effect of ego-resilience

Both external factors and individual resources influence the process of compassion fatigue. As compassion fatigue research has progressed, researchers have become more interested in the buffering effect of individuals' internal resources, such as ego-resilience, on compassion fatigue. Masten [21] stated that resilience is the result of an individual's ability to develop and adapt well even when faced with adversity, trauma, tragedy, threat, or other significant stress and is a positive psychological resource for individuals when faced with difficult experiences. In the rescue process, if the nurse's ego-resilience is strong, they can adjust their self-psychological state in a short time after giving much empathy and emotional energy, which can greatly reduce the possibility of compassion fatigue. Ego-resilience not only buffers the attrition of high job demands on employees but also mitigates the negative behaviours of nurses in stressful situations; however, according to JD-R theory, occupational stressors have a positive effect on individuals with high ego-resilience and can be used as a job resource to positively influence nurses by not denying and avoiding stress, and encouraging problem solving can help the natural adjustment process of stress. Ego-resilience can therefore help nurses

face stress positively, reduce it, and adjust to it, thus manifesting as lower levels of compassion fatigue. Based on this, the following hypothesis is proposed:

H5 Ego-resilience plays a moderating role in the relationship between occupational stressor and compassion fatigue.

Usually, when nurses perceive stress, they can reduce work stress by talking about their stressors and psychological problems, expressing their feelings based on a trusting relationship, and seeking appropriate help, which shows the important role of supportive organizational resources in preventing stress and reducing burnout. Organizational support, as a positive "resource", is an important and indispensable work resource for frontline nurses in particular. It has been shown that perceived organizational support helps to eliminate occupational stress, alleviate burnout, improve job satisfaction, and reduce turnover [22]. When nurses face complex work stressors, their perceived organizational support decreases, and negative emotions such as job burnout can occur. However, human potential is unlimited and has its roots in human psychological capital, and resilience is one of the four elements of psychological capital, which is an individual's ability to survive and thrive in the face of adversity, as well as the ability to respond effectively to workplace stress and balance stress and demands [23]. During difficult and challenging times, self-reliant nurses may "bounce back" and be able to better balance depleted resources in the face of stressors, thereby reducing the negative impact of resource depletion. High levels of ego-resilience can facilitate effective resistance to stress, recovery, and adjustment from stress; perceived support and assistance from the organization; and reduced compassion fatigue from various high-risk work tasks. Therefore, the following hypotheses are proposed:

H6 Ego-resilience plays a moderating role in occupational stressors and perceived organizational support;

H7 Ego-resilience plays a moderating role in the relationship between perceived organizational support and nurses' compassion fatigue.

The conceptual model of this study is shown in Fig. 1.

Methods
Research design
A cross-sectional design was used to investigate the relationship between occupational stressor and compassion fatigue, the mediating role of perceived organizational support, and the moderating role of ego-resilience among nurses in Sichuan, China during the COVID-19 pandemic.

Sampling and participants
Participants were recruited from several hospitals in Sichuan Province using convenience sampling and online questionnaires collected from January to March 2023. The questionnaires were distributed to the hospital nurses after obtaining the departments' consent to do so. The inclusion criteria were nurses older than 18 years and involved in frontline clinical work against COVID-19. Furthermore, the participants volunteered to participate in this study. Nurses who had worked on the frontline of the fight against the pandemic for less than six months were excluded from the study. A sample size of 812 was computed by multiplying the number of items of the instruments by ten and taking into account a 20% questionnaire invalidation rate. A total of 1461 questionnaires were collected, excluding 29 questionnaires that were too short (<3 min) or took too long (>40 min) to complete, resulting in 1432 valid questionnaires. The effective rate of the questionnaires was 98.02%.

Measurement tools
Occupational stressor was measured by the Nurse Occupational Stressor Scale (NOSS), which has high reliability and validity [24] and contains 21 items with 5 reverse-scored items and 9 dimensions, such as work demands and work-family conflict. Each item is scored on a
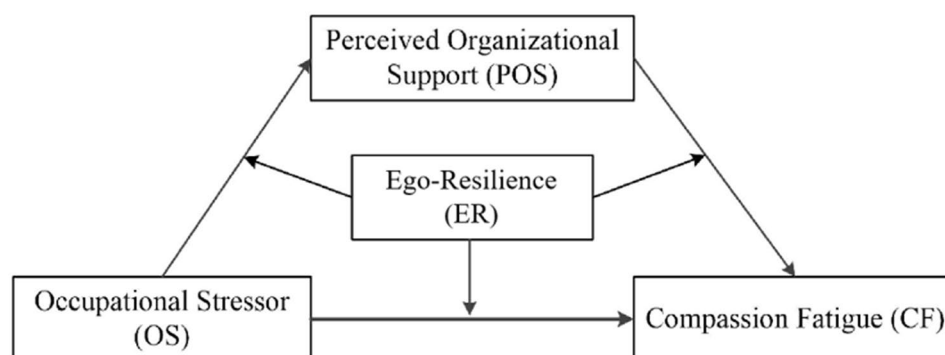

Fig. 1 Theoretical model diagram

4-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree), with higher scores indicating a higher frequency of work stressors experienced. The alpha coefficient was 0.943 in this study, indicating that this instrument is highly reliable.

Perceived organizational support was measured by the Eisenberger [25] Unidimensional Survey of Perceived Organizational Support (SPOS), which contains 9 items, including 2 reverse-scored items. Each item is scored on

a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicate higher perceived organizational support. This scale has been widely used in the nursing population. The alpha coefficient was 0.904 in this study, indicating that this instrument is highly reliable.

Ego-resilience was measured by the original version of the Ego-Resilience Scale (ERS) [26]. This scale measures purely resilient traits of personality. It is designed to assess the resilience of the subject's self and consists of 14 items scored on a 4-point Likert scale, ranging from 1 (does not apply at all) to 4 (applies very strongly), with higher scores indicate higher ego-resilience. The alpha coefficient was 0.919 in this study, indicating a high level of reliability.

Compassion fatigue was measured by the Compassion Fatigue Brief Scale [27] revised by Lou. The scale consists of 13 items and is scored on a 10-point Likert scale ranging from 1 (never) to 10 (extremely frequent), with higher scores indicate higher compassion fatigue. Based on the average score of the items, the level of compassion fatigue can be divided into three categories: mild (<4 points), moderate (4-7 points), and severe (>7 points) [28]. A validation factor analysis showed that the questionnaire had good construct validity. The alpha coefficient was 0.956 in this study.

Statistical analysis

This study used IBM SPSS 26.0 for data analysis. Descriptive analyses were performed using frequencies and percentages for categorical variables. Moreover, to depict continuous variables, means (M) and standard deviations (SD) were used. Differences in compassion fatigue between groups were compared using one-way analysis of variance (ANOVA) and t-tests. Pearson correlation coefficient was used to examine the associations between variables. This study analysed the mediating effect of perceived organizational support and the moderating effect of ego-resilience through Models 4 and 58 in PROCESS 3.3 (Hayes, 2013). This study used 5000 bootstrap samples, and the statistical significance level was set at $\alpha = 0.05$. To further explore the impact of the nine dimensions of occupational stressor on compassion fatigue, this study conducted multiple linear regression analysis.

Results

Demography and work-related characteristics

The demographic and work-related characteristics of the participants are shown in Table 1. Of the 1432 participants, 37 were men (2.6%), 1395 were women (97.4%), and the average age was 32.47 ± 7.32 years. Regarding education level, 67.6% of the participants held a bachelor's degree. The average job tenure was 11.52 ± 7.75 years. There are significant differences in compassion

Table 1 Demography and work-related characteristics in compassion fatigue($N = 1432$)

Variables	N (%)	Compassion Fatigue (M ± SD)	t/F	p	LSD
Gender					
Male	37 (2.6)	4.634 ± 2.048	1.375	0.169[a]	/
Female	1395 (97.4)	4.157 ± 2.084			
Age (years)					
≤25	212 (14.8)	4.208 ± 2.048	3.170	0.024[b]	①②③>④
26–35	849 (59.3)	4.135 ± 2.134			
36–45	269 (18.8)	4.425 ± 2.009			
≥46	102 (7.1)	3.703 ± 1.835			
Education level					
Secondary school and below	13 (0.9)	5.154 ± 1.771	1.112	0.343[b]	/
College degree	431(30.1)	4.15 ± 2.099			
Bachelor degree	968 (67.6)	4.171 ± 2.091			
Postgraduate and above	20 (1.4)	3.877 ± 1.351			
Job tenure (years)					
≤5	312 (21.8)	4.042 ± 2.104	3.528	0.007[b]	①②③④>⑤
6–10	438 (30.6)	4.264 ± 2.075			
11–15	367 (25.6)	4.204 ± 2.152			
16–25	220 (15.4)	4.388 ± 2.028			
≥26	95 (6.6)	3.514 ± 1.774			
Professional title					
Nurse	283 (19.8)	4.16 ± 2.100	1.047	0.382[b]	/
Nurse Practitioner	604 (42.2)	4.131 ± 2.101			
Supervising Nurse Practitioner	428 (29.9)	4.306 ± 2.110			
Deputy Chief Nurse	106 (7.4)	3.878 ± 1.856			
Director Nurse Practitioner	11 (0.8)	4.021 ± 1.575			
Sleep quality					
Good	125 (8.7)	3.575 ± 2.087	93.047	<0.001[b]	①②<③
Fair	636 (44.4)	3.493 ± 1.877			
Bad	671 (46.9)	4.922 ± 2.014			

Notes: *LSD*: Least-Significant Difference (LSD); [a]*t*, t test. [b]*F*, one-way ANOVA

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fatigue related to nurses' ages, job tenure, and sleep quality ($p < 0.05$). We employed the Least-Significant Difference (LSD) method for post-hoc comparisons of group differences, with results presented in Table 1.

Correlation analysis

The descriptive statistics and correlations among the variables are shown in Table 2. Occupational stressors were positively correlated with compassion fatigue ($r = 0.693$, $p < 0.01$). Occupational stressors were negatively correlated with perceived organizational support ($r = -0.469$, $p < 0.01$) and ego-resilience ($r = -0.144$, $p < 0.01$). Perceived organizational support was significantly negatively correlated with compassion fatigue ($r = -0.456$, $p < 0.01$).

Testing the mediation model

As shown in Table 3, occupational stressors were positively correlated with compassion fatigue among nurses ($B = 2.429$, $p < 0.001$). After perceived organizational support was added as a mediating variable, occupational stressors were positively correlated with compassion fatigue among nurses ($B = 2.153$, $p < 0.001$), and perceived organizational support was negatively correlated with compassion fatigue ($B = -0.291$, $p < 0.001$). In addition, occupational stressors were found to be a negative predictor of perceived organizational support ($B = -0.949$, $p < 0.001$). According to the bias-corrected percentile bootstrap analysis, the mediating effect of perceived organizational support on the relationship between occupational stressors and compassion fatigue was significant (ab = 0.276, 95% CI = [0.194, 0.362]), accounting for 11.36% of the total effect. The direct effect of occupational stressors on compassion fatigue was significant,

Table 2 Descriptive statistics and correlations among variables

	M ± SD	1	2	3	4
1. Occupational Stressor	2.541 ± 0.594	1			
2. Perceived Organizational Support	4.662 ± 1.201	-0.469**	1		
3. Ego-resilience	2.792 ± 0.601	-0.144**	0.411**	1	
4. Compassion Fatigue	4.170 ± 2.083	0.693**	-0.456**	-0.143**	1

Notes: **$p < 0.01$

indicating a partial mediating effect. Therefore, these results revealed that perceived organizational support partially mediated the relationship between occupational stressors and compassion fatigue.

Testing the moderated mediation model

As shown in Table 4, the interaction effect of occupational stressors and ego-resilience on perceived organizational support was significant ($B = 0.297$, $p < 0.001$), indicating that the relationship between occupational stressors and perceived organizational support was moderated by ego-resilience. The interaction effect of occupational stressors and ego-resilience on compassion fatigue was significant ($B = -0.257$, $p = 0.018$), indicating that the relationship between occupational stressors and compassion fatigue was moderated by ego-resilience. In addition, the interaction effect of perceived organizational support and ego-resilience on compassion fatigue was significant ($B = -0.114$, $p = 0.048$), indicating that the relationship between perceived organizational support and compassion fatigue was moderated by ego-resilience. The moderated mediation model is shown in Fig. 2.

Table 3 Testing the mediation model

Criterion	Predictors	R^2	B	SE	t	p	95%CI
CF	OS	0.480	2.429	0.067	36.324	< 0.001	[2.298, 2.561]
POS	OS	0.220	-0.949	0.047	-20.099	< 0.001	[-1.042, -0.857]
CF	OS	0.502	2.153	0.074	29.037	< 0.001	[2.008, 2.299]
	POS		-0.291	0.037	-7.942	< 0.001	[-0.363, -0.219]

Notes: OS, Occupational Stressor. POS, Perceived Organizational Support. CF, Compassion Fatigue

Table 4 Testing the moderated mediation model

Criterion	Predictors	R^2	B	SE	t	p	95%CI
POS	OS	0.350	-0.929	0.047	-19.686	< 0.001	[-1.021, -0.836]
	ER		0.710	0.043	16.440	< 0.001	[0.625, 0.795]
	OS×ER		0.297	0.065	4.551	< 0.001	[0.169, 0.425]
CF	OS	0.505	2.215	0.081	27.413	< 0.001	[2.056, 2.373]
	POS		-0.291	0.040	-7.255	< 0.001	[-0.370, -0.213]
	ER		0.054	0.071	0.763	0.445	[-0.086, 0.194]
	OS×ER		-0.257	0.109	-2.363	0.018	[-0.471, -0.044]
	POS×ER		-0.114	0.058	-1.979	0.048	[-0.227, -0.001]

Notes: OS, Occupational Stressor. POS, Perceived Organizational Support. CF, Compassion Fatigue. ER, Ego-resilience
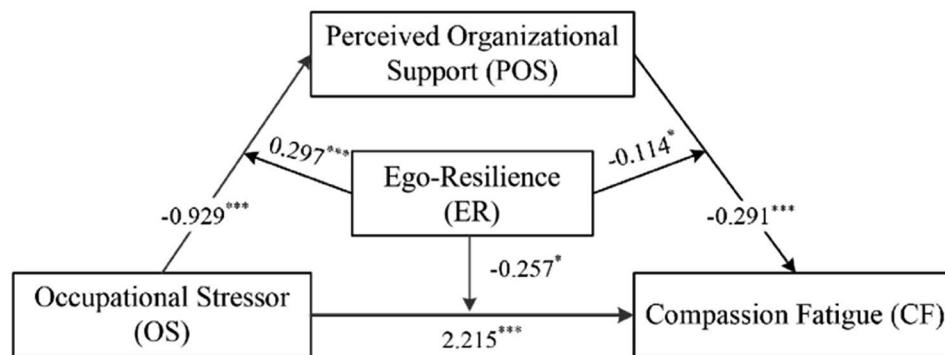
Fig. 2 Diagram of the moderated mediation model

Table 5 Effect sizes at different levels of ego-resilience

Ego-resilience	Effect	SE	t	p	Boot LLCI	Boot ULCI
OS → POS						
M - SD	-1.107	0.072	-15.393	< 0.001	-1.248	-0.966
M	-0.929	0.047	-19.686	< 0.001	-1.021	-0.836
M + SD	-0.750	0.049	-15.467	< 0.001	-0.845	-0.655
POS → CF						
M - SD	-0.223	0.055	-4.079	< 0.001	-0.330	-0.116
M	-0.291	0.040	-7.255	< 0.001	-0.370	-0.213
M + SD	-0.360	0.051	-7.015	< 0.001	-0.461	-0.259
OS → CF						
M - SD	2.369	0.122	19.419	< 0.001	2.130	2.609
M	2.215	0.081	27.413	< 0.001	2.056	2.373
M + SD	2.060	0.082	25.132	< 0.001	1.899	2.221

Notes: OS, Occupational Stressor. POS, Perceived Organizational Support. CF, Compassion Fatigue
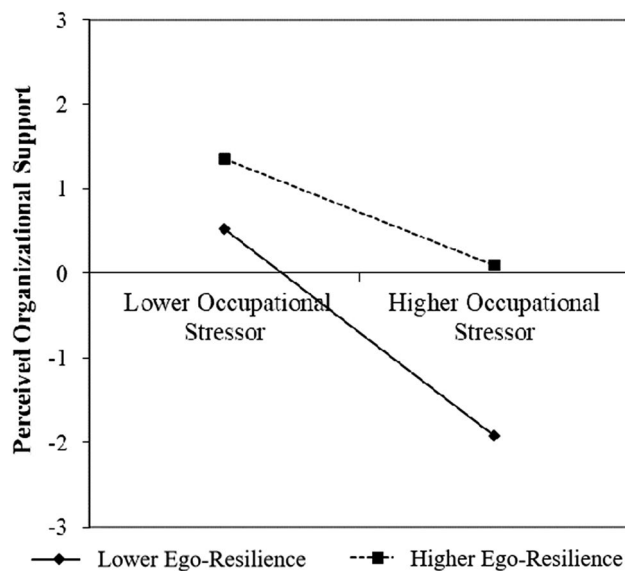

Fig. 3 Moderation of ego-resilience to occupational stressor and perceived organizational support

The results of the simple slope test (see Table 5) further suggested that when ego-resilience was lower, occupational stressors were negatively associated with perceived organizational support (B_{simple}=-1.107, p<0.001).

However, for nurses with greater ego-resilience, the association between occupational stressors and perceived organizational support was still significant but was greater (B_{simple}=-0.750, p<0.001). The moderating effect is shown in Fig. 3. This result indicates that ego-resilience can mitigate the negative effects of occupational stressor on perceived organizational support.

The results of the simple slope test further suggested that when ego-resilience was lower, perceived organizational support was negatively associated with compassion fatigue (B_{simple}=-0.223, p<0.001). For nurses with greater ego-resilience, the association between perceived organizational support and compassion fatigue was still significant but was weaker (B_{simple}=-0.360, p<0.001). The moderating effect is shown in Fig. 4. This result indicates that ego-resilience can increase the positive effects of perceived organizational support on compassion fatigue.

Furthermore, the results of the simple slope test suggested that when ego-resilience was lower, occupational stressors were positively associated with compassion fatigue (B_{simple}=2.369, p<0.001). However, in nurses with greater ego-resilience, the association between occupational stressors and compassion fatigue was still significant but was weaker (B_{simple}=2.060, p<0.001). The moderating effect is shown in Fig. 5. This result indicates
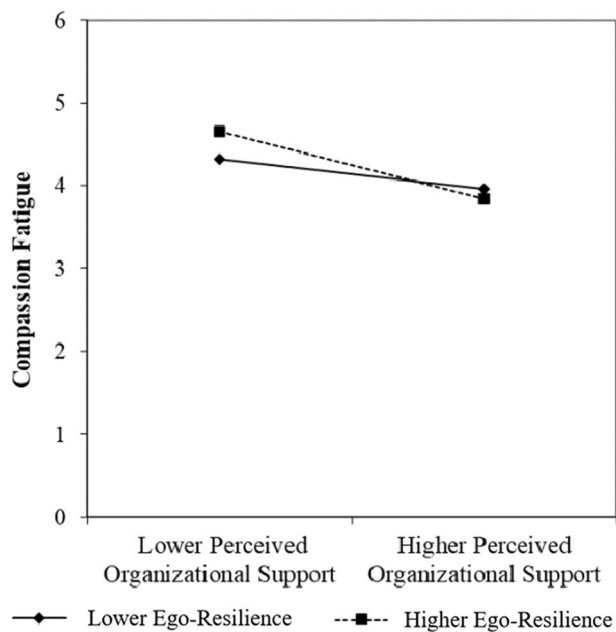
Fig. 4 Moderation of ego-resilience to perceived organizational support and compassion fatigue
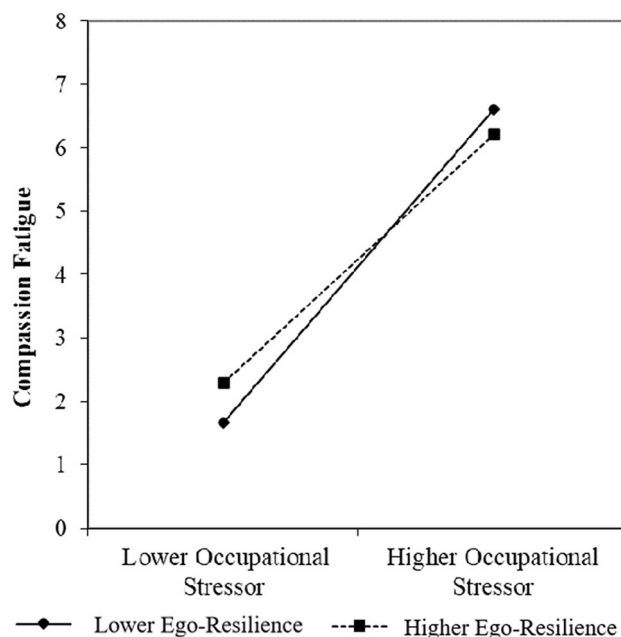

Fig. 5 Moderation of ego-resilience to occupational stressor and compassion fatigue

that ego-resilience can mitigate the negative effects of occupational stressors on compassion fatigue.

To further explore the impact of the nine dimensions of occupational stressors on compassion fatigue, this study conducted multiple linear regression analysis, and the results are shown in Table 6. The model fit well ($R^2 = 0.488$, $F = 152.260$, $p < 0.001$), and the Durbin-Watson value was 1.979, which is approximately 2, indicating

Table 6 Multiple Linear regression

	Unstandardized Coefficients		Standardized Coefficients	t	*p*
	B	SE	β		
Constant	-1.774	0.191		-9.313	< 0.001
Work Demands	0.309	0.082	0.103	3.744	< 0.001
Work-Family Conflict	0.7	0.087	0.253	8.089	< 0.001
Insufficient Support from Coworkers or Caregivers	0.227	0.080	0.080	2.832	0.005
Workplace Violence and Bullying	0.164	0.058	0.073	2.807	0.005
Organizational Issues	0.413	0.093	0.153	4.439	< 0.001
Occupational Hazards	0.142	0.081	0.047	1.752	0.080
Difficulty Taking Leave	0.27	0.069	0.102	3.905	< 0.001
Powerlessness	-0.027	0.089	-0.008	-0.299	0.765
Unmet Basic Physiological Needs	0.141	0.075	0.054	1.884	0.060

that the residuals fit a normal distribution. The magnitude of the effect of the dimensions on compassion fatigue can be compared by the absolute values of standardized regression coefficients. The results showed that the most influential factor for compassion fatigue was work-family conflict (=0.253, $p < 0.001$), followed by organizational issues (=0.153, $p < 0.001$), work demands (=0.103, $p < 0.001$) and difficulty taking leave (=0.102, $p < 0.001$).

Discussion

Considering that compassion fatigue has become a substantial challenge in nursing practice [29], to further explore the mechanisms underlying the occurrence of compassion fatigue among frontline nurses in the fight against the pandemic, this study examined the effects of occupational stressors and perceived organizational support on compassion fatigue among nurses, as well as the moderating role of ego-resilience. Before the outbreak of COVID-19, the global nursing system already suffered from nursing staff shortages and long working hours, which caused nurses to experience chronic traumatic stress, burnout, compassion fatigue, and a high risk of low morale [30, 31]. Since the outbreak of COVID-19, nurses have been one of the main frontline caregivers, and compassion fatigue not only affects nurses' health, job satisfaction, job stability, and organizational performance but also has a negative effect on the length of patient stay, treatment outcome, and prognosis. Since

the pandemic began three years ago, the level of compassion fatigue among health care workers has increased dramatically due to changes in work stressors and work resources [32], and psychological problems among nurses have worsened [33]. In this study, 52.2% of nurses had moderate to high levels of compassion fatigue, which was higher than that reported by Labrague [9]. The reason for this may be related to the arrival of the peak of pandemic infection due to the adjustment of China's pandemic prevention policy, where frontline nurses fought for long hours on the frontline of the pandemic and experienced both physical and psychological stress, making them prone to various psychological problems. Previous research has focused on the moderating role of nurses' internal resources on compassion fatigue, ignoring the important influence of external environmental factors; therefore, this study focused on the mechanisms of compassion fatigue in nurses from the external perspective of occupational stressors.

First, the study concluded that occupational stressors had a significant effect on nurses' compassion fatigue, which is consistent with Xie's findings that nurses' stressors increased the risk of nurses' developing compassion fatigue [34, 35]. The significant stressors leading to compassion fatigue among nurses include high work demands, work-family conflict, insufficient support from coworkers or caregivers, workplace violence and bullying, organizational problems and difficulty taking leave, in line with Sinclair's [29] study. On the one hand, these work-related stressors may have hindered nurses' capacity for empathy. The constant exposure of nurses to stressful situations accelerates mental energy drain and makes it easy for them to neglect their own emotional needs [36], leading to compassion fatigue. On the other hand, heavy workloads and intense stress encroach on nurses' emotional recovery time, which potentially accelerates the deterioration of their psychological condition and the development of compassion fatigue. Therefore, by focusing on nurses' work stressors, this study highlights the importance of nursing managers' efforts to alleviate stress by making reasonable arrangements. This includes addressing nurses' work demands, meeting leave requirements, decreasing workplace violence [37], and fostering supportive environments [38] to enhance nurses' stress coping abilities and address compassion fatigue for recognition and recovery [39].

Second, these findings also confirmed that occupational stressors influence nurses' compassion fatigue by reducing perceived organizational support. Previous research has suggested that organizational support as an external resource is more likely to balance job demands and job resources and that nurses also tend to reward the organization with high levels of emotional labour [40], making nurses more likely to overcome and recover from stress.

Interestingly, however, our study revealed that high levels of stressors diminished nurses' perceived organizational support, thus preventing them from recovering from the loss of psychological energy depletion and experiencing compassion fatigue. This may be because when faced with complex stressors from the hospital, nursing practices, family and the changing work environment during the COVID-19 pandemic, nurses require more time and energy to cope with work tasks and thus tend to neglect support from the organization, and the lack of an effective support system brings about more psychological problems. The adverse effects of work stressors on nurses are multifaceted, and few previous studies have explored the effects of stressors on nurses' perceived organizational support. The results of the study show that managers should reduce nurses' perceptions of stress from all aspects of stressors while enhancing nurses' perceived organizational support by establishing reasonable mechanisms and providing multiple organizational support systems to alleviate nurses' compassion fatigue.

Third, this study investigated the moderating effect of ego-resilience on occupational stressors and nurse compassion fatigue, stressors and perceived organizational support, and perceived organizational support and nurse compassion fatigue. Our findings suggest that how nurses cope with stressors and the consequences of being in a stressful situation partly depend on nurses' ability to regulate themselves. This study concluded that ego-resilience mitigates the potential impact of stressors on nurses, i.e., individuals with higher levels of ego-resilience are more likely to perceive support from the organization and to cope with and recover from stress, suggesting that nurses with higher levels of ego-resilience are able to understand and apply certain stress and emotional regulation strategies that enable them to better maintain their psychological well-being and cope with emotional reactions in nursing, thereby improving compassion fatigue. Habibpour et al. [41] also suggested that ego-resilience diminished the impact of stressors on nurses' psychological well-being, which is consistent with our findings. Therefore, there is a need for managers to train nurses in ego-resilience to mitigate the adverse reactions caused by stressors. Additionally, our study revealed that ego-resilience enhances nurses' perceived organizational support in stressful situations, implying that organizational support is effective in consolidating the improvement of nurses' mental health because managers can enhance nurses' ego-resilience. In addition, these findings also raise some concerns about the effectiveness of the support given to nurses in hospitals, highlighting that the quality of the nurse-organizational exchange relationship should be focused on when providing support to nurses, broadening the scope of the current study.

Conclusion

Building on earlier research, this study explored the effect of perceived organizational support and ego-resilience on the association between occupational stressors and compassion fatigue based on a survey of 1,432 frontline nurses in Sichuan Province. This study found that occupational stressors significantly predicted nurse compassion fatigue, perceived organizational support partially mediated the associations that were examined, and ego-resilience moderated the associations between occupational stressors and nurse compassion fatigue, stressors and perceived organizational support, and perceived organizational support and compassion fatigue. JD-R theory and COR theory were used in this study, which complements previous research on the influence of the external environment on nurses' compassion fatigue. With nurses facing complex stressors and daunting pandemic preparedness challenges in the context of the COVID-19 pandemic, attention to nurses' mental health, understanding the mechanisms at play in compassion fatigue and early prevention and intervention are critical for nursing managers.

Limitations and future research directions

Limitation

First, this was a cross-sectional study and may not shed light on the mechanisms underlying the relationship between stressors and compassion fatigue in nurses. Future longitudinal studies could further elucidate the mechanisms by which stressors act on compassion fatigue in nurses. Second, all scales in this study were self-reported by nurses, which may be subject to bias, and future consideration could be given to collecting data from multiple sources, such as nursing leaders and other nursing managers. Finally, this study is based on the context of nurses in Sichuan Province, and its use in other contexts remains somewhat controversial, suggesting that the scope and context of the study could be further expanded.

Implications for nursing management

This study describes the effects of stressors on nurses' compassion fatigue and their mechanisms of action in the context of three years of the COVID-19 pandemic in China. The outbreak of this respiratory disease has had an enormous impact on the world, and nurses have played an important role in this major public health event and will continue to be challenged by nursing reform and other public health events that may arise in the future. Therefore, the traumatic experiences and psychological issues such as emotional exhaustion that nurses experience when dealing with complex work environments and stress should not be overlooked by managers. Managers can support nurses' mental health in a variety of ways,

including fostering a stress-reduction environment in the workplace, focusing on the growth of nurses' ego-resilience to enhance their perceived organizational support and their capacity to recover from stress, encouraging nurses' self-awareness, and providing education on compassion fatigue.

Abbreviations

JD-R	Job Demands-Resources
COR	The Conservation of Resources Theory
OS	Occupational Stressor
POS	Perceived Organizational Support
ER	Ego-Resilience
CF	Compassion Fatigue

Data availability

Data are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was performed in line with the principles of the Declaration of Helsinki and was approved by the Ethics Board at Sichuan Provincial People 's Hospital (No.2023-012,issued on 6 January 2023) and followed informed consent and voluntary participation principles. Study participants were briefed in detail about the purpose and methodology of this study prior to being surveyed so that they could make their own choices about whether or not they wished to participate in the study. All study participants was anonymous can withdraw from the study at any time. Informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

Sichuan Science and Technology Program surpports our study，but all authors declare we have no relevant interests to disclose, include financial and non-financial competing interests.

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