

Impact of Perceived Stress and Resilience on Depression:

A Study in Medical Staff

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Abstract

Background: Depression has become a serious public health problem during the COVID-19 pandemic. However, relatively little is known about the relations between depression, resilience, and perceived stress among medical staff.

Method: A cross-sectional study was conducted among medical staff using an online questionnaire. A total of 1146 participants ($M_{\text{age}} = 36.10$, $SD = 9.37$; 83.1% female) were included. Self-reported depression, resilience, and perceived stress were assessed using the Patient Health Questionnaire (PHQ-9), Connor-Davidson Resilience Scale (CD-RISC-10), and Perceived Stress Scale (PSS-10), respectively.

Results: The prevalence of depression was 24.6% in the current study. Elevated perceived stress was significantly associated with higher levels of depression ($\beta = 0.68$, $p < 0.001$). Furthermore, resilience significantly moderated the relationships between perceived stress and depression ($\beta = -0.18$, $p < 0.001$). That is, resilience significantly lessened the negative impact of perceived stress on depression.

Conclusions: The current study highlights the protective function of resilience over the effect of perceived stress on depression. These findings provide novel insights into the status of depression and its association with perceived stress and resilience among medical staff.

Keywords: depression, resilience, perceived stress, medical staff

1. Introduction

Coronavirus disease 2019 (COVID-19) was first identified in December 2019 in Wuhan City in central China. During the battle with COVID-19, medical staff in Wuhan were working under high-pressure and risky conditions to treat patients with COVID-19 infection. The enormous pressure they have been facing includes the risk of infection at any time, an overwhelming workload, and exhaustion (Kang et al., 2020). Previous studies have shown that medical staff exposed to severe life-threatening situations may experience mental health problems such as stress, depression, anxiety, and anger (Chen et al., 2020; Garfn, Silver, & Holman, 2020). Mental health problems have negative effects on medical staff's attention and decision making and their ability to fight the epidemic (Kang et al., 2020). Therefore, it is important to understand the status of mental health in medical staff and provide appropriate psychological services.

Previous studies have indicated that medical staff experience high rates of depression, especially during anti-pandemic work (Lu, Shu, Chang, & Lung, 2006; Xiao et al., 2020). The prevalence of depression was estimated to be 4%–17.3% among medical staff after the severe acute respiratory syndrome (SARS) epidemic (Lancee, Maunder, & Goldbloom, 2008; Lu, Shu, Chang, & Lung, 2006). A considerable proportion of medical staff (22.2%–50.4%) have reported symptoms of depression during the COVID-19 pandemic (Lai et al., 2020; Xiao et al., 2020). Overall, depression is widespread among medical staff during a pandemic. Therefore, the influencing factors and mechanisms of depression in medical staff are particularly

worth studying.

Among the influencing factors, perceived stress has been identified to be a predictor of depression. According to the transactional theory developed by Lazarus and Folkman (1984), perceived stress is defined as an imbalance between a person's perception of change in his or her environment and his or her ability to have an appropriate coping response to deal with that change. In other words, stress is understood as a subjective experience dependent on perceived resources and demands. It is a process that includes cognitive and emotional perception of stressful events, the development of coping strategies, and the generation of cognitive responses (Sinha, 2001). When individuals perceive an increase in stress, they may experience negative emotional reactions, such as guilt, dissatisfaction, a sense of failure, depressive mood, irritability, and other symptoms associated with depression (Choi & Dancy, 2009). Therefore, a high level of perceived stress increases the risk of depression (Lee et al., 2007), particularly if the individual is unable to cope with the stressor effectively (Liu et al., 2012).

A quasi-experimental study provided empirical support for this. The authors' findings showed that effective management of stress had a significant effect on reducing the level of depression in individuals with drug addiction (Habibi, Tourani, Sadeghi, & Abolghasemi, 2013). In other words, stress levels were positively correlated with depression in drug users. To date, a large number of studies have shown a significant correlation between perceived stress and depression among all kinds of participants. For example, a large community-based cohort study found a

positive correlation between perceived stress and depression in adult women with polycystic ovary syndrome (Damone et al., 2018). The same results were also found in Hispanic smokers (Webb Hooper, McNutt, & Baker, 2015), Chinese heroin addicts (Wang, Xu, Gu, Zhu, & Liang, 2018) and survivors (Lee et al., 2007), as well as in general population youth (McElroy, Wintemberg, Cronk, & Everett, 2015). These results suggest that elevated perceived stress in individuals is associated with high levels of depression.

Moreover, it is possible that not all individuals with high levels of perceived stress will develop depression (Damone et al., 2018; Webb Hooper, McNutt, & Baker, 2015). Indeed, there may be specific factors that may impact perceived stress within individuals, counteracting the negative outcomes. One such protective factor is resilience. Resilience is an umbrella term that has been conceptualized as an ability or characteristic that helps individuals withstand stressors and effectively cope with psychological distress when faced with hardship, stressful life events, or adversity (Connor & Davidson, 2003). Resilience is also characterized by a high level of positive emotion (Tugade & Fredrickson, 2004). According to broaden-and-build theory, positive emotional experience might broaden an individual's instantaneous thought-action category and help him or her build lasting personal resources, such as physical, intellectual, psychological, and social resources, to address future threats (Fredrickson, 2001). Therefore, a resilient individual might have a broadened mindset and more flexible cognition than a nonresilient individual, which might be beneficial for coping with adversity, improving emotional stability and weakening the negative

emotions caused by perceived stress.

The protective role of resilience is supported by a range of research (Ma et al., 2019; Shapero et al., 2018), and studies have indicated that a higher level of resilience buffers against the adverse effects of stress exposure (Wingo et al., 2010; Lim et al., 2015). For example, resilience protects against traumatic stress and symptoms of depression in older Chinese adults exposed to stressful life events (Lim et al., 2015). Importantly, studies have shown that resilience can change the strength of the relationship between perceived stress and depression. High resilience lowers the predictive power of perceived stress for depression. In other words, resilience moderates the association between perceived stress and depression (Anyan & Hjemdal, 2016; Havnen et al., 2020).

Based on the literature, the present study aimed to investigate the status of depression and its association with perceived stress and resilience in medical staff. Consistent with previous studies, we hypothesized that medical staff may be at an elevated risk for depression. In addition, we hypothesized that elevated perceived stress would be associated with higher levels of depression. Finally, we expected that resilience might function as a moderator of the relationship between perceived stress and depression.

2. Methods

2.1. Procedure and participants

A cross-sectional study was carried out from March 12, 2020, to April 17, 2020. The survey protocol was approved by the institutional review board of the authors'

institution. In this study, an online questionnaire survey was conducted by medical staff after informed consent was obtained. The main channels for recruitment were hospitals. Participants were invited to participate in the survey via a WeChat applet that was publicized through posters in hospitals. The inclusion criteria were as follows: 1) age 18 to 60 years old and 2) Chinese-speaking residents of China. A total of 1152 medical staff participated in the present study. Of these participants, 6 (0.5%) were excluded due to incomplete or incorrect information. The final study sample consisted of 1146 (99.5%) medical staff. Of those, 586 participants were from Hubei Province (566 were from Wuhan City in Hubei Province), and 560 participants were from other provinces. In terms of position, 162 were doctors, 604 were nurses, and 380 were staff members, including medical technicians, emergency room attendants, and administrators.

2.2. Measures

2.2.1. Depression

Depression was measured by the nine-item Patient Health Questionnaire-9 (PHQ-9; Kroenke, Spitzer, & Williams, 2001). The PHQ-9 assesses depressive symptoms in the past week. The options for each item range from 0 (*not at all*) to 3 (*nearly every day*). The total PHQ-9 score is calculated by summing the ratings for all symptoms, with a possible range of 0-27. A higher score indicates more depression. Cutoff points of 5, 10, 15 and 20 indicate mild, moderate, moderately severe and severe levels of depressive symptoms, respectively (Kroenke, Spitzer, & Williams, 2001). A cutoff score of 10 or higher indicates the presence of significant depression (Lincoln,

Nicholl, Flannaghan, Leonard, & Van, 2003). The Chinese version of the PHQ-9 has shown good reliability and validity in Chinese populations (Wang et al., 2014). In the present study, Cronbach's alpha value for this measure was 0.91.

2.2.2. Perceived stress

Perceived stress was measured by the ten-item Perceived Stress Scale-10 (PSS-10; Cohen, Kamarck, & Mermelstein, 1983). The PSS-10 is a 10-item scale that assesses the degree to which participants appraise events as stressful during the past month. Items are rated on a 5-point Likert scale ranging from 0 (*never*) to 4 (*very often*). The total score of the PSS-10 ranges from 0 to 40, with higher scores indicating more perceived stress. The Chinese version of the PSS-10 has shown good reliability and validity in Chinese samples (Sun, Gao, Kan, & Shi, 2018). In the present study, Cronbach's alpha value for this measure was 0.81.

2.2.3. Resilience

Resilience was measured by the short version of the Connor-Davidson Resilience Scale (CD-RISC; Campbell-Sills & Stein, 2007), which was originally developed by Connor and Davidson (2003). The short version of the CD-RISC is a 10-item scale that measures the ability to cope with stress and adversity. Items are rated on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*). Higher scores indicate higher levels of resilience. The Chinese version of the CD-RISC has been validated and widely used in Chinese populations (Yu & Zhang, 2007). In the present study, Cronbach's alpha value for this measure was 0.97.

2.2.4. Demographic information

Demographic information included sex (0 = female, 1 = male), age, marital status (0 = single, 1 = married, 2 = other, including remarried, separated, divorced, and widowed), educational level (0 = high school and below, 1 = junior college, 2 = university, 3 = graduate school and above), position (0 = doctor, 1 = nurse, 2 = other, including medical technicians, emergency room attendants, or administrative staff), hours of work per day (0 = 4-6 hours, 1 = 6-8 hours, 2 = 8-10 hours, 3 = > 10 hours), years of work experience (0 = < 1 years, 1 = 2-3 years, 2 = 4-5 years, 3 = 6-10 years, 4 = 10-20 years, 5 = > 20 years), currently residing in Wuhan (0 = no, 1 = yes), and previous trauma experience, such as with a natural disaster, traffic accident, death of a loved one, and SARS (0 = no, 1 = yes).

2.3. Statistical analyses

The statistical analyses were conducted using IBM SPSS Statistics version 21.0 with the PROCESS plug-in for moderation analyses. First, continuous variables were described as the mean and standard deviation (*SD*), and categorical variables were described as the frequency and percentage. Second, Pearson correlations were calculated between depression, perceived stress, resilience, and the demographic variables. Third, the moderating role of resilience was analyzed in the PROCESS plug-in using least squares regression (Hayes, 2013). The total depression score served as the dependent variable (*Y*), perceived stress was an independent variable (*X*), and resilience was entered as a moderator (*W*). To test for the moderation effect, the significance of the interaction term between perceived stress and resilience was tested in a model with depression as the dependent factor. We controlled for sex, age,

and current residence in Wuhan, as previous research has found that these variables affect mental health outcomes (Lai et al., 2020; Özdin, S., & Özdin, S. B., 2020). To eliminate multicollinearity effects among the variables, the data were standardized before analyses (Frazier, Tix, & Barron, 2004). Finally, to examine the form of the interaction, a simple slope test for the association between perceived stress and depression was conducted for low ($-1 SD$) and high ($+1 SD$) levels of resilience.

3. Results

3.1. Descriptive analyses

A total of 1146 medical staff were included in the final data analyses, including 932 (81.3%) females and 214 (18.7%) males. In terms of position, 162 (14.1%) participants were doctors, 604 (52.7%) were nurses, and 380 (33.2%) held other positions. The participants' ages ranged from 18 to 60 years ($M = 36.10$, $SD = 9.37$). The sociodemographic characteristics of the study sample are presented in Table 1. Among the 1146 participants, 418 (36.5%) were considered to suffer from mild levels of depression (score: 5-9), 194 (16.9%) were considered to suffer from moderate levels of depressive symptoms (score: 10-14), 63 (5.5%) were considered to suffer from moderately severe levels of depressive symptoms (score: 15-19), and 25 (2.2%) were considered to suffer from severe levels of depressive symptoms (score: ≥ 20). The mean depression, resilience, and perceived stress scores were 6.64 ($SD = 5.19$), 26.74 ($SD = 9.07$), and 16.01 ($SD = 5.96$), respectively.

TABLE 1 Sociodemographic characteristics of the medical staff (n = 1146)

Variables	Category	N	%
Sex	Male	214	18.7
	Female	932	81.3
Age (years)	18-30	389	33.9
	31-40	396	34.6
	41-50	262	22.9
	51-60	99	8.6
Marital status	Single	303	26.4
	Married	792	69.1
	Other ^a	51	4.5
Educational level	High school or below	42	3.7
	Junior college	196	17.1
	University	766	66.8
	Graduate school or above	142	12.4
Position	Doctors	162	14.1
	Nurses	604	52.7
	Other ^b	380	33.2
Hours of work per day	4-6	105	9.2
	6-8	511	44.6
	8-10	456	39.8
	> 10	74	6.5
Years of work experience	< 1	71	6.2
	2-3	92	8.0
	4-5	88	7.7
	6-10	278	24.3
	11-20	295	25.7
	> 20	322	28.1
Current residence in Wuhan	Yes	566	49.4
	No	580	50.6
Trauma experience	Yes	415	36.2
	No	731	63.8

Note. ^a Other: remarried, separated, divorced, and widowed; ^b Other: medical technicians, emergency room attendants, and administrative staff.

3.2. Correlations between the study variables

Correlations between the study variables are presented in Table 2. The results showed that perceived stress was positively correlated with depression ($r = 0.63, p < 0.001$) and negatively correlated with resilience ($r = -0.54, p < 0.001$). Among the demographic variables, only sex ($r = -0.06, p < 0.05$), age ($r = -0.13, p < 0.001$), and

years of working ($r = -0.12$, $p < 0.001$) were negatively related to depression, and no other sociodemographic variables were associated with depression (all p -values > 0.05).

TABLE 2 Pearson correlations among the target and the control variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. Sex	1											
2. Age	0.21***	1										
3. Marital status	0.06*	0.56***	1									
4. Educational level	0.01	-0.01	0.09**	1								
5. Position	-0.03	0.09**	-0.03	-0.15***	1							
6. Hours of working per day	0.17***	0.23***	0.15***	0.10**	-0.03	1						
7. Years of working	0.10*	0.84***	0.59***	0.04	0.02	0.26***	1					
8. Current residence in Wuhan	0.02	0.12***	-0.01	-0.17***	-0.11***	-0.08**	0.08**	1				
9. Trauma experience	0.02	0.16***	0.09**	-0.05	-0.06*	0.02	0.13***	0.22***	1			
10. PHQ-9	-0.06*	-0.13***	-0.04	-0.01	-0.01	-0.01	-0.12***	0.04	-0.02	1		
11. CD-RISC	-0.01	0.08**	0.05	0.07*	0.01	0.06	0.08**	-0.08**	0.04	-0.31***	1	
12. PSS	-0.08**	-0.12***	-0.06	-0.05	-0.01	-0.04	-0.12***	0.07*	-0.03	0.63***	-0.54***	1
Mean	—	36.10	—	—	—	—	—	—	—	6.64	26.73	16.01
SD	—	9.37	—	—	—	—	—	—	—	5.19	9.07	5.96

Note. Sex: Male= 1, Female= 0; Marital status: 0 = single, 1 = married, 2 = other; Educational level: 0 = high school and below, 1 = junior college, 2 = university, 3 = graduate school and above; Position: 0 = doctors, 1 = nurses, 2 = other; Hours of work per day: 0 = 4-6 hours, 1 = 6-8 hours, 2 = 8-10 hours, 3 = > 10 hours; Years of work experience: 0 = < 1 years, 1 = 2-3 years, 2 = 4-5 years, 3 = 6-10 years, 4 = 10-20 years, 5 = > 20 years; Current residence in Wuhan: 0 = no, 1 = yes; Trauma experience: 0 = no, 1 = yes; PHQ-9 is the score from the Patient Health Questionnaire-9; CD-RISC is the score from the Connor-Davidson Resilience Scale; PSS is the score from the Perceived Stress Scale.

SD: standard deviation.

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

3.3. Moderation analyses

The statistical model examining the moderating effect of resilience on the relationship between perceived stress and depression was significant ($F(6, 1139) = 142.02, p < 0.001, \Delta R^2 = 0.43$). Specifically, as shown in Table 3, both perceived stress ($\beta = 0.68, t = 25.04, p < 0.001$) and resilience ($\beta = 0.06, t = 2.26, p < 0.05$) significantly predicted depression. In addition, the interaction effect of perceived stress and resilience on depression was significant ($\beta = -0.18, t = -7.54, p < 0.001$). This finding indicates that resilience might significantly moderate the effects of perceived stress on depression.

To examine the form of the interaction, a simple slope test for the association between perceived stress and depression was conducted for low ($-1 SD$) and high ($+1 SD$) levels of resilience. As shown in Figure 1, the results showed that the slope was significant both for individuals with low resilience ($\beta = 0.86, t = 21.98, p < 0.001$) and for those with high resilience ($\beta = 0.50, t = 15.25, p < 0.001$). The simple slope value at low resilience was higher than that at high resilience (0.86 vs. 0.50). That is, as perceived stress increased, the depressive symptom score increased, and the depressive symptom score seemed to be lower in the higher resilience group than in the lower resilience group. In addition, when perceived stress was low, individuals with high resilience had greater depression than individuals with low resilience.

TABLE 3 Moderating role of resilience on the associations between perceived stress and depression

Variables	β	SE	t	P	95%CI
Perceived stress	0.68	0.03	25.04	< 0.001	[0.63, 0.73]
Resilience	0.06	0.03	2.26	< 0.05	[0.01, 0.11]
Perceived stress \times Resilience	-0.18	0.02	-7.54	< 0.001	[-0.23, -0.13]
Levels of resilience					
Low ($Z = -1.0$)	0.86	0.04	21.98	< 0.001	[0.78, 0.94]
High ($Z = 1.0$)	0.50	0.03	15.25	< 0.001	[0.44, 0.57]

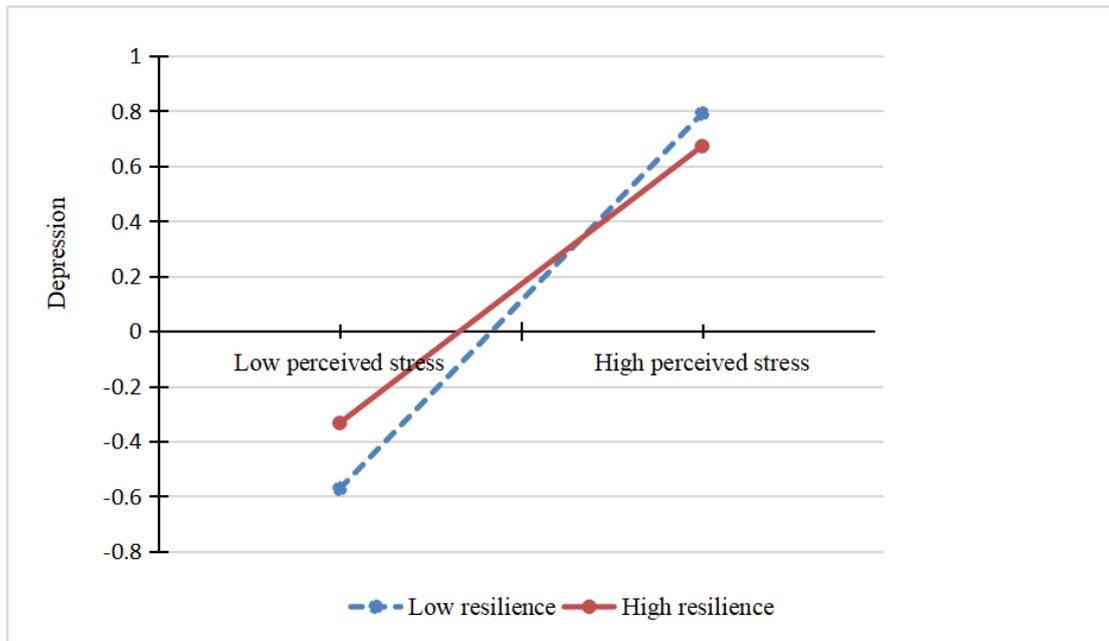


FIGURE 1 Simple regression lines of perceived stress on depression under different levels of resilience.

Note. All the continuous variables used in the PROCESS were standardized in order to avoid multicollinearity; Resilience was divided into two groups, low ($-1 SD$) and high ($+1 SD$) levels of resilience.

4. Discussion

The current study investigated the status of depression and its associations with perceived stress and resilience in medical staff. The results showed that medical staff reported lower levels of depression on the total scores of the PHQ-9. The prevalence of depression was 24.6% in the current study. The prevalence of depression was lower than that reported in a previous study (50.4%; Lai et al., 2020). The inconsistent finding may be explained by differences in the times when the research was conducted. Specifically, a previous study was conducted earlier than our study. In the early period of the epidemic, a lack of specific drugs, the depletion of personal protection equipment, and a lack of knowledge about the disease (Chen et al., 2020) may have contributed to the higher prevalence of depression among medical staff. Nevertheless, the prevalence of depression among medical staff was still higher than

that reported in nonepidemic periods (15.1%; Erdur, 2006).

In addition, with respect to the primary hypothesis, the current findings show that elevated levels of perceived stress were associated with greater levels of depression. Consistent with previous studies (Damone et al., 2018; Wang, Xu, Gu, Zhu, & Liang, 2018), a high level of perceived stress increases the risk of depression. Research on stress and coping suggests that individuals who are experiencing stress may become overwhelmed, leading to the depletion of cognitive and emotional resources (Lazarus & Folkman, 1984), which results in a lack of effective coping strategies. When an individual has less effective coping strategies, they may experience guilt, dissatisfaction, a sense of failure, and other symptoms associated with depression (Choi & Dancy, 2009). Therefore, the greater the amount of perceived stress, the more obvious the increase in an individual's level of depression. In the early stage of COVID-19, the rapid increase in infected and suspected patients and the uncertainty of transmission patterns of the pandemic may have increased the enormous workload and perceived stress level of medical staff (Chen et al., 2020). Moreover, negative emotions from patients and lack of contact with their families (Kang et al., 2020) may have also added to the psychological burden and perceived stress of medical staff. These perceived stress levels of medical staff may further contribute to their higher depression.

Further analysis showed that the relationship between perceived stress and depression was moderated by resilience. That is, resilience served as a protective factor that mitigated the impact of perceived stress on depression. The results also supported our hypothesis. These findings are in line with previous research on the role of resilience as a moderator of stress-related depression (Anyan & Hjemdal, 2016; Havnen et al., 2020). Previous research has demonstrated that resilience as the ability

to bounce back from stress may be a uniquely important personal resource (Smith, Tooley, Christopher, & Kay, 2010). Personal resources include confidence in one's capacity to withstand and overcome stressors, as well as adaptive coping strategies (Moos & Holahan, 2003). Individuals with higher resilience have more adaptive coping strategies (Connor & Davidson, 2003) and therefore show lower depression following stress than those with low resilience. In addition, there is evidence suggesting that high-resilience individuals use positive emotions to rebound from stressful encounters, such as humor and optimistic thinking, and find positive meaning in encounters (Tugade & Fredrickson, 2004). Thus, those with higher resilience can cope with stress and reduce their psychological distress effectively, such as depression (Lim et al., 2015; Shapero et al., 2018).

Finally, it is worth noting that individuals with high resilience had greater depression than those with low resilience when there was low perceived stress. This result suggests that resilience can only show its protective effect when the individual's stress reaches a certain level. This finding was consistent with a prior study (Masten, 2001) that showed that the necessary condition for resilience is that the individual is faced with considerable threats, severe pressure, or high-level destructive changes currently or in the recent past, including long-term unfavorable social environments and traumatic events.

4.1. Limitations

In the interpretation of our findings, the limitations of the present study should be considered. First, the sample size was small, and most of the participants (81.3%) in this study were female medical staff. Although the sex ratio of the sample reflected the sex ratio of the corresponding population, that is, the higher proportion of women than men among medical staff, to a certain extent, the findings of this study must be

interpreted with caution, and the conclusions should be extended carefully. Second, our data were obtained via self-report measures rather than clinically assessed measures, particularly measures of depression. The use of a self-report measure without further clinical observations may only be suggestive of the levels of symptoms and not necessarily imply a clinical diagnosis. Nonetheless, the PHQ-9 is a well-established measure of depression. Future studies should assess depression by clinical observations to verify our findings. Finally, our study was cross-sectional and thus could not verify the causal relationships between these variables. Future longitudinal research is needed to better depict the relationships among perceived stress, resilience, and depression in medical staff.

4.2. Implications

The present study has important practical implications. First, mental health professionals and society should pay more attention to medical staff who have high perceived stress. Prevention and intervention strategies should focus on reducing perceived stress among medical staff to prevent depression. For instance, the provision of adequate external materials, including virus prevention, living and medical supplies, is essential to help medical staff cope with perceived stress. Second, mental health professionals should be provided with guidelines in hospitals and medical centers. Using a cognitive behavioral-based stress management program to increase medical staff's stress management competency is also crucial to confronting perceived stress (Terp, Hjärthag, & Bisholt, 2017). Furthermore, a variety of mental health services through online platforms, such as Weibo and WeChat, should be provided for people in need. Third, improving the resilience of medical staff may be beneficial to a certain extent, as resilience mitigates the adverse effect of perceived stress on depression that contributes to the mental health of medical staff. Resilience

can be enhanced with appropriate interventions. For instance, strengthening social support from family, friends, and colleagues and using cognitive-behavior therapeutic techniques are key strategies to enhance resilience (Steinhardt & Dolbier, 2008).

5. Conclusion

The prevalence of depression was 24.6% in the current study. The results showed that an elevated level of perceived stress was significantly associated with higher levels of depressive symptoms in medical staff. Furthermore, resilience might moderate the association of perceived stress with depression. Specifically, resilience served as a protective factor that mitigated the impact of perceived stress on depression. The present study extends our understanding of depression and its associations with perceived stress and resilience among medical staff.

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