ORIGINAL RESEARCH

Investigation, Analysis, and Management Application of Mental Resilience and Psychosomatic State of the Medical Team Against COVID-19

Xiaoli Xu, MD; Guangyao Li, MM; Shunhong Huang, BM; Sibing Zhang, MM

ABSTRACT

Objective • In the initial stages of the COVID-19 epidemic, frontline medical staff faced numerous psychological pressures, such as shortages of medical supplies, lack of treatment experience, and high risk of infection. This study plans to understand the mental resilience and psychosomatic status of first-line anti-epidemic medical team members to provide a reference for managing their mental health status and the improvement of mental resilience.

Methods • From March 3 to March 5, 2020 a medical team serving as a first-line medical rescue group in Wuhan was chosen as the research subject, with 160 cases. The staff status questionnaire and the Chinese Version of the mental resilience scale were used simultaneously in a mobile phone questionnaire survey on the selected subjects using a cluster sampling method, which refers to the sampling strategy considering an independent cluster as a unit. (Chinese Version of the CD-RISC).

Results • The participants were frontline medical staff against COVID-19. A total of 156 samples were effective, with a 97.5% effective sample rate. The 156 cases investigated included 77 males (49.4%) and 79 females (51.6%), with an average age of 36.50±8.50. There were 22 (14.1%) cases with a junior college diploma or less, 97 (62.2%) cases with a bachelor's degree, and 37 (23.7%) cases with a master's degree or higher. Conversely, men were more tenacious than women (Cohen's d = 0.319, t = 1.997, P = .048). In terms of the psychosomatic state influence score, women had a greater psychosomatic influence than men (F = 3.076, P = .006).

Conclusion • The anti-epidemic task significantly impacts the psychosomatic state of first-line medical personnel, who may require improved social and psychological support. Women experience more stress than men. Frontline medical personnel should seek social support and learn positive stress management techniques. When facing medical emergencies, medical decision-makers also need to pay attention to strengthening the psychosocial support of frontline personnel. (*Altern Ther Health Med.* [E-pub ahead of print.])

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INTRODUCTION

Since the outbreak of the new coronavirus pneumonia (COVID-19) at the end of 2019, which caused a critical global health crisis, a large number of medical staff have been deployed to the forefront of fighting the COVID-19 epidemic, and they have made outstanding contributions to the effective control of the epidemic in Wuhan. In the process of medical treatment and care of patients with COVID-19, frontline medical staff should not only face tremendous demand for medical treatment in patients with severe COVID-19 and a lack of prior treatment experience but also suffer a serious high risk of being easily infected due to its invisibility and various routes of transmission.[1] Additionally, COVID-19 has no specific treatment drugs until now and a high mortality rate of the original strain.[2,3] All of these factors are major stressors for frontline medical staff. Being at long-term exposure to stressors, which inevitably causes a greater impact on physical and mental health, can easily lead to psychological imbalance and disintegration.[4] A meta-analysis showed that during COVID-19, the prevalence of anxiety among frontline medical staff was 23.2%, and the prevalence of depression was 22.8%. Insomnia 38.9%. Much higher than during nonepidemic periods.[5]

Previous studies have confirmed that medical staff who participate in the medical treatment of emerging infectious

diseases (e.g., severe acute respiratory syndrome coronavirus (SARS), Ebola virus disease (EVD) and COVID-19), have a high risk of experiencing posttraumatic stress disorder (PTSD), anxiety and other mental health problems. One study showed that nursing staff members were anxious, depressed, and could not sleep well during the SARS outbreak. An investigation aimed to assess nurses' rapidly changing psychological status during the acute phase of the 2003 SARS outbreak. The results showed that three-unit participants of SARS Intensive Care Unit (ICU), SARS regular, and neurology had significantly higher rates of posttraumatic stress symptoms than those in the CCU (29.7% vs. 11.8%, respectively).[6,7] A rapid review provided quantitative evidence of the psychological impact of epidemic/pandemic outbreaks (i.e., SARS, Middle East Respiratory Syndrome, COVID-19, Ebola, and influenza A) that between 11 and 73.4% of healthcare workers, mainly physicians, nurses, and auxiliary staff, reported posttraumatic stress symptoms, with symptoms lasting after 1-3 years in 10-40%, depressive symptoms in 27.5-50.7%, insomnia symptoms in 34-36.1%, and severe anxiety symptoms in 45% during outbreaks.[8] Chronic and persistent exposure to stress can lead to adverse health consequences by impairing the function of the immune and neuroendocrine systems, activating the hypothalamic-pituitary-adrenal axis and increasing cortisol levels.[9] Enterochromaffin (EC) cells, which function as chemosensors on the gut epithelium, are known to translate environmental cues into serotonin (5-hydroxytryptamine, or 5-HT) production, contributing to intestinal physiology. Interleukin-33 (IL-33) is considered to have a crucial role in the functional process, it triggers calcium influx via a noncanonical signaling pathway, specifically in EC cells, to induce 5-HT secretion.[10] In the early stages of the COVID-19 pandemic, frontline medical staff needed to overcome nervousness and panic, endure enormous work pressure, and face a high risk of infection. These factors are likely to cause psychological abnormalities such as depression, insomnia, and anxiety, further affecting neuroendocrine systems and forming a vicious circle. Therefore, it can be hypothesized that medical staff against COVID-19 in Wuhan were prone to have more psychosomatic disorders.

Personality mediates or regulates the pathological process from environmental stress to psychosomatic disorder. Appropriate mental resilience helps individuals to deal with pressure and reduce negative emotions calmly. The calmness and control shown by individuals with good mental resilience in the face of difficulties and the mental toughness to recover easily after emergency trauma are all favorable factors to reduce occupational stress.[11] We hypothesize that COVID-19 has caused a higher incidence of psychosomatic disorders in medical staff and that good psychological resilience can help medical staff reduce the risk of psychosomatic disorders. This paper aims to investigate the relationship between mental resilience and psychosomatic disorders among medical staff fighting against COVID-19.

MATERIALS AND METHODS

Research participant

From March 3 to March 5, 2020, a medical team participating as a first-line medical rescue group in Wuhan was selected as the research participant, consisting of 160 cases, among which 156 cases were effective samples, with an effective sample rate of 97.5%. Among the 156 cases investigated, 77 were males (49.4%) and 79 were females (51.6%), with an average age of 36.5±8.50 years. There were 22 cases with a junior college degree or less (14.1%), 97 cases with bachelor's degree (62.2%), and 37 cases with a master's degree or above (23.7%). There were 43 doctors (27.6%), 78 nurses (50.0%), and 35 staff (22.4%). 23 people have worked for five years or less (14.7%), 64 people had worked for 6-15 years (41.0%), and 69 people have worked for more than 15 years (44.2%).

Mental assessment scales

A mobile phone questionnaire survey was conducted on the selected participants by means of cluster sampling. The Staff Status Questionnaire (SSQ) and Connor-Davidson Resilience scale-Chinese Version (CD-RISC-CV) based on the Connor Davidson mental resilience scale was prepared.[12,13]

The Staff Status Questionnaire

SSQ was designed according to the research purpose and content, with the following contents collected: gender, age, culture, marital status, job type, working years, and psychological symptoms, and subjective feelings related to the work of fighting against the epidemic. It includes 10 items that could be consolidated into 4 dimensions of "self-feeling", "sense of fatigue", "sleep," and "psychosomatic influence" (Supplementary Table 1). The Cronbach's α of the SSQ is 0.813 in this study.

Connor-Davidson resilience scale-Chinese Version

CD-RISC-CV was first revised by Xiao and applied in various Chinese groups nationwide. It contains 25 items, three factors (tenacity, power, and optimism), and is rated on a scale from 0 to 4. "Tenacity" (13 items with 52 scores in total) is usually considered as indomitable perseverance, and indomitable spirit overcomes difficulties in making a decision to achieve a goal, such as, "I can achieve my goals". "Power" (8 items with 32 scores in total) means confidence and courage to take a risk, such as "past success gives me the confidence to face challenges". "Optimism" (4 items with 16 scores in total) is a personality trait that someone could keep positive, achievable in dilemma, such as, "I can handle it no matter what". The theoretical median value of the scale is 50, and the higher the score is, the better the mental resilience. The Cronbach's α of CD-RISC-CV is 0.793 in this study.

Research Methods

Before quality control assessment, the psychological expert carefully reviewed the assessment tools and items and standardized the guidance language to ensure clarity, authoritative, and consistency in the questionnaire items. For example, "I can see the

humorous side of things" in the questionnaire was adjusted to an expression more consistent with Chinese "I can see the interest side of things". The assessment, in addition to the name, general data, and topic, must be answered completely. The answers should be based on one's actual condition. No communications with other persons were allowed. The detail is a mobile questionnaire created through the "Tencent Documents" app. The platform can automatically collect questionnaires. After the communication group was established, the participants completed the questionnaire on their mobile phones from March 3 to March 5, 2020.

Statistical analysis

SPSS19.0 software was used for statistical processing. The chi-square test was used for intergroup comparisons of classified variable data and the independent sample *t* test or analysis of variance was used for intergroup comparisons of continuous variable data. The least significant difference (LSD) method was used for posterior partwise comparisons. LSD is used for pairwise comparison analysis after analysis of variance to make the results more robust by correcting the *t* value. In the bilateral significance test, $P < .05$ was considered statistically significant.

RESULTS

Comparison of psychological resilience of epidemic prevention personnel with different genders, occupations, and educational levels. The results showed that men's tenacity was higher than women's ($P = .048$) (Table 1). The remaining dimensions did not show significant differences between males and females. The tenacity of the service staff was higher than that of medical staff ($P = .049$) (Table 2). Other indexes also did not show significant differences among staff with different job types. And then, there was no correlation between mental resilience and educational level (Table 3). Among the nursing staff, women made up an absolute proportion. These people had longer contact with COVID-19 patients and more frequent exposure to dangerous specimens such as sputum. Therefore, more emphasis should be placed on the protection of women's psychosomatic health to reduce adverse events such as depression, anxiety, and insomnia.

Psychosomatic status of epidemic prevention personnel of different genders on their own influence degree.

Regarding the psychosomatic state influence score, the psychosomatic influence of the first-line anti-epidemic task on female was greater than that on male. Among males, 37.7% had an unaffected psychosomatic status, and 11.7% were moderately affected. The percentages among females were 16.5% and 22.8%, respectively (Table 4, Figure 1).

Comparison of gender differences in psychosomatic status among epidemic prevention personnel

There was no significant difference between males and females except for the item of " self-feeling" ($P = .084$). In terms of "sense of fatigue", "sleep" and "psychosomatic

Table 1. Comparison of mental resilience by gender.

Dimensions	Male (n = 77)	Female (n = 79)	*t*	*P* value
Optimism	11.44±2.63	11.27±2.60	0.420	.675
Power	25.47±5.31	24.61±4.61	1.080	.282
Tenacity	38.14±8.42	35.47±8.31	1.997	.048[a]
The total score	75.05±15.70	71.34±14.65	1.527	.129

[a]$P < .05$.

Table 2. Comparison of mental resilience by duties

Dimensions	physicians (n = 43)	nurse (n = 78)	Service personnel (n = 35)	F	*P* value
Optimism	11.26±2.23	11.18±2.65	11.89±3.45	0.534	.588
Power	24.60±4.44	24.49±4.87	27.17±6.41	2.218	.113
Tenacity	37.05±6.66	35.31±8.42[a]	40.61±11.21	3.076	.049[a]
The total score	72.91±12.66	70.97±15.06	79.67±15.30	2.414	.093

[a]$P < .05$.

Table 3. Comparison of psychological resilience by educational levels.

Dimensions	College degree or below (n = 22)	bachelor's degree (n = 97)	master's degree or above (n = 37)	F	*P* value
Optimism	11.68±3.60	11.34±2.51	11.19±2.18	0.247	.782
Power	26.59±6.50	24.97±4.84	24.27±4.15	1.533	.219
Tenacity	38.77±11.26	36.49±8.44	36.38±6.35	0.707	.495
The total score	77.05±20.45	72.80±15.06	71.84±11.83	0.879	.417

Table 4. Comparison of degree of psychosomatic status by gender

Project	Male (n = 77)		Female (n = 79)		χ^2	*P* value
	n	%	n	%		
No effect	29	37.7	13	16.5	10.204	.006[a]
Mild	39	50.6	48	60.8		
Moderate	9	11.7	18	22.8		
Severe	0	0	0	0		

[a]$P < .01$.

Figure 1. Pie plots of psychosomatic status degree by gender.

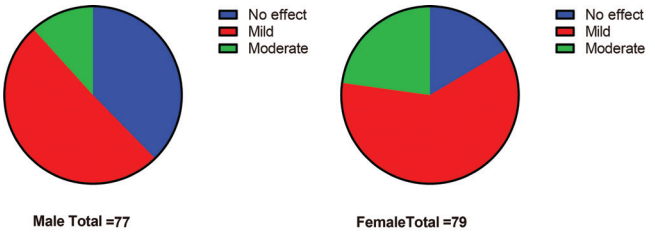

Table 5. Status comparison of epidemic prevention personnel of different genders.

Dimensions	Male (n = 77)		Female (n = 79		χ^2	*P* value
	n	%	n	%		
Self-feeling						
Good	43	55.8	30	38.0	2.993	.084
Poor	34	44.2	49	62.0		
Sense of fatigue						
Tired	31	40.3	55	69.6	16.020	<.001[b]
Fair or not tired	46	59.7	24	30.4		
Sleep						
Good	30	39.0	19	24.1	4.024	.045[a]
Poor	47	61.0	60	75.9		
Psychosomatic influence						
Impact	49	63.6	63	79.7	4.998	.025[a]
No effect	28	36.4	16	20.3		

[a]$P < .05$
[b]$P < .001$.

Table 6. Comparison of the status of epidemic prevention personnel with different duties.

Dimensions	Clinician (n = 43)		Nurse (n = 78)		Attendant (n = 35)		χ^2	*P* value
	n	%	n	%	n	%		
Self-feeling								
Good	20	46.5	28	35.9	29	82.8	13.315	.001[a]
Poor	23	53.5	50	64.1	6	17.2		
Sense of fatigue								
Tired	17	39.5	58	74.4	10	28.5	21.265	<.001[c]
Fair or not tired	26	60.5	20	25.6	25	71.5		
Sleep								
Very good	16	37.2	21	26.9	14	40.0	1.856	.395
Poor	27	62.8	57	74.1	21	60.0		
Psychosomatic influence								
Impact	30	69.7	64	82.1	16	45.7	11.005	.004[b]
No effect	13	30.2	14	17.9	19	54.3		

[a]$P < .05$
[b]$P < .01$
[c]$P < .001$.

influence", the proportion of males with corresponding conditions was significantly lower than that of females ($P < .001$, $P = .045$, $P = .025$, respectively) (Table 5).

Comparison of different duties of psychosomatic status in epidemic prevention personnel

We compared the psychosomatic state of epidemic prevention between medical workers in different positions. There was no significant difference in the "sleep condition" among the epidemic prevention personnel of different positions ($P = .395$). Regarding "self-feeling", "sense of fatigue" and "psychosomatic influence", there were significant differences among epidemic prevention workers with different levels ($P < .01$) (Table 6).

DISCUSSIONS

Our results showed that the level of mental resilience of the medical team was higher than that of the social norm, reinforcing the team's ability to cope with stress. A previous study demonstrated a significant correlation between mental resilience and occupational stress ($\beta = 0.318$; $P < .001$).[14] In this study, the mental and physical well-being of personnel of different genders and different levels were significantly affected, resulting in a higher proportion of insomnia and a greater sense of mental and physical fatigue. This might be related to the high intensity and long-term task and the corresponding risks. A previous study of health care workers found that medical workers suffered from depression, anxiety, psychological distress and poor sleep quality during the COVID-19 pandemic.[4] A meta-analysis concluded that during COVID-19, the prevalence of anxiety among frontline medical staff was 23.2%, depression was 22.8%, and insomnia was 38.9%, which are much higher than those among social normality and medical staff during nonepidemic periods. The data therefore also reflect the broader context of psychological challenges faced by healthcare workers during the COVID-19 pandemic.[5] The occurrence of psychological problems is related not only to the individual's own psychological quality, but also to the living environment.[15] Therefore, it is necessary to strengthen psychological support, sleep management and public awareness. Meanwhile, medical personnel should be encouraged to seek self-adjustment methods and provide mutual support to reduce pressure.[16] Then, a warm environment and family support also help to reduce the occurrence of psychological problems.

Psychological resilience refers to the subject's psychological and behavioral response to the changing environment. The greater the psychological resilience is, the stronger the individual's ability to regulate the external environment and the higher the level of adaptability. Individuals with high mental resilience have a low degree of psychological trauma, rapid recovery and high success rate in coping with negative events.[17-19] In performing such tasks in men and responding to adapt to the environment, men will be better than women. The state and the staff in the questionnaire in "fatigue" and "sleep" and "psychosomatic influence" on entry, both men appeared in proportion to the corresponding condition below women, which highly supports the conclusion that the depression and anxiety of the nursing staff were more serious during COVID-19 pandemic.[20,21] Correspondingly, during COVID-19, female medical staff are at greater risk of depression (Odds ratio: 2.21; 95% Confidence interval: 1.63, 3.01; $P < .001$) and anxiety (Odds ratio: 1.98; 95% Confidence interval: 1.43, 2.75; $P < .001$) than male medical staff.[22] The noted burden fell particularly heavily on young women.[23] This suggests that women need better protection and more psychological care while performing tasks. In the results of mental resilience at different levels, the tenacity of the service staff was significantly higher than that of the medical staff ($P = .049$), which might be associated with the high frequency and intensity of the training received by service personnel, supporting the point that the mental resilience level of the medical personnel is higher than social norms. It is suggested that the training of psychological adaptability should be strengthened in the future. Among the nursing staff, women made up an absolute proportion. These people had longer contact with COVID-19 patients and more frequent exposure to infected specimens. Therefore, female nurses have a higher risk of mental illness. However, surprisingly, we showed no significant difference in mental resilience among different educational backgrounds, which is inconsistent with a previous study.[24] The reason for the inconsistency of the survey results may be due to differences in the background of major epidemiological events. Zhao et al. investigated nurses in daily departmental work,[24] and the medical staff investigated in this work was in the early stage of the COVID-19 pandemic. Educational background may not significantly affect mental resilience in the face of diseases that are not fully understood. Further investigation is needed to confirm these differences. For example, a survey was conducted on the medical staff in this study in their daily work (non-COVID-19 pandemic).

Reasonable and scientific task planning, resource allocation, rest time and team support are very important in managing stress and fatigue, which will help to enhance psychological resilience and improve the physical and mental

health of personnel. Studies have shown that it is an effective scientific method to extend the task period to make overall planning of task division, achieve the optimal allocation of human resources, and give team members necessary rest in turn.[25] In similar tasks, we recommend strategies such as optimizing task division, increasing nurse numbers, promoting rotation, organizing activities, and enhancing occupational protection.

Based on the results of this study, the impact of the COVID-19 pandemic is different among medical staff of different genders and different job types. The frontline work against the pandemic has a greater impact on psychosomatic status in females than in males. At the same time, fatigue and sleep disorders caused by frontline work are also more obvious among female and nurse populations. Therefore, in frontline work against major epidemiological events, more attention should be given to the female and nurse populations to reduce the adverse impact on psychosomatic status. There was higher mental resilience of service staff compared to medical staff, potentially due to the intensity of training.

There are, however, several limitations worth noting. First, this study aims to conduct comparisons of psychosomatic state, the resilience of gender group, different educational level, and different duties in frontline medical staff in Wuhan, so non- frontline medical staff as control group were not recruited in the recent study. Second, the absence of a nonfrontline medical staff control group and the use of nonparametric tests affected data collection. The sample size was relatively small, and larger cohorts are needed to validate the study results. Therefore, further validation in larger cohorts is needed to better evaluate the results of this study.

CONCLUSION

In summary, because of the frontline medical fear of infection, long working hours, and emotional toll, COVID-19 has affected the psychosomatic state of medical team members under the unique challenges posed by dealing with a highly contagious virus. This study suggests that t decision-makers should provide internal and external support networks for the organization that can strengthen organizational management, life security, and daily psychological counseling. Extending the task period, planning the division of tasks as a whole, realizing the optimal allocation of human resources, and taking turns to give team members the necessary rest are also practices to ensure the well-being of medical team members. Regular counseling sessions and access to mental health resources can contribute to their overall well-being by relieving psychological pressure. Females (mostly nurses) need to face patients for a long time and are inevitably exposed to pollutants that cause more psychological pressure than males. Social and medical decision-makers should encourage medical team members to actively seek help and support, destigmatizing the act of seeking assistance for stress-related issues. Communication within the medical team was also effective and could encourage open dialog about stressors, concerns, and coping mechanisms. Meanwhile, medical team members should also take the initiative to seek help, actively deal with, strengthen communication and alleviate the psychological impact caused by stress. In addition, medical team members can adopt practical coping strategies to manage stress, such as mindfulness practices, physical activity, and maintaining a healthy work-life balance. Disasters such as COVID-19 are unpredictable, and the lessons learned from this study can contribute to improved preparedness and support strategies for medical team members in times of crisis.

AUTHOR CONTRIBUTIONS

Xu Xiaoli and Li Guangyao contributed equally to this work and considered cofirst authorhs..

ABBREVIATIONS

5-HT, 5-hydroxytryptamine; CD-RISC-CV, Connor-Davidson resilience scale-Chinese Version; COVID-19, Coronavirus disease 2019; EC, Enterochromaffin; EVD, Ebola virus disease; ICU, Intensive Care Unit; IL-33, Interleukin-33; LSD, least significant difference; PTSD, posttraumatic stress disorder; SARS, Severe acute respiratory syndrome coronavirus; SSQ, Staff Status Questionnaire.

ACKNOWLEDGEMENTS

The authors greatly appreciate the staff of all medical team members for their cooperation and the Military Medical Research editorial office staff for their hard work.

FUNDING

The National Social Science Fund of China (Key Projects) 17AGL024.

COMPETING INTERESTS

The authors declare that they have no conflict of interest.

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Supplementary Table 1. Staff Status Questionnaire

Staff Status Questionnaire (SSQ)		
		Date:
Index	Dimension	Answer
Gender		
	Male	
	Female	
Age		
Working years		
Culture		
	College degree or below	
	Bachelor degree	
	Master's degree or above	
Job type		
	Physicians	
	Nurse	
	Attendant	
Marital status		
	Unmarried	
	Married	
	Divorced	
Self-feeling (0: Good; 1-2: Poor)		
	Can others easily change my opinion?	Y(1)/N(0)
	My behavior often depends on what I feel others want me to do?	Y(1)/N(0)
Sense of fatigue (0-1: Fair or not tired; 2-3: Tired)		
	Do you need more rest?	Y(1)/N(0)
	Do you feel hard to concentrate?	Y(1)/N(0)
	Recently, is your memory worse than it used to be?	Y(1)/N(0)
Sleep (0: Good; 1-2: Poor)		
	Recently, do you think your subjective sleep quality is bad?	Y(1)/N(0)
	Do you need sleeping aids to help you sleep?	Y(1)/N(0)
Psychosomatic influence (0-1: No effect; 2-3: Impact)		
	Do you feel that the outbreak of the Covid19 pandemic has significantly changed your living habits?	Y(1)/N(0)
	Do you often feel stressed, depressed, or anxious?	Y(1)/N(0)
	How has the relationship between you and your family been affected by the Covid19 pandemic?	Worse (1)/No effect or better (0)