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Psychological responses of medical staff during COVID-19 and the adjustment effect of brief mindfulness meditation

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ABSTRACT

Background: COVID-19 has posed an unprecedented threat to public health and remains a critical challenge for medical staff, especially those who have been fighting against the virus in Wuhan, China. Limited data have been reported regarding the psychological status of these medical staff members. Therefore, we conducted this study to explore the mental health status of medical staff and the efficacy of brief mindfulness meditation (BMM) in improving their mental health.
Methods: A survey was conducted between April 18 and May 3, 2020. Upon completing the pre-test, participants in the treatment group received a 15-min BMM intervention every day at 8 p.m. Post-test questionnaires were completed after 16 days of therapy. The questionnaire comprised demographic data and psychological measurement scales. The levels of pre and post-test depression, anxiety, stress, and insomnia were assessed using the 9-item Patient Health Questionnaire, 7-item Generalized Anxiety Disorder Scale, Perceived Stress Scale, and Athens Insomnia Scale, respectively.
Results: A total of 134 completed questionnaires were received. Of the medical staff, 6.7%, 1.5%, and 26.7% reported symptoms of depression, anxiety, and insomnia, respectively. Public officials from military hospitals reported experiencing greater pressure than private officials ($t = 2.39$, $p = 0.018$, $d = 0.50$). Additionally, BMM treatment appeared to effectively alleviate insomnia ($t = 2.27$, $p = 0.027$, $d = 0.28$).
Conclusions: The medical staff suffered negative psychological effects during the COVID-19 pandemic. BMM interventions are advantageous in supporting the mental health of medical staff.

1. Introduction

The rapid increase in the number of cases of coronavirus disease 2019 (COVID-19) after its outbreak has posed a serious challenge to public health. COVID-19 has become one of the most serious public health emergencies in human history. As of October 27, 2021, the virus has spread to 214 countries and infected more than 280 million people, resulting in over 4.97 million deaths. Worldwide concerns have arisen from the pandemic as COVID-19 has adverse effects on personal health, societal development, and the national economy. Fear about the spread of the virus and abrupt changes in the way of life due to self-isolation or quarantine requirements, have resulted in tremendous psychological distress, especially among medical staff [1].

Medical staff have been working as the first line of defense against COVID-19. They have undertaken extensive medical work and have experienced a high risk of infection and fatality. Compared to the general population, medical staff are more vulnerable to sustained psychological stress [2]. In particular, those who have been working in hospitals supporting patients with confirmed or suspected COVID-19, fear being infected and transmitting the virus to their family, friends, or colleagues [1]. A survey focusing on mental health among healthcare workers showed that rates of depression, anxiety, insomnia, and distress

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were up to 50.4%, 44.6%, 34.0%, and 71.5%, respectively [3]; nurses were more likely to show symptoms of anxiety than other medical staff members during the COVID-19 pandemic [4]. In addition, the risk of posttraumatic stress has been high among medical staff. Similarly, during the severe acute respiratory syndrome (SARS) epidemic, symptoms of psychological distress were widespread among the medical staff. Fear and anxiety may reach a peak at the start of the outbreak and decrease gradually with the stable spread of the virus, while depression and posttraumatic stress symptoms tend to appear later and can possibly last for a long time [5–7]. Thus, effective and enforceable psychological crisis interventions are needed to promote the recovery of medical staff from adverse psychological conditions.

Mindfulness meditation, a form of spiritual training, is widely accepted as a form of psychological treatment in clinics. An integrated literature review indicated that mindfulness meditation had a positive impact on decreasing the levels of stress, anxiety, depression, and burnout, as well as on the sense of well-being, and empathy among nurses and nursing students [8]. However, the application of mindfulness meditation is limited by its associated time consumption, teacher shortage, and high cost. Thus, brief mindfulness meditation (BMM), a new variant of meditation, has attracted increasing attention. For example, a previous study demonstrated the emotional benefits of BMM in modulating negative affectivity [9]. A 20 min/day, 4-day BMM program showed a reduction in negative feelings such as fatigue and anxiety, and an improvement in cognitive functioning [10]. However, another study showed that 3 days of 25-min BMM reduced self-reported stress reactivity but increased salivary cortisol level [11]. Thus, the specific effects of BMM on medical staff remain unclear.

BMM has several variant forms and is not limited by time or location. In our previous study, we developed a 15-min BMM called JW2016. This form of BMM is based on the core concepts of mindfulness, practical experience, and data from scientific reports on meditation. The study showed that JW2016 BMM was effective in maintaining a peaceful mind and decreasing the influence of negative emotional stimuli [12]. Therefore, in this study, we aim to explore the mental status of medical staff in the fight against COVID-19 and the efficacy of the JW2016 BMM as a mental health intervention.

2. Method

2.1. Participants

For the survey, we recruited medical staff who were back from providing assistance in Wuhan. All staff members were voluntarily recruited and experienced in their work. With full consideration, the government combined doctors, nurses, and volunteers into a medical team. They departed during the COVID-19 outbreak in Wuhan and stayed there for 78–95 days. Thus, participants meeting the following criteria were enrolled in this study: (1) working history in the frontline fight against COVID-19 in Wuhan, (2) over 18 years of age, (3) had access to the Internet, and (4) were willing to attend the BMM program. The exclusion criteria were as follows: (1) history of participation in a meditation program, (2) serious physical or mental illness, and (3) failure to participate in all scheduled sessions. Data were collected from April 18 to May 3, 2020. Ethical approval for this study was granted by the Naval Medical University and registered in the Chinese Clinical Trial Registry (ChiCTR2000039002). Questionnaires were distributed to all participants before and after the intervention. All the participants signed informed consent forms and had the right to quit the experiment at any time.

2.2. Procedures

The experimental procedure lasted for 16 days and consisted of 3 sections: pre-test, intervention, and post-test. After the pre-test, all participants were randomly divided into two groups: a control group (N = 47) and a BMM group (treatment group, N = 87). A 15-min BMM intervention was provided every day at 8 p.m. Post-test questionnaires were completed after 16 days of quarantine.

All 87 BMM group participants attended training at the same time every day. Before the first training session, the participants attended a lecture. They then followed the BMM instructions using electronic equipment. Participants were instructed to close their eyes, relax, and focus on the flow of breath. If thoughts came randomly, the participants were instructed to passively notice them and simply let them go by bringing attention back to their breathing. As a manipulation check after each meditation session, each participant was asked, "Did you feel that you were truly meditating?" Further, it is important to note that the participants were allowed to ask questions about meditation training [12].

2.3. Questionnaire

The questionnaire was composed of basic demographic data and psychological measurement scales.

The basic demographic data included gender, age, identification (public official or private citizen), occupation, level of education, department, technical level, childcare, parent situation, days of combating the epidemic, the impact of the virus on daily life, and impact of the virus on marriage. Public officials in this study referred to doctors, nurses, and hospital managers in the government.

The 9-item Patient Health Questionnaire (PHQ-9), 7-item Generalized Anxiety Disorder Scale (GAD-7), Perceived Stress Scale (PSS), and Athens Insomnia Scale (AIS) scores were used to assess the mental health status of the workers. The PHQ-9 is a self-report scale with good reliability and validity used to evaluate the severity of depression [13]. It contains several questions on medication, lifestyle risks, smoking, alcohol consumption, diet, general well-being, and current health. The GAD-7 is a clinical tool for assessing subjective anxiety and has extensive reliability and validity [14]. Seven items were assessed in this scale, including the degree to which the participant has trouble relaxing. The PSS is a 14-item scale that measures the general perception of stress [15]. The reliability and validity of this scale have been verified by numerous studies in many countries [16–18]. The AIS is a subjective assessment of the severity of insomnia, with a total of eight items [19]. The items included questions about waking during the night, total sleep duration, overall sleep quality, and so on. All four scales have one thing in common: the higher the score, the more severe the symptom.

2.4. Statistical analysis

Statistical analyses were performed using SPSS software (Version 22.0). Basic demographic data were assessed using descriptive analysis. Count data were expressed using descriptive statistics, including frequencies and percentages. Means and standard deviations (SD) were used to express the continuous variables. The impacts of gender, identification, and occupation on the mental health status of medical staff were evaluated using dependent sample t-tests. A dependent sample *t*-test was used to analyze within-group effects (pre-vs. post-test), whereas an independent sample *t*-test was applied to assess between-group effects (control vs. BMM group). A multiple linear regression analysis was performed to explore the factors that influenced the PSS total scores. Post hoc power analyses were conducted using GPower 3.1 and statistical significance was set at $p < 0.05$.

3. Results

3.1. Demographic characteristics

Fig. 1 shows the flowchart of the enrollment process. Initially, 179 staff members were eligible for inclusion in the study. As such, they were randomly assigned to control (N = 89) and intervention groups (N =

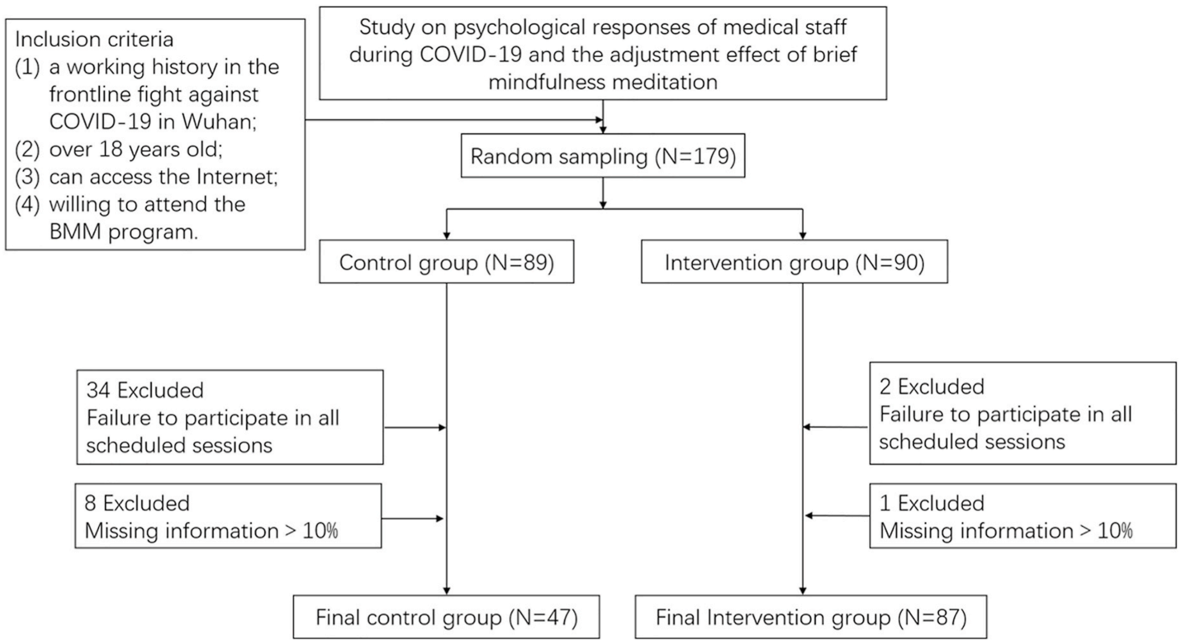

Fig. 1. Enrollment of medical stuff fight against COVID-19.

90). Among them, 36 were excluded because they had attended other missions and missed posttests. After data quality control, nine participants were excluded because of missing information (>10%). Our final sample comprised 134 staff members, with 47 in the control group and 87 in the intervention group.

The study sample consisted of 34 doctors (25.4%), 86 nurses (64.2%), and 14 medical volunteers (10.4%). The majority of participants were female (70.1%), aged 21–40 years (76.9%), and working in wards (89.5%). Most had educational levels of at least an undergraduate degree (79.9%) and had minor children (83.8%). Most participants considered that COVID-19 had little impact on normal life (89.8%) and marriage (71.1%). Thirty (25%) public officials were included in the study. At least one participant had a dependent parent who lived with them. All patients had stayed in Wuhan for at least 60 days. Professional qualification results were as follows: 57 (44.2%) had primary titles, 47 (36.4%) intermediate titles, and 25 (19.4%) senior titles. The results are presented in Table 1.

3.2. *Mental status of medical staff*

The pre-test mental status results are shown in Table 2. The mean scores of the PHQ-9, GAD-7, PSS, and AIS were 3.76 (SD = 3.40), 2.04 (SD = 2.81), 15.96 (SD = 5.93), and 4.14 (SD = 3.58), respectively. The prevalence rates of depression (PHQ-9 score>9), anxiety (GAD-7 score>9), and insomnia (AIS score>6) were 6.7, 1.5, and 26.7%, respectively. The impact of gender, identification, and occupational differences on these four scales was assessed using t-tests. The differences in psychological status among participants with different identifications were significant. As shown in Table 2, public officials scored significantly higher on PSS items than non-military personnel, which implies that public officials were under greater pressure ($t = 2.39$, $p = 0.018$, $d = 0.50$).

3.3. *Effects of BMM*

The PHQ-9, GAD-7, PSS, and AIS scores of the BMM and control groups are shown in Table 3. The results of within-group t-tests between pre and post-tests reflected a decrease in post-test PHQ-9 ($t = 3.84$, $p < 0.001$, $d = 0.43$) and AIS scores ($t = 2.27$, $p = 0.027$, $d = 0.28$) in the BMM group. A decrease in the post-test PHQ-9 score was also observed in the within-group *t*-test in the control group ($t = 2.46$, $p = 0.021$, $d = 0.51$). There were no significant differences in the PHQ-9, GAD-7, PSS, and AIS scores between the BMM and control groups.

3.4. *Post-hoc power analysis*

Post-hoc power analysis showed that the sample power to demonstrate significant differences in post-intervention PHQ-9 and AIS ranged from 0.94 to 1 in both groups, which were all above 0.94. However, the sample size did not have sufficient power to detect statistically significant effects for the significant differences in the post-intervention PSS (sample power = 0.08) and GAD-7 (sample power = 0.78). The study only had a power of 0.11–0.21 to detect significant group differences in pre-post mean changes.

4. Discussion

This trial aimed to explore the mental health status of medical staff and the efficacy of BMM in terms of depression, anxiety, stress, and insomnia. In this survey, the total prevalence rates of depression, anxiety, and insomnia in the 134 participants were 6.7%, 1.5%, and 26.7%, respectively. This result shows that a substantial proportion of medical staff who helped fight COVID-19 in Wuhan had mental health problems, especially insomnia. Likewise, the psychological health level of health workers was moderately high in a study by Zhu et al. [20]. A total of 681 (13.5%) health workers reported depressive symptoms, while 1218 (24.1%) suffered from anxiety. This difference may be attributed to the time point of the measurement. Our study was conducted on April 18, 2020 when the pandemic was under control in China. Nevertheless, the study by Zhu et al. was conducted in February, when the new virus had just begun to spread, and little was known about the risk of infection. The psychological status of the medical staff in response to the COVID-19 outbreak tended to gradually improve over time. The insomnia rate in a previous study was 34%, which is similar to the rate in our study [3]. Long working hours, high-intensity work, sleep disturbance, and high psychological pressure contributed to severe sleep disorders.

Moreover, the medical staff suffered from a high level of stress. Furthermore, public officials were more likely to be affected than private citizens. This may be because in addition to their daily medical

Table 1
The descriptive characteristics of the participants.

Variables	Number (%)
Gender	
Male	40 (29.9%)
Female	94 (70.1%)
Age	
21-30	46 (34.3%)
31-40	57 (42.6%)
41-50	23 (17.1%)
51-60	8 (6%)
Identification	
Public official	30 (25%)
Private citizen	90 (75%)
Occupation	
Doctor	34 (25.4%)
Nurse	86 (64.2%)
Others	14 (10.4%)
Level of education	
Short-cycle Courses and Under	27 (20.1%)
Undergraduate	70 (52.2%)
Postgraduate	24 (17.9%)
Doctor	13 (9.7%)
Department	
ICU	27 (20.3%)
General ward	92 (69.2%)
mobile field hospital	0 (0%)
non-clinical department	14 (10.5%)
Technical level	
Junior	57 (44.2%)
Intermediate	47 (36.4%)
Senior	25 (19.4%)
Children situation	
None	3 (3.8%)
minor children	67 (83.8%)
grown-up children	10 (12.5%)
Parent situation	
None	0 (0%)
One	39 (36.4%)
Two or more	68 (63.6%)
Days of combating the epidemic	
60-80	64 (47.8%)
>80	70 (52.2%)
Impact on life	
None	32 (25.2%)
Minor	38 (29.9%)
General	44 (34.6%)
Large	8 (6.3%)
Enormous	5 (3.9%)
Impact on marriage	
Positive	32 (23.9%)
Negative	2 (1.5%)
None	96 (71.1%)
Others	4 (3%)

work, they were under more pressure due to the requirements of their superiors and a sense of social responsibility. The mean score of the participants was much higher than the established community standard of 12. Multiple reasons could explain this phenomenon, such as the fear of contracting a new highly infectious virus, long working hours, adverse working conditions, being away from family, physical deterioration, and worries about unknowingly transmitting the virus to loved ones.

We further assessed the effectiveness of BMM. Our results provide empirical evidence of the significant effects of the 16-day BMM intervention. BMM played a role in alleviating the symptoms of insomnia in medical staff who were back from the frontline in Wuhan. A similar positive impact of mindfulness meditation was found on the mental health of female teachers during the COVID-19 outbreak in Italy where an 8-week mindfulness-oriented meditation course effectively relieved anxiety, depression, emotional exhaustion, and other negative psychological symptoms [21]. However, there were no significant differences between the intervention and control groups. This may have been due to the relatively small number of subjects in this study, which could have led to a large standard deviation during data analysis. The BMM group also showed reduced levels of depression, as measured by the PHQ-9. However, the same trend was observed in the control group. No statistically significant differences were observed between the BMM and control groups. Insignificant improvements related to stress and anxiety were also found in the BMM group after the intervention. These results were consistent with those of our previous study [12]. All the participants were healthy individuals without a diagnosis of depression or anxiety. Multiple studies have shown that meditation improves symptoms in patients diagnosed with major depression or anxiety [22,23]. The limited improvement among healthy individuals may be explained by a ceiling effect. However, the duration of the intervention may have needed extension. A previous study showed that assessing the effects of meditation at the end of a two-week intervention, which is a relatively short period, did not allow the full effect of meditation to emerge [24].

With the continuous spread of COVID-19, it is important to pay attention to the mental health of medical staff, especially those working on the frontline and to prepare health care systems. Our findings provide some reference points and have important clinical implications. The results show negative psychological changes in most medical staff who have worked on the frontline. In addition to focusing on frontline healthcare workers fighting against COVID-19, we also need to focus on those back from Wuhan. We aimed to identify high-risk groups based on the demographic information provided by the questionnaires. Demographic data showed that public officials suffered from higher levels of stress than other people. Our findings delineate the efficacy of BMM and recommend it as an effective way for medical staff to regulate their psychological status. It is beneficial not only in relieving the negative mental status of frontline medical staff but also in treating the residual symptoms when they return. In addition, BMM is easy to use, time-saving, and economical, which makes it suitable for large-scale applications. BMM and other convenient interventions should be properly tailored to help maintain the mental health of medical staff.

Although the results of our study are significant, several limitations should be considered. First, as the study was composed of a small sample size, there was insufficient power to detect statistically significant effects

Table 2
Descriptive statistics of PSS, PHQ, GAD and differences between different genders, identities and occupations.

	Mean ± SD	participants above cutoff score %	*t*-test for gender			*t*-test for identification			ANOVA for occupation			
			Mean ± SD of male	Mean ± SD of female	t,d	Mean ± SD of soldier	Mean ± SD of others	t,d	Mean ± SD of doctor	Mean ± SD of nurse	Mean ± SD of others	F,η2
PSS	15.96 ± 5.93	/	16.88 ± 6.10	15.47 ± 5.79	1.26 , 0.24	18.20 ± 5.18	15.36 ± 5.78	**2.39*** , **0.50**	16.65 ± 6.36	15.43 ± 5.84	16.85 ± 5.12	0.73, 0.01
PHQ	3.76 ± 3.40	6.7%	3.23 ± 3.91	3.99 ± 3.16	−1.19 , -0.22	4.53 ± 4.37	3.66 ± 3.01	1.23 , 0.26	3.41 ± 4.24	4.10 ± 3.11	2.50 ± 2.68	1.59, 0.02
GAD	2.04 ± 2.81	1.5%	1.95 ± 2.56	2.11 ± 2.93	−0.29 , -0.05	2.57 ± 3.10	1.91 ± 2.76	1.09 , 0.23	1.82 ± 2.55	2.18 ± 2.94	1.86 ± 2.80	0.24, 0.79
AIS	4.14 ± 3.58	26.7%	4.68 ± 4.35	4.71 ± 3.52	−0.05 , -0.01	5.40 ± 4.63	4.51 ± 3.45	0.27 , 0.07	4.56 ± 0.65	4.83 ± 0.41	4.39 ± 1.02	0.15,0.002

Table 3
Results of pre- and post-test outcomes of PSS, PHQ, GAD, and AIS scores in two groups using t-tests.

		Mean ± SD		Mean change from pre-test Mean ± SD		Within-group *t*-test *t, d*		Between-group *t*-test	Between-group *t*-test for mean change
		BMM	Control	BMM	control	BMM	control	*t, d*	*t, d*
PSS	Pre	15.94 ± 5.29	16.69 ± 5.13					−0.11, −0.03	
	Post	15.82 ± 4.65	15.73 ± 5.72	−0.12 ± 1.05	−0.96 ± 1.44	0.11, 0.02	0.67, 0.18	0.07, 0.02	0.47, 0.11
PHQ	Pre	3.06 ± 2.99	3.73 ± 3.09					−0.92, −0.22	
	Post	1.82 ± 2.72	2.27 ± 2.55	−1.24 ± 2.88	−1.46 ± 3.04	**3.84***, 0.43**	**2.46*, 0.51**	−0.70, −0.17	0.36, 0.09
GAD	Pre	1.52 ± 2.57	1.96 ± 2.41					−0.73, −0.18	
	Post	1.00 ± 2.41	1.12 ± 1.93	−0.52 ± 2.19	−0.85 ± 2.20	1.68, 0.21	1.96, 0.38	−0.21, −0.05	0.62, 0.15
AIS	Pre	3.84 ± 3.69	4.73 ± 3.35					−1.03, −0.25	
	Post	2.86 ± 3.14	4.00 ± 3.62	−0.98 ± 3.05	−0.73 ± 0.60	**2.24*, 0.28**	1.22, 0.15	−1.43, −0.35	−0.34, −0.08

for some indicators. As only a small proportion of medical staff who had recently returned from the frontline of COVID-19 were involved, it is difficult to generalize the results to all Chinese medical staff. Second, the measurement scales of the psychological responses of medical staff may be vulnerable to recall bias because of self-reported results. Nevertheless, it is common to use self-report scales to measure levels of depression, anxiety, stress, and insomnia in most studies. Third, because only pre and post-tests were conducted, the trajectory of the psychological status of the medical staff could not be observed. Finally, in addition to the factors mentioned above, other potentially significant factors that affect the mental health of medical staff are not fully discussed. Further research is needed to expand on these factors.

5. Conclusions

In summary, our data indicate that a large number of medical staff fighting against COVID-19 has been suffering from mental disturbances. Medical staff from the military were more likely to be affected than staff from other areas. BMM interventions could alleviate the negative mental health of medical staff to some extent. Thus, greater investment is needed in the future to provide BMM and other convenient interventions to medical staff to help improve their negative mental state.

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Author's contributions

YZL and CLJ conceived the study. JML and RW conducted the study and collected the data. TZ, SYZ, and TH analyzed the data. DW wrote the manuscript. All authors have approved the manuscript.

Declaration of competing interest

None.

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None.

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