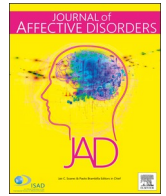




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## Research paper

# The prevalence and risk factors of psychological disturbances of frontline medical staff in china under the COVID-19 epidemic: Workload should be concerned



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## ABSTRACT

**Background:** To our best knowledge, this was the first time to investigate the prevalence and risk factors of psychological disturbances, including depression, anxiety, somatization symptoms, insomnia and suicide, among frontline medical staff, who were working with the COVID-10 infected patients directly.

**Methods:** Patient Health Questionnaire Depression (PHQ-9), Generalized Anxiety Disorder Questionnaire scale (GAD-7), Symptom Check List-90 (SCL-90) somatization, Insomnia Severity Index (ISI), and the suicidal module of the Mini International Neuropsychiatric Interview were used for online survey.

**Results:** A total of 606 frontline hospital staff and 1099 general population were recruited. The prevalence of depression, anxiety, somatization symptoms, insomnia, and suicide risk in frontline medical staffs were 57.6%, 45.4%, 12.0%, 32.0% and 13.0%, respectively. Except for suicide risk, the prevalence of other psychological disorders in frontline medical staff were higher than those in general population (all  $p < 0.01$ ). Among the frontline medical staff, the daily working hours were associated with all psychological disturbance (all  $p < 0.01$ ), women with anxiety ( $p = 0.02$ ), body mass index (BMI) with anxiety and insomnia ( $p = 0.02$ ,  $p = 0.03$ ). Age was negatively associated with depression, anxiety, and insomnia (all  $p < 0.01$ ). Finally, years of working and family income were negatively associated with suicide risk ( $p = 0.03$ ,  $p < 0.001$ ).

**Conclusion:** Our study demonstrates that during the outbreak of COVID-19, the frontline medical staff are more likely to suffer from psychological disturbances than general population. It is noticeable that daily working hours are a risk factor for all measured psychological disturbances, and some other variables may be involved in certain psychological disturbances of frontline medical staff.

## 1. Introduction

In December 2019, a novel coronavirus epidemic broke out in Wuhan, the capital city of Hubei province, China (Li et al., 2020;

Paules et al., 2020). Epidemiological studies have confirmed its spread from person to person and spreads rapidly around the world. It is named as Corona Virus Disease 2019 (COVID-19) by the World Health Organization (WHO) (World Health Organization, 2020). COVID-19 is a

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highly contagious disease with asymptomatic infection during the incubation period, and can be transmitted through respiratory droplets, contact and aerosols (World Health Organization, 2020). As a result, COVID-19 quickly spread throughout the country and many other countries. COVID-19 is highly contagious and has a high mortality rate in some populations, but there is even no special treatment (Guan et al., 2020; Zhou et al., 2020), which seriously threatens the physical and mental health of the public (Gao et al., 2020). In particular, frontline medical staff are vulnerable to infection and spread the virus to their colleagues or family members. Since January 24, 2020, China has sent more than 30,000 medical staff to provide medical support to Hubei Province. To date, more than 3000 medical personnel across the country have been infected with COVID-19 (Guangming Online, 2020). Previous studies have shown that in high-stress and high-risk disease pandemics, medical staff often encounter huge mental burdens and various psychological barriers (Lehmann et al., 2015; Lin et al., 2007; Kang et al., 2018). Although attention has been paid to the mental health of medical staff in the fight against COVID-19 (Kang et al., 2020), few studies have investigated the psychological disturbances and risk factors of frontline medical staff, especially considering the impact of the work conditions, such as workload.

Therefore, the purpose of this study was to investigate the prevalence and risk factors (including work overload) of psychological disorders among frontline medical staffs in China, including depression, anxiety, and somatization symptoms, insomnia and suicide risk. To the best of our knowledge, this was the first study to investigate the prevalence and risk factors of psychological disorders of frontline medical staff.

## 2. materials-methods

### 2.1. Participants and methods

Since this study was conducted during the COVID-19 pandemic, it was difficult to conduct face-to-face interviews on quarantine policy. Therefore, online questionnaire was constructed using a mobile application. This online questionnaire was designed to investigate psychological disorders during the epidemic by using Ranxing Technology "SurveyStar". The questionnaire was anonymous, and the information of all respondents was confidential. The data was collected from February 14 to March 29, 2020. Responders aged 18 years or older were included in this study. A total of 606 first-line hospital staff and 1099 ordinary people were recruited from 133 cities in China. The survey was approved by the Institute of Psychology, Chinese Academy of Sciences. Each participant signed an electronic informed consent form before starting the survey.

### 2.2. Assessment and measurements

Demographic and working status information were collected, including age, sex, body mass index (BMI), ethnicity, marriage status, education, annual family income, infected status of relatives or friends, years of working, daily working hours, and whether experienced SARS outbreak in 2003.

Depressive symptoms were assessed using the Patient Health Questionnaire Depression (PHQ-9), which is a convenient and effective scale for detecting depressive symptoms (Kroenke et al., 2001). PHQ-9 includes 9 questions, and each question has a score of 0 to 3. The total score ranges from 0 to 27, and a score  $\geq 5$  is identified as having depressive symptoms (Li et al., 2019; Kroenke et al., 2001).

Anxiety symptoms were assessed using the Generalized Anxiety Disorder Questionnaire scale (GAD-7) (Spitzer et al., 2006). GAD-7 includes 7 questions and each question has a score of 0 to 3. The total score ranges from 0 to 21, and a score  $\geq 5$  is identified as having anxiety symptoms (Li et al., 2019; Spitzer et al., 2006). Somatization symptoms were assessed by Symptom Check List-90 (SCL-90)

somatization factor (SOM). There are 12 questions, and each question has a score of 1 to 5 (Fau et al., 1973). The total score ranges from 12 to 60, and a score  $\geq 24$  is identified as having somatization symptoms. Insomnia was assessed by using the Insomnia Severity Index (ISI). There are 7 questions, and each question has a score of 0 to 4. The total score ranges from 0 to 28, and a score  $\geq 8$  is identified as having insomnia.

Suicide risk was assessed by using the suicidal module of the Mini International Neuropsychiatric Interview (MINI), which includes 6 questions. The total score ranges from 0 to 33. A score  $\geq 1$  and  $< 6$  is classified as mild suicide risk,  $\geq 6$  and  $< 10$  as moderate suicide risk, and  $\geq 10$  as severe suicide risk.

### 2.3. Statistical analysis

Kolmogorov-Smirnov one-sample test was conducted to test the normality of the distribution. An analysis of variance (ANOVA) of continuous variables and a Chi-square test of categorical variables were conducted. Then analysis of covariance (ANCOVA) was applied to adjust for the confounding factors to compare scores on each assessment scale. In order to explore the risk factors for each psychological disorders of front-line medical staff, a univariate analysis was conducted. Then the variables with significant differences were included in the multivariate logistic regression. Bonferroni correction was applied for multiple tests.

The data were considered statistically significant when  $p < 0.05$ . Analyses were performed by using SPSS version 20.0 (IBM Co. LTD, Chicago, IL, USA).

## 3. Results

As shown in Table 1, except BMI, there were significant differences in age, sex, education, marital status, ethnicity, family income, physical

**Table 1**  
Socio-demography and clinical assessment between frontline staff and general population.

Variable	Frontline medical staff	General population	$F/\chi^2$	$p$
Age	35.77 $\pm$ 8.13	29.23 $\pm$ 10.33	159.62	<0.001
Sex			27.81	<0.001
Male, n (%)	114 (18.8%)	336 (30.6%)		
Female, n (%)	492 (81.2%)	763 (69.4%)		
Education			107.47	<0.001
High school, n (%)	14 (2.3%)	111 (10.1%)		
University degree, n (%)	446 (73.6%)	883 (80.3%)		
Master's degree, n (%)	92 (15.2%)	90 (8.2%)		
Doctor degree, n (%)	54 (8.9%)	15 (1.4%)		
Marital status			228.49	<0.001
Single, n (%)	125 (20.6%)	636 (57.9%)		
Married, n (%)	454 (74.9%)	413 (37.6%)		
Widowed or divorced	27 (4.5%)	50 (4.5%)		
Ethnicity			5.04	0.03
Han population	556 (91.7%)	1039 (94.5%)		
Non-Han population	50 (8.3%)	60 (5.5%)		
Family income			97.14	<0.001
Low	106 (17.5%)	449 (40.9%)		
Medium	402 (66.3%)	525 (47.8%)		
Higher	98 (16.2%)	125 (11.4%)		
Physical diseases			25.13	<0.001
No	471 (77.7%)	957 (87.1%)		
Yes	135 (22.3%)	142 (12.9%)		
Relatives or friends infected			6.45	0.01
No	593 (97.9%)	1091 (99.3%)		
Yes	13 (2.1%)	8 (0.7%)		
BMI, kg/m <sup>2</sup>	22.63 $\pm$ 3.53	22.28 $\pm$ 3.33	1.16	0.28

**Table 2**  
The prevalence of psychological disturbances between frontline medical staffs and general populations.

Variable	Patients frontline medical staff (N = 606)	General population (N = 1099)	Statistic ( $\chi^2$ )	p	p*	OR*	95%CI*
Depressive symptoms	349 (57.6%)	523 (47.6%)	15.64	<0.001	<0.001	1.54	1.24–1.93
Anxiety symptoms	275 (45.4%)	372 (33.8%)	22.06	<0.001	<0.001	1.61	1.29–2.02
Somatic symptoms	73 (12.0%)	85 (7.7%)	8.64	0.003	0.001	1.93	1.32–2.78
Insomnia	194 (32.0%)	276 (25.1%)	9.31	0.002	0.002	1.47	1.15–1.87
Suicide risk	79 (13.0%)	127 (11.6%)	0.81	0.37	0.14	1.29	0.92–1.81

\* After adjusted for age, sex, education, marital status, ethnicity, family income, physical diseases and infected relatives or friends.

diseases and the COVID-19 infection of relatives and friends between frontline medical staff and the general population (all  $p < 0.05$ ), which were adjusted for in the following statistical analyses. After adjusting for age, sex, education, marital status, ethnicity, family income, physical diseases and infection of relatives and friends, ANCOVA showed that except suicide risk score ( $F = 1.16, p = 0.28$ ), frontline medical staff had significantly higher scores of PHQ-9 ( $F = 12.89, p < 0.001$ ), GAD-7 ( $F = 19.48, p < 0.001$ ), SCL-90 somatization ( $F = 32.76, p < 0.001$ ), and ISI than general population ( $F = 19.30, p < 0.001$ ).

**Table 2**

**3.1. The prevalence of psychological disturbances between frontline medical staffs and general populations**

After adjusting for age, sex, education, marital status, ethnicity, family income, physical diseases and infection of relatives or friends, the prevalence rates of depressive symptoms, anxiety symptoms, somatization symptoms, and insomnia were higher in frontline medical staff than those in general population (57.6% vs. 47.6%,  $p < 0.001$ , OR=1.54; 45.4% vs. 33.8%,  $p < 0.001$ , OR=1.61; 12.0% vs. 7.7%,  $p = 0.001$ , OR=1.93; 32.0% vs. 25.1%,  $p = 0.002$ , OR=1.47).

**3.2. The risk factors for psychological disturbances in frontline medical staff**

As shown in Table 3, univariate analysis found that there was a significant difference in some variables between frontline medical staff with and without psychological disorders. Then these significant variables were included in each logistic regression to investigate factors related to each psychological disorder of frontline medical staff. In terms of depressive symptoms, logistic regression showed that age was negatively associated with depressive symptoms ( $B = -0.04$ , Wald's statistic = 16.55,  $p < 0.0001$ , OR=0.96, 95%CI: 0.94–0.98), while daily working hours were positively associated with depressive symptoms ( $B = 0.36$ , Wald's statistic = 10.04,  $p = 0.002$ , OR=1.43, 95%CI: 1.15–1.79) in frontline medical staff. For anxiety symptoms, logistic regression showed that age was negatively associated with anxiety symptoms ( $B = -0.03$ , Wald's statistic = 8.79,  $p = 0.003$ , OR=0.97,

95%CI: 0.95–0.99), while daily working hours ( $B = 0.31$ , Wald's statistic = 7.41,  $p = 0.006$ , OR=1.36, 95%CI: 1.09–1.70), women ( $B = 0.57$ , Wald's statistic = 5.90,  $p = 0.02$ , OR=1.77, 95%CI: 1.12–2.79) and BMI ( $B = 0.06$ , Wald's statistic = 5.17,  $p = 0.02$ , OR=1.06, 95%CI: 1.01–1.12) were positively associated with anxiety symptoms in frontline medical staff. Regarding somatization symptoms, logistic regression showed that the daily working hours ( $B = 0.50$ , Wald's statistic = 8.41,  $p = 0.004$ , OR=1.65, 95%CI: 1.18–2.31) were positively associated with somatization symptoms in frontline medical staff.

As for insomnia, logistic regression showed that age was negatively associated with insomnia ( $B = -0.04$ , Wald's statistic = 12.39,  $p < 0.001$ , OR=0.96, 95%CI: 0.94–0.98), while daily working hours ( $B = 0.47$ , Wald's statistic = 14.89,  $p < 0.001$ , OR=1.60, 95%CI: 1.26–2.04) and BMI ( $B = 0.06$ , Wald's statistic = 4.97,  $p = 0.03$ , OR=1.06, 95%CI: 1.01–1.11) were positively associated with insomnia in frontline medical staff.

As for suicide risk, the years of working ( $B = -0.25$ , Wald's statistic = 4.62,  $p = 0.03$ , OR=0.78, 95%CI: 0.62–0.98) and family income ( $B = -1.07$ , Wald's statistic = 20.65,  $p < 0.001$ , OR=0.34, 95%CI: 0.22–0.54) were negatively associated with suicide risk, while daily working hours ( $B = 0.59$ , Wald's statistic = 11.27,  $p = 0.001$ , OR=1.81, 95%CI: 1.28–2.56) were positively associated with suicide risk in frontline medical staff.

**4. Discussion**

COVID-19 is a stressor that has a great impact on both individuals and the public, especially those at the core of the event. In the face of the COVID-19 patients, frontline hospital staff are under unprecedented tremendous mental distress, thus it is becoming more and more urgent to research and solve the needs of these health care workers. Our study mainly found that (1) Except for the risk of suicide, the symptoms of depression, anxiety, somatization and insomnia in frontline medical staff were more serious than those in the general population; (2) In frontline medical staff, daily working hours were positively associated with all psychological disorders, including depression, anxiety,

**Table 3**  
Socio-demographic characters between psychological disturbance vs. without psychological disturbance in frontline medical staffs.

Variable	Depressive symptoms		Anxiety symptoms		Somatic symptoms		Insomnia		Suicide risk	
	F/ $\chi^2$	p	F/ $\chi^2$	p	F/ $\chi^2$	p	F/ $\chi^2$	p	F/ $\chi^2$	p
Age	16.29	<0.001	6.07	0.01	2.24	0.14	8.25	0.004	8.06	0.005
Sex	0.01	0.94	5.02	0.03	0.31	0.59	0.11	0.74	0.44	0.51
Education	18.45	<0.001	1.37	0.71	4.88	0.18	7.41	0.06	16.28	0.001
Marital status	4.00	0.14	0.85	0.65	0.32	0.35	6.43	0.04	19.07	<0.001
Ethnicity	3.44	0.06	0.15	0.70	3.33	0.07	<0.001	0.99	0.44	0.51
Family income	5.43	0.07	9.78	0.08	1.29	0.52	8.72	0.04	31.95	<0.001
Physical diseases	0.20	0.66	2.30	0.13	0.96	0.33	0.002	0.96	3.44	0.06
Relatives or friends infected	0.09	0.77	1.14	0.29	0.24	0.63	0.25	0.61	0.07	0.80
BMI, kg/m2	0.93	0.34	5.86	0.02	0.76	0.38	5.38	0.02	3.59	0.06
Years of working	15.08	0.01	9.78	0.08	2.70	0.75	8.41	0.14	16.65	0.005
Working hours	9.58	0.02	8.66	0.03	8.03	0.04	30.84	<0.001	11.43	0.01
Experienced SARS	0.42	0.52	0.23	0.63	0.02	0.89	1.46	0.23	7.38	0.007

somatization, insomnia and suicide risk. (3) Female gender was positively associated with anxiety symptoms in frontline medical staff. (4) BMI was positively associated with anxiety symptoms and insomnia in frontline medical staff; (5) Age was negatively associated with the symptoms of depression, anxiety and insomnia, while the years of working and family income were negatively associated with suicide risk in frontline medical staff. We found that the prevalence of depressive symptoms, anxiety symptoms, somatization symptoms, insomnia and suicide risk in frontline medical staff were 57.6%, 45.4%, 12.0%, 32.0% and 13.0%, respectively. Lai et al., recently reported that depression, anxiety symptoms and insomnia accounted for 50.4%, 44.6%, and 34.0% of the total medical staff, which was very similar to our results (Lai et al., 2020). However, Zhang et al. recently reported that depression, anxiety symptoms, insomnia and somatization symptoms were 12.2%, 13.0%, 38.4% and 1.6% in medical workers, respectively, most of which were lower than our results (Zhang et al., 2020). The reason may be that they did not distinguish between frontline and non-frontline medical staff, because frontline medical staff who were in face of infected patients were reported more severe mental health symptoms than other health care workers (Lai et al., 2020). Compared with the general population, we found that frontline medical staff experienced higher symptoms of depression, anxiety, somatization, and insomnia. Zhang et al. also showed that medical staff reported much more depression, anxiety, somatization symptoms and insomnia than non-medical workers (Zhang et al., 2020), suggesting that the medical staff, especially frontline medical staff had greater psychological distress than the general population. Most medical staff in hospitals usually had not received mental health training (Lima et al., 2020). Therefore, during this COVID-19 epidemic, China also sent a large number of psychiatrists and psychologists to Hubei Province to provide mental health support to both patients and frontline medical staff. In this study, we also investigated the risk factors of psychological disorders in frontline medical staff. The main causes of psychological distress for frontline medical staff may include long working hours, fatigue and the risk of infection, as well as putting their families at life-threatening risk. However, no studies have investigated the impact of these factors on the psychological disorders under the COVID-19 epidemic. We first reported that daily working hours were a risk factor for all measured psychological disorders including depression and anxiety, somatization, insomnia and suicide risk. In the COVID-19 pandemic, frontline medical staff were facing overwhelming workload pressure, which may lead to job burnout (Moazzami et al., 2020). Previous evidence indicates that work overload was a critical cause of exhaustion, which led to burnout of health care workers (Portoghese et al., 2014). In addition, Cole et al., found that medical staff with the largest workload were more likely to receive mental health treatment (Cole et al., 2009). We found that women were a risk factor for anxiety symptoms in frontline medical staff, which was partly consistent with recent study. Lai et al. showed that women had more severe anxiety symptoms than male medical staff (Lai et al., 2020). Interestingly, we also found that BMI was positively associated with anxiety symptoms and insomnia. There is growing evidence that overweight/obesity was associated with anxiety (Simon et al., 2006) and poor sleep quality in adults (Jennings et al., 2007). Huang et al., indicated that less slow-wave sleep, or deep sleep, in patients with insomnia was associated with higher BMI (Huang et al., 2013). Shochat et al., found that high BMI was associated with shorter sleep time and lower sleep efficiency than normal and low BMI individuals (Shochat et al., 2016). In this study, several protective factors for psychological disorders were observed in the frontline medical staff. We found that the advanced age was a protective factor for depression symptoms, anxiety symptoms and insomnia, while years of working and family income were protective factors for suicide risk. It is worth noting that since the COVID-19 epidemic, there have been cases of medical staff suicides worldwide (Goyal et al., 2020; Nicola, 2020). Recently, the new epicenter of the COVID-19 pandemic, the National Suicide Prevention Lifeline, has been launched to prevent suicide in the United

States due to psychological distress related to COVID-19.

There were several limitations in this study. First, due to the special situation of the COVID-19 epidemic, the online questionnaire was designed by using psychological scales, and the diagnosis cannot be determined by face to face interviews. We only detected psychological symptoms such as depression, and anxiety but did not make a diagnose. Further, the information of the participants were not obtained if they did not submitted the online questionnaire. Therefore, we could not obtain the data of the participants who did not submit the questionnaire, which could not eliminate the selection bias. Second, the cross-sectional design prevented investigation of the causal relationship between related factors and psychological disorders. The psychological disorders of medical staff may become more serious when they encounter the COVID-19 epidemic. Further prospective cohort studies should be conducted to verify our results and hypotheses.

In summary, our study shows that compared with the general population, the frontline medical staff are more likely to develop depression, anxiety, somatization and insomnia. Among frontline medical staff, daily working hours are a risk factor for all measured psychological disturbances. Further, women and BMI are risk factors, while age, years of working and family income are protective factors for certain psychological disorders of frontline medical staff. However, considering the limitations of our cross-sectional study, our findings should be validated using a prospective cohort design in future studies.

#### Statement of ethics

All participants provided their online informed consent. The study was approved by the Institute of Psychology, Chinese Academy of Sciences.

#### Conflicts of interest

The authors declare no conflicts of interest.

#### Author contributions

Y.Z., Z.L., and X.Z. designed the study. Y.Z. and Z.L. wrote the paper. Z.L. and R. W. analyzed the data; W. Q., Z. L., L. Q., J. Y., X. S., X. Z. provided administrative, technical, or material support; Z.L., and X.Z. revised the manuscript.

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#### Data availability statement

The data that support the findings of this study are available from the corresponding author X.Z. upon reasonable request.

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