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Survey of stress and anxiety among medical staff supporting Hubei province under the COVID-19 pandemic

Yanqian Wu[1] ,Wu Yan[2] , Zhimin Fan[1] ,Yan Lu[1] , Heming Yu[1,*]

[1] Nanjing Hospital of Chinese Medicine Affiliated to Nanjing University of Chinese Medicine, Nanjing, Jiangsu, 210022, China
[2]School of Public Health, Nanjing Medical University, Nanjing 211166, China
**Corresponding author: Prof. Heming Yu*

ABSTRACT. *Background: During the Corona Virus Disease 2019 (COVID-19) outbreak, medical staffs across the country supported Hubei province to control the pandemic effectively. Meanwhile, the unpredictable characteristics of COVID-19 have put medical staff under tremendous pressure and made them prone to psychological problems. Methods: Questionnaires were investigated among 126 medical staff who supported Hubei province. Multiple linear regression was used to explore the association between characteristics and stress and anxiety scores; ; the receiver operating characteristics (ROC) were performed to evaluate the predictive value of characteristics for anxiety and stress. Results: The proportions of 126 medical staff's anxiety and stress were 19.05% and 12.70% respectively. Many characteristics were significantly associated with stress and anxiety scores. The first three factors that were closely related to medical staff's anxiety and stress were consistent, and the order was as follows: department, monthly income and marital status; the top 8 features of importance were used to construct the ROC curve, and the area under the curve (AUC) for predicting anxiety and stress was respectively 0.755 and 0.674. Conclusions: The mental health of front-line medical staffs need to be concerned, and medical institutions should provide supportive protective measures, active social support and continuous psychological assistance.*

KEYWORDS: *Covid-19, Medical staff, Mental health, Post-traumatic stress disorder, Anxiety*

1. Introduction

Since December 2019, there have been many patients with unexplained pneumonia. The National Health Commission of the People′s Republic of China named it “new coronavirus pneumonia”, and included it in the Class B infectious diseases stipulated in the “Law of the People's Republic of China on the Prevention and Control of Infectious Diseases”, and adopted the prevention and control measures for Class A infectious diseases 1,2. Subsequently, the World Health

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Organization (WHO) officially named it Corona Virus Disease 2019 (COVID-19) 3. On March 11, 2020, the WHO announced the outbreak of COVID-19 pandemic. The WHO COVID-19 Situation Report showed that as of May 21, more than 4,893,186 cases and 323,256 deaths were reported worldwide with China having 84, 507 total confirmed cases and 4,645 deaths 4.

In order to prevent the rapid spread of COVID-19, medical staff across the country rushed to help Wuhan city. On January 25, 2020, the first batch of medical teams arrived in Wuhan. As of March 8, 346 medical teams with 42,600 medical staff across the country arrived in Hubei province and worked together with local medical staff to rescue patients 5. Jiangsu Province sent 13 batches of 2813 medical staff to Wuhan and Huangshi, Hubei province to carry out treatment work 6. The number of medical staff supporting Hubei in Jiangsu Province ranked first in the country.

Frontline medical staff were burdened with the public's expectations and trust, faced with unfamiliar working environment, isolated from their families, and endured the high-intensity work contents. Various potential factors would increase their psychological pressure, and put them in a state of high stress. It is worth noting that this symptom of psychological stress may persist for a long-term or intermittently even after the end of frontline support. Previous studies have found that because of the particularity and high risk of work, front-line medical staff should not only bear heavy work responsibilities, but also at high risk of infection, which leads to psychological pressure on medical staff to fight pandemic 7. Anxiety, depression and overstress caused by internal or external factors are common subjective negative emotions among medical staff 8,9.

Post traumatic stress disorder (PTSD) refers to psychological trauma caused by acute and serious traumatic events, resulting in persistent or intermittent abnormal mental reactions 10. It can cause long-term adverse effects on individuals' social functions, family life, as well as physical and mental health. The clinical manifestations of PTSD are characterized by recurrent mental trauma events, accompanied by emotional irritability and avoidance behaviour. In fact, PTSD coexists with depression or anxiety in many cases 11. Research by Zhao Xiaohui found that PTSD significantly affected patients' emotional psychology; and patients with severe PTSD symptoms were more prone to anxiety and depression 12.

Most of the research on mental health were aimed at ordinary medical staff. Our research was aimed at medical staff who go to other places to support the epidemic,this was quite special. The purpose of this study is to help medical staff develop coping skills for anxiety and stress disorders, offer a basis for preventing and reducing mental health problems, and provide reference for targeted psychological interventions for medical staff fighting the pandemic worldwide.

2. Methods

2.1 Survey Questionnaire and Protocol

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A self-designed questionnaire was used to investigate the mental health of medical staff supporting Hubei during COVID-19 outbreak. We produced and distributed questionnaires through a professional online survey evaluation and voting platform "Questionnaire Star", which allows questionnaire design, data collection, report customization and result analysis13.

From April 1, 2020 to April 5, 2020, Jiangsu medical staff supporting Hubei during COVID - 19 outbreak was invited to answer the questionnaire by the Questionnaire Star link. Also, the link was sent to medical staff in Nanjing, Changzhou, Wuxi, Nantong, Yancheng and other third-level hospitals for them to fill in and they were encouraged to share the link with other colleagues also supporting Hubei.

2.2 Data Collection

2.2.1 Post-Traumatic Stress Disorder Self-Assessment Scale (Ptsd-Ss)

The PTSD symptoms were measured by the post-traumatic stress disorder self-assessment scale. The scale consists of 24 items and can be classified into 5 parts: subjective assessment of traumatic events, repeated recurrence experience, avoidance of symptoms, increased alertness and impaired social function 14. Each item is divided into 5 parts according to psychological perception after traumatic events. The cumulative score of 24 items is the total score of PTSD -SS., The higher the score, the more severe stress disorder . A total score of $\geqslant$50 is considered as mild PTSD symptoms, and $\geqslant$60 is indicates moderate to severe PTSD symptoms.

2.2.2 Self-Rating Anxiety Scale (Sas)

The scale comprises 20 items and provides a score based on a 4-point system for each item (1-A little of the time; 2-Some of the time; 3-A good part of the time; 4-Most of the time). Among the 20 items, 15 items are evaluated negatively, with scores ranging from 1 to 4, and the remaining 5 items (i.e., 5, 9, 13, 17, 19) are stated positively and are graded in reverse, that is, from 4 to 1. The scores of all items were summed to obtain a rough score and then multiplied by 1.25 to get the standard score 15. Scores were categorized as no anxiety (below 49), mild anxiety (50–59), moderate anxiety (60–69) and severe anxiety (above 70). SAS has been demonstrated to have good reliability and validity by previous studies 16. In our study, scores $\geqslant$50 points were considered indicative of anxiety .

2.3 Quality Control

This survey adopted a network questionnaire method, the same IP address could only answered once, and all parts of the questionnaire were completed before submission. In addition to ensure the reliability of the data, questionnaires with an answer time of less than 180 seconds were deleted.

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Statistical analysis

The measurement data was expressed as mean ± standard deviation. Multiple linear regression analysis was used to analyse the relationship between medical staff′s post-traumatic stress disorder and anxiety scores, and forest map contrast value ratio (OR) value was used for the legend description. We used a random forest model to predict the importance of the investigated factors to stress and anxiety of medical staff. In this study, 16 characteristic variables were selected as independent variables, stress and anxiety scores were respectively taken as dependent variables, and the effect of each independent variable on the dependent variable was obtained by using the random forest in the regression model. We used this method to estimate the relative importance of each variable to the classification by calculating the accuracy of importance. The value was proportional to the importance, and the visual results showed the top 8 variables in the importance ranking. For the first eight variables of random forest importance ranking, the receiver operating characteristic (ROC) and the area under the curve (AUC) were used to evaluate the predictive value of these characteristics for anxiety and stress among medical staff. With $P < 0.05$ was considered statistically significant. Stata 15.0 was applied for statistical analysis.

3. Results

3.1 Characteristic of the Participants

After excluding 1 duplicate IP address and 2 questionnaires with a response time of less than 180 seconds, the survey information of 126 medical staff was included in the study. The mean age of the medical staffs was 33.86 ± 8.23 years. Among 126 medical staffs enrolled in the survey, 72 were female (57.14%) and 54 were male (42.86%). There were 12 colleges graduates (9.52%), 87 bachelors (69.05%), 21 masters (16.67%) and 6 doctors (4.76%). In terms of marital status, 86 people were married (68.25%), 36 people were unmarried (28.57%) and 4 people were divorced (3.17%). 21 had a monthly income below 6000 yuan (16.67%), 36 between 6001 to 8000 yuan (28.57%), 27 between 8001 to 10000 yuan (21.43%) and 42 higher than 10001 yuan (33.33%). All came from tertiary hospital,102 people came from grade iii-a (80.95%) and 24 people came from grade iii-b (19.05%). By department,45 medical staffs came from ICU (35.71%), 21 from respiratory department (16.67%),12 from emergency department (9.52%),18 from clinical laboratory (14.29%) and the rest from other departments (23.81%). In terms of occupation, there were 18 doctors (14.29%) ,84 nurses (66.67%), 21 technician (16.67%) and 3 administrator (2.38%). According to the professional titles, there were 51 junior professional titles (40.48%), 48 intermediate professional titles (38.1%) and 27 senior professional titles (21.43%). The average length of service of the medical staffs was 11.88 ± 8.49 years. They usually work 8.58 ± 1.58 hours a day and work 5.36 ± 0.67 days a week. But when they were supporting Hubei, they worked 6.55 ± 2.17 hours a day and 4.85 ± 1.07 days a week. The average number of days of medical staff supporting Hubei was 40.48±9.75, and it took 24.64±7.38 minutes to

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wear protective equipment(Table 1).

Table 1 Characteristics of Medical Staff Who Participated in the Survey

Characteristics		n / ($\bar{x}\pm s$)	Proportion (%)
Age (year)		33.86±8.23	
Gender	Male	54	42.86
	Female	72	57.14
Education level	College	12	9.52
	Bachelor	87	69.05
	Master	21	16.67
	Doctor	6	4.76
Marital status	Unmarried	36	28.57
	Married	86	68.25
	Divorced	4	3.17
Monthly income (yuan)	≤ 6000	21	16.67
	6001-8000	36	28.57
	8001-1000	27	21.43
	≥ 10001	42	33.33
Hospital level	grade iii-a	102	80.95
	grade iii-b	24	19.05
Department	ICU	45	35.71
	Respiratory	21	16.67
	Emergency	12	9.52
	Laboratory	18	14.29
	Other	30	23.81
Occupation	Doctor	18	14.29
	Nurse	84	66.67
	Technician	21	16.67
	Administrator	3	2.38
Professional title	Primary	51	40.48
	Secondry	48	38.10
	Senior	27	21.43
Length of service (year)		11.88±8.49	
Length of daily work (hour / per day)		8.58±1.85	
Daily work days (per week)		5.36±0.67	
Support working hours (hour / per day)		6.55 ± 2.17	
Support working days (per week)		4.85±1.07	
Length of total support (day)		40.48±9.75	
Duration of wearing preventer (minute)		24.64±7.38	

3.2 Analysis of Potential Influencing Factors

When exploring the factors affecting anxiety and stress of medical staff, we fitted the multiple linear regression models, and the variables included in the model were individual characteristics of the subjects, occupational information and the situation when supporting Hubei province. The fitting of both models was statistically significant ($P<0.05$). Among the relevant factors affecting anxiety scores, we found that the anxiety score decreased significantly with increasing age (β=-0.44, 95%CI: -0.73, -0.15). In addition, the anxiety score of medical staff with a bachelor's degree and technician decreased significantly (β=-5.54, 95%CI: -10.43, -0.66; β=-12.69, 95%CI: -21.05, -4.33, respectively).

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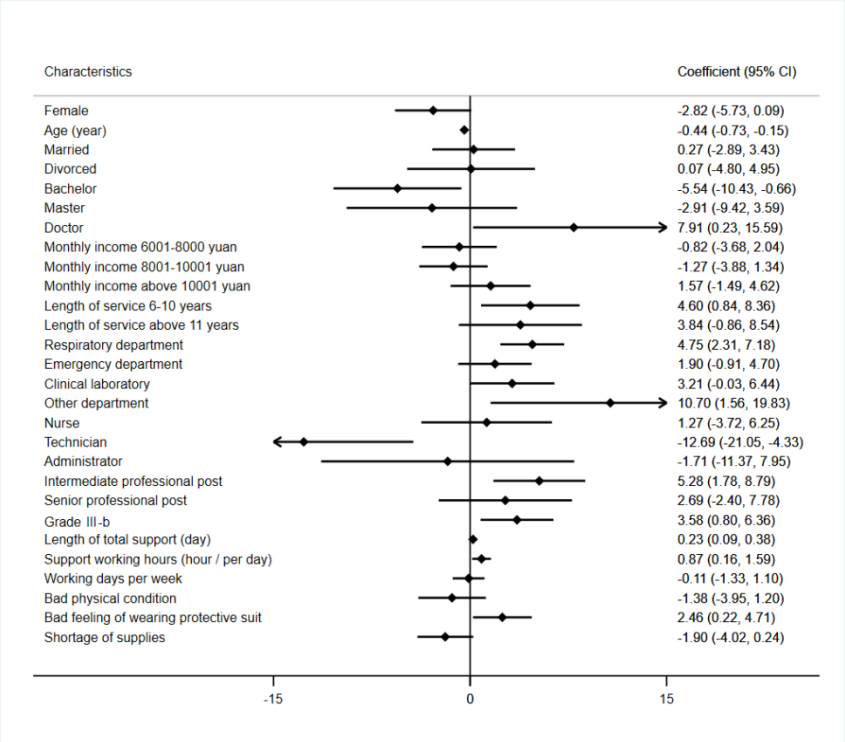
In addition, we found factors that increase the symptoms of anxiety. From the perspective of personal characteristics, medical staff with a doctorate degree are more anxious (β=7.91, 95%CI: 0.23-15.59). In terms of job information, compared with those who had worked for 5 years or less, the anxiety scores of them who had worked for 6-10 years increased significantly (β=4.60, 95%CI: 0.84-8.36); the anxiety symptoms of the medical staff in respiratory department increased significantly (β=4.75, 95%CI: 2.31-7.18) than those in ICU, and the anxiety level of medical staff with intermediate titles increased significantly (β=5.28, 95%CI: 1.78-8.79). From some perspectives of support, the length of weekly support and the number of days of support were positively related to anxiety levels, and poor experience in protective clothing also increased anxiety scores (Table 2). The visualized results of the association between each characteristic and anxiety were presented in Figure S1.



Firgure S1 The results of visualization of the relationship between various characteristics and anxiety scores

The influencing factors of the pressure of medical staff were further discussed, and it was found that the stress of female medical staff was significantly less than that of male. Married and divorced medical workers had significantly lower (= -8.02, 95%CI: -12.91, -3.12; =-7.87, 95%CI: -15.43, -0.30, respectively) levels of stress

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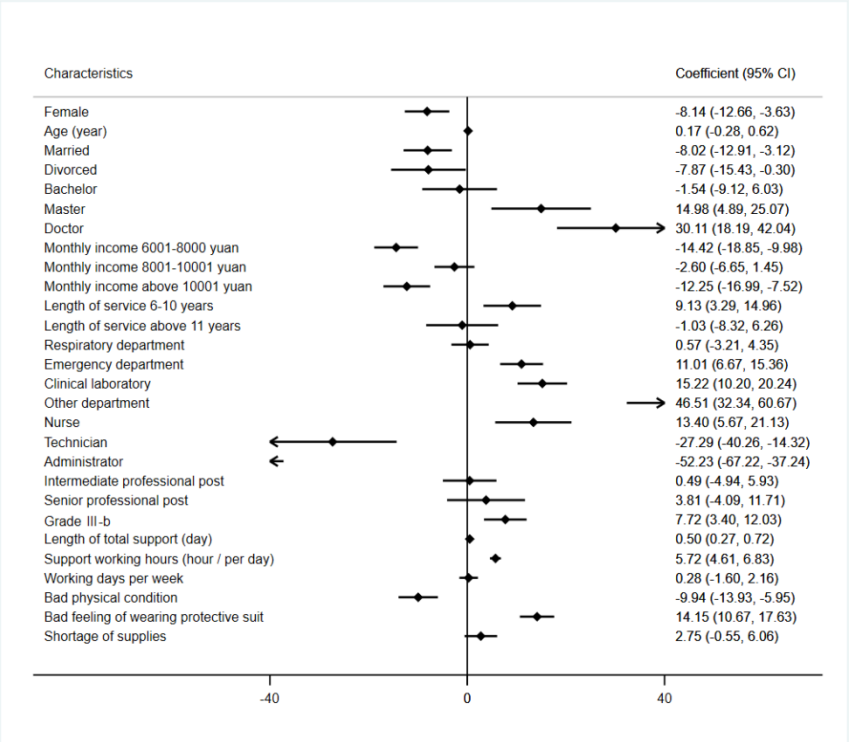
than their unmarried counterparts. With the increase of monthly income, the stress level also decreased significantly. Compared with doctors,the pressure ontechnicians and administrators was significantly reduced (=-27.29, 95%CI: -40.26, -14.32, =-52.23, 95%CI: -67.22, -37.24, respectively), and those in poor health were also less stressed. Among the factors that increase stress levels, we found that the stress of the medical staff who had worked for 6-10 years was significantly higher(=9.13, 95%CI: 3.29, 14.96) than those who worked for 0-5 years. Compared with ICU staff, the pressure on emergency department, laboratory and other departments was significantly increased. The stress score of nurses was significantly higher than that of doctors. Medical staff working in grade Ⅲ-b hospitals had higher stress scores. Consistent with anxiety, working hours per day and total number of support days were positively correlated with stress scores, and poor experience in wearing protective clothing significantly increased the stress scores of health care workers (Table 2). The visualized results of the association between each characteristic and stress were presented in Figure S2.



Firgure S2 The results of visualization of the relationship between various characteristics and stress scores

Table 2 Association between The Characteristics of Medical Staffs and the Scores of Anxiety and Stress

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*** P<0.01, ** P<0.05, * P<0.1

Characteristics		Anxiety score					Stress score			
		β	95% *CI*	*P*-value	Sig		*β*	95% *CI*	*P*-value	Sig
Gender	Male	Ref	.				Ref			
	Female	-2.82	(-5.73, 0.09)	0.057	*		-8.14	(-12.66, -3.63)	0.001	***
Age (year)		-0.44	-0.73, -0.15)	0.003	***		0.17	(-0.28, 0.62)	0.455	
Marital status	Unmarried	Ref	.				Ref			
	Married	0.27	(-2.89, 3.43)	0.866			-8.02	(-12.91, -3.12)	0.002	***
	Divorced	0.07	(-4.80, 4.95)	0.977			-7.87	(-15.43, -0.30)	0.042	**
Education level	College	Ref	.				Ref			
	Bachelor	-5.54	(-10.43, -0.66)	0.026	**		-1.54	(-9.12, 6.03)	0.687	
	Master	-2.91	(-9.42, 3.59)	0.377			14.98	(4.89, 25.07)	0.004	***
	Doctor	7.91	(0.23, 15.59)	0.044	**		30.11	(18.19, 42.04)	<0.001	***
Monthly income (yuan)	≤ 6000	Ref	.				Ref			
	6001-8000	-0.82	(-3.68, 2.04)	0.572			-14.42	(-18.85, -9.98)	<0.001	***
	8001-1000	-1.27	(-3.88, 1.34)	0.338			-2.60	(-6.65, 1.45)	0.206	
	≥ 10001	1.57	(-1.49, 4.62)	0.312			-12.25	(-16.99, -7.52)	<0.001	***
Length of service (year)	≤ 5	Ref	.				Ref			
	6-10	4.60	(0.84, 8.36)	0.017	**		9.13	(3.29, 14.96)	0.003	**
	≥ 11	3.84	(-0.86, 8.54)	0.108			-1.03	(-8.32, 6.26)	0.780	
Department	ICU	Ref	.				Ref			
	Respiratory	4.75	(2.31, 7.18)	<0.001	***		0.57	(-3.21, 4.35)	0.767	
	Emergency	1.90	(-0.91, 4.70)	0.183			11.01	(6.67, 15.36)	<0.001	***
	Laboratory	3.21	(-0.03, 6.44)	0.052	*		15.22	(10.20, 20.24)	<0.001	***
	Other	10.70	(1.56, 19.83)	0.022	**		46.51	(32.34, 60.67)	<0.001	***
Occupation	Doctor	Ref	.				Ref			
	Nurse	1.27	(-3.72, 6.25)	0.615			13.40	(5.67, 21.13)	0.001	***
	Technician	-12.69	(-21.05, -4.33)	0.003	***		-27.29	(-40.26, -14.32)	<0.001	***
	Administrator	-1.71	(-11.37, 7.95)	0.726			-52.23	(-67.22, -37.24)	<0.001	***
Professional title	Primary	Ref	.				Ref			
	Secondry	5.28	(1.78, 8.79)	0.003	***		0.49	(-4.94, 5.93)	0.858	
	Senior	2.69	(-2.40, 7.78)	0.297			3.81	(-4.09, 11.71)	0.341	
Hospital level	grade Ⅲ-a	Ref	.				Ref			
	grade Ⅲ-b	3.58	(0.80, 6.36)	0.012	**		7.72	(3.40, 12.03)	0.001	***
Length of total support (day)		0.23	(0.09, 0.38)	0.002	***		0.50	(0.27, 0.72)	<0.001	***
Support working hours (hour / per day)		0.87	(0.16, 1.59)	0.018	**		5.72	(4.61, 6.83)	<0.001	***
Support work days (per week)		-0.11	(-1.33, 1.10)	0.856			0.28	(-1.60, 2.16)	0.768	
Physical condition	good	Ref	.				Ref			
	bad	-1.38	(-3.95, 1.20)	0.291			-9.94	(-13.93, -5.95)	<0.001	***
Feeling of wearing protective equipment	well	Ref	.				Ref			
	badly	2.46	(0.22, 4.71)	0.032	**		14.15	(10.67, 17.63)	<0.001	***
Material supply	Abundance	Ref	.				Ref			
	Shortage	-1.90	(-4.02, 0.24)	0.081	*		2.75	(-0.55, 6.06)	0.102	

3.3 Ranking of Feature Importance

The random forest models were ranked from top to bottom based on the contribution rates of each feature to the value. Among the 16 factors, the first three factors that were most closely related to the anxiety and stress of medical staff were consistent, and the order was as follows: department, monthly income, and marital status. The visualized results showed the top 8 characteristics with the greatest influence on anxiety and stress. Medical staff were divided into two groups based on the scale score, and the ROC curve was constructed by combining 8 features, and the AUC for predicting anxiety and stress were 0.755 and 0.674 respectively (Figures 1 and 2).

3.4 Sensitivity Analysis

When the population was restricted to below 50 on the anxiety and the stress scale, the sensitivity analysis found that there were still stable associations between the anxiety score, the stress score and the potential factors(Table S1).

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Table S1 Association between the Characteristics of Medical Staffs and the Scores of Anxiety and Stress.

Characteristics		Anxiety score					Stress score			
		β	*95% CI*	*P*-value	Sig		*β*	*95% CI*	*p-value*	Sig
Gender	Male	Ref		.			Ref		.	
	Female	1.47	(-0.53, 3.47)	0.146			-8.14	(-12.66, -3.63)	0.001	***
Age (year)		-0.49	(-0.67, -0.30)	<0.001	***		0.17	(-0.28, 0.62)	0.455	
Marital status	Unmarried	Ref		.			Ref		.	
	Married	3.36	(1.07, 5.65)	0.005	***		-8.02	(-12.91, -3.12)	0.002	***
	Divorced	2.85	(-0.42, 6.11)	0.086	*		-7.87	(-15.43, -0.30)	0.042	**
Education level	College	Ref		.			Ref		.	
	Bachelor	-1.16	(-5.16, 2.85)	0.566			-1.54	(-9.12, 6.03)	0.687	
	Master	2.56	(-3.13, 8.25)	0.373			14.98	(4.89, 25.07)	0.004	***
	Doctor	11.20	(5.74, 16.66)		***		30.11	(18.19, 42.04)	<0.001	***
Monthly income (yuan)	≤ 6000	Ref		.			Ref		.	
	6001-8000	-2.42	(-4.95, 0.10)	0.060	*		-14.42	(-18.85, -9.98)		***
	8001-1000	-3.61	(-5.54, -1.67)	<0.001	***		-2.60	(-6.65, 1.45)	0.206	
	≥ 10001	-2.64	(-5.57, 0.30)	0.077	*		-12.25	(-16.99, -7.52)		***
Length of service (year)	≤ 5	Ref		.			Ref		.	
	6-10	0.89	(-1.83, 3.60)	0.516			9.13	(3.29, 14.96)	0.003	***
	≥ 11	10.71	(6.48, 14.95)	<0.001	***		-1.03	(-8.32, 6.26)	0.780	
Department	ICU	Ref		.			Ref		.	
	Respiratory	2.70	(0.51, 4.88)	0.016	**		0.57	(-3.21, 4.35)	0.767	
	Emergency	-0.91	(-2.94, 1.11)	0.372			11.01	(6.67, 15.36)	<0.001	***
	Laboratory	-0.67	(-2.86, 1.53)	0.546			15.22	(10.20, 20.24)	<0.001	***
	Other	5.92	(-1.16, 13.01)	0.100			46.51	(32.34, 60.67)	<0.001	***
Occupation	Doctor	Ref		.			Ref		.	
	Nurse	-0.04	(-3.95, 3.87)	0.983			13.40	(5.67, 21.13)	0.001	***
	Technician	-6.20	(-12.16, -0.24)	0.042	**		-27.29	(-40.26, -14.32)	<0.001	***
	Administrator	-					-52.23	(-67.22, -37.24)	<0.001	***
Professional title	Primary	Ref		.			Ref		.	
	Secondry	-5.70	(-9.06, -2.33)	0.001	***		0.49	(-4.94, 5.93)	0.858	
	Senior	-8.79	(-14.05, -3.52)	0.001	***		3.81	(-4.09, 11.71)	0.341	
Hospital level	grade Ⅲ-a	Ref		.			Ref		.	
	grade Ⅲ-b	-4.16	(-6.53, -1.78)	0.001	***		7.72	(3.40, 12.03)	0.001	***
Length of total support (day)		0.23	(0.11, 0.35)		***		0.50	(0.27, 0.72)	<0.001	***
Support working hours (hour / per day)		0.88	(0.24, 1.52)	0.008	***		5.72	(4.61, 6.83)	<0.001	***
Support work days (per week)		-0.13	(-1.02, 0.76)	0.771			0.28	(-1.60, 2.16)	0.768	
Physical condition	good	Ref		.			Ref		.	
	bad	-0.08	(-2.09, 1.94)	0.941			-9.94	(-13.93, -5.95)	<0.001	***
Feeling of wearing protective equipment	well	Ref		.			Ref		.	
	badly	5.23	(3.15, 7.31)	<0.001	***		14.15	(10.67, 17.63)	<0.001	***
Material supply	Abundance	Ref		.					.	
	Shortage	-4.43	(-6.04, -2.81)	<0.001	***		2.75	(-0.55, 6.06)	0.102	

Note: *** P<0.01, ** P<0.05, * P<0.1

4. Discussion

Our results revealed that the incidence of anxiety and stress among medical staff were 19.05% and 12.70% respectively. This was close to the results of the research to 656 medical staff and 266 general population by Zhen Zhu et al, approximately 18.3% had psychological health problems 17. But compared with 78.95% of Xinjiang aid to Hubei medical staff were found to be anxious, the Jiangsu aid to Hubei medical staff were less anxious 18. In terms of demographic characteristics, the age, gender and educational level of medical staff would affect their anxiety and stress. As for working conditions, anxiety and stress levels of medical staff also varied due to differences in their departments, grades of hospital, occupation and lengths of service. Notably, the increase in the total number of days of support and the number of working hours per day during support, as well as the poor perception

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of wearing protective equipment, significantly increased the stress and anxiety scores of medical staff.

Based on the results of regression analysis results, it was found that the anxiety score decreased significantly with age. Senior medical staff had rich experience in infectious disease prevention and control and public health emergencies, so the response was mild; younger medical staff might be lack experience in this field and had greater psychological pressure [19]. The anxiety symptoms of the medical staff in the respiratory department increased significantly, which might be related to the work content of the department. The respiratory department was the core department to fight against COVID-19 and undertook heavy work tasks, so the psychological burden was also greater. These medical staff also had a higher risk of panic, insomnia and mental illness in these medical staffs [20].

When fighting infectious diseases, male medical teams had higher work pressure than females. This finding is not consistent with published epidemiological studies [18]. In most cases, men are the main source of family finances and the main spiritual pillar of family development. Men faced high-intensity work pressure and high-risk occupational psychological problems [9]. Nurses were the largest professional team in the fighting against the pandemic [21]. At the beginning of the pandemic, the protective materials were insufficient, the disease transmission route and the treatment situation were unclear. The nurses undergone the nursing operations and was in close contact with patients for a long time, so their psychological stress response was more likely to be affected.

Stress and anxiety are common mental disorders. Many studies have shown that stress and anxiety are highly often associated with and interact with each other [22,23]. In terms of occupational information, People who had worked for 6 to 10 years had significantly higher anxiety and stress scores than those who had worked for 5 years or less. In addition to treating patients, most medical staff who had worked for 6-10 years also played a leading and coordinating role in this pandemic prevention work besides treating patients. In addition, they often take on more routine tasks, such as scientific research and administration, and their families are burdened more. Long-term performance of tasks usually leads to greater mental and physical conflict and anxiety.

The length of weekly support and the number of days of support were positively correlated with anxiety and stress levels, and the poor experience in wearing protective clothing also increased anxiety and stress scores. During the support period, frontline medical staff worked an average of 6.55 ± 2.17 hours per day for a total of 40 days of support. Medical staff wore multi-layer protective clothing, multi-layer masks, multi-layer gloves and goggles, etc., and could resume normal diet and rest only after working for 6 consecutive hours. In order to avoid cross-infection, they lined up and removed protective equipment in sequence after get off work. Protective equipment cannot meet some basic physiological needs and may cause adverse psychological changes and emotional reactions.Front-line medical staff had the longest contact time with patients. They knew that patients would experience pain and even death. In addition, some colleagues who fought

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together were unfortunately infected or even killed, which lead to physical and mental exhaustion and various discomforts.

The COVID-19 pandemic is characterized by abruptness and high infectivity, and many medical staff have been infected or even died [24], which may increase the psychological pressure of front-line medical staff. The impact of public health emergencies often affects the psychological changes of the public such as anxiety, stress, sensitivity and overthinking. As the front-line medical workers for pandemic prevention in Hubei province, they bore greater psychological pressure than ordinary people. Therefore, the supported hospital should formulate a reasonable schedule, timely rotation and supplementation, and reduce the workload of medical staff. In addition, the reserve of protective materials should be strengthened and the integrity of protective equipment should be checked to ensure the safety of medical staff. In the context of public health emergencies, medical staff's emotional changes gradually changed from destructive negative emotions and huge psychological pressure to constructive and exciting psychological promotion of work. With the effective control of the pandemic, this change would happen quickly, which would have a positive effect on reducing the stress response of medical staff. This research has certain practical reference value for the construction of psychological intervention models in response to future unexpected infectious disease outbreaks in China and other regions of the world.

At the first time when the medical staff who supported Hubei in the fight against COVID-19 returned to Jiangsu province, we conducted relevant questionnaires, and the survey results could accurately reflect the psychological state during the support period. The higher incidence of mild psychological problems among frontline medical staff was found, and potential factors affecting anxiety and stress were also explored. In addition, we noted that although online questionnaires had become the mainstream method of investigation research during pandemic prevention and control, due to the voluntary participation of the respondents, there might be a bias in sample selection. The small sample size in this study did not yet reflect the mental state of all medical staffs supporting Hubei.In the future, it is necessary to continue to further observe the impact of the long-term mental health of supporting medical staff in Hubei during and after the epidemic, and compare it with other regions.

5. Conclusion

In responding to public health emergencies, frontline medical staff have serious mental health problems, which not only affects the medical staff's working state and physical and mental health, but even has a direct impact on the safety of patients' lives. Therefore, medical institutions should pay attention to the mental health status of front-line medical workers and provide supporting protective measures, active social support and continuous psychological assistance, which will not only guarantee the life safety of front-line medical workers and the public, but also provide favourable support for the early victory of pandemic prevention and control.

Competing interests

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The authors declare that they have no competing interests.

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