Saudi Journal of Biological Sciences 28 (2021) 2726–2732

Contents lists available at ScienceDirect

Saudi Journal of Biological Sciences

journal homepage: www.sciencedirect.com

Original article

Investigation on psychological state of occupational exposure of medical staff in operation room under novel coronavirus

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ARTICLE INFO

Article history:
Received 18 November 2020
Revised 24 February 2021
Accepted 25 February 2021
Available online 4 March 2021

Keywords:
Novel coronavirus
Medical staff
Anxiety
Stress

ABSTRACT

This article mainly explores the psychological state of occupational exposure of medical staff in operation room contaminated with novel coronavirus, and provides targeted suggestions for mental health service of medical staff so as to maintain their physical and mental health. On February 28, 2020, a questionnaire survey was conducted using Internet. Nurses, anesthesiologists and surgeons in the operating room of the First Affiliated Hospital of Harbin Medical University from January 2020 to March 2020 were selected as the research objects. The psychological state of medical staff was investigated by SAS and PSS-14. As on February 29, 2020, 301 valid questionnaires and one invalid questionnaire were received. The survey showed that there was anxiety but no moderate or severe anxiety in the occupational behavior of operating room medical staff, while some medical staff had a certain degree of psychological pressure ($P < 0.05$). The present survey suggested that medical staff was under anxiety and pressure in different degrees in the operation room because of novel coronavirus contamination during occupational activities, much attention is required to improve mental health of medical professionals and to reduce their negative emotions.

1. Introduction

Coronavirus is a small enveloped positive-RNA virus which concludes four genera, namely, α - coronavirus, β - coronavirus, δ - coronavirus, and γ - coronavirus. This virus widely exists in humans and other mammals (Rui et al., 2020). In December 2019, a number of patients with pneumonia of unknown causes were admitted to Wuhan City, Hubei Province, China. These patients have several symptoms including, poor breath, fatigue, cough, fever and pneumonia like symptoms (Malik et al., 2020; Ziwei et al., 2010; Xuemei, 2016). The mode of transmission of the virus includes respiratory droplets transmission and contact transmission, whiles other unknown transmission. The main sources of infection are transmission of virus through asymptomatic carriers. According to the law of the people's Republic of China on the prevention and control of infectious diseases, the disease was included in the scope of b category infectious diseases and was prevented and treated in accordance with a category infectious diseases (Renqi et al., 2020; Xiaomei, 2019; Weiming, 2019; Shouchun, 2010; Ronghuan et al., 2010; Qin et al., 2010). The novel coronavirus was initially named "Novel coronavirus pneumonia (NCP)" by the National Health and Health Committee in February 8, 2020. In February 11, 2020, disease caused by novel coronavirus infection was named as "Corona Virus Disease 2019″ (COVID 19) in 2019 by WHO. National Health Commission of the People's Republic revised the disease's English name from novel coronavirus pneumonia to "COVID 19″ in February 21, while its Chinese name remained unchanged (Zilin et al., 2020). As a special department, operating room has a closed environment, a complex population and a tense atmosphere. The purpose of this study is to find out the psychological status of medical staff during the occupational activities in operating room during the study period through questionnaire survey, in order to provide them with targeted psychological services during the epidemic period and imporve their mental health.

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Peer review under responsibility of King Saud University.

Production and hosting by Elsevier

https://doi.org/10.1016/j.sjbs.2021.02.080
1319-562X/

2. Data and methods

2.1. Samples

A total of 301 medical staff including, surgeons, nurses and anesthesiologists working in the operating room of the First Affiliated Hospital of Harbin Medical University from January 2020 to March 2020 were selected as the subjects of study. All participants participated in this survey voluntarily with written informed consents.

2.2. Method of analysis

A questionnaire was distributed to the candidates. The questionnaire was self-designed general information. The questionnaire included age, gender, educational background, length of service, knowledge on novel coronavirus, and training of handling new coronavirus pneumonia, etc.

2.2.1. Self-rating anxiety scale (SAS)

The self-rating Anxiety Scale (SAS) was developed by Zung in 1971, which was used to assess the subjective anxiety of patients. A total of 20 symptoms have been reported and SAS scale works based on these symptoms. According to the standard of Chinese norm, the cut off value is 50 points, including 50–59 points for mild anxiety, 60–69 points for moderate anxiety, and more than 69 points for severe anxiety (Wang, 2019).

2.2.2. Pressure perception scale (PSS-14)

There are 14 items in PSS-14, and 5 scaling levels of 0–4 score system are adopted, among which 7 reverse scores mainly reflect the degree of pressure out of control of subjects. This scale is mainly used to measure the psychological stress of general population or special population and carry out clinical research. As early as 2003, Professor Yang Ting Zhong and co-workers introduced the Chinese version of pss-14 in China. The best demarcation value of the scale is 25 / 26. If the score of the scale is $\geq$ 26, the pressure with health risk can be judged; if the score is $\leq$ 25, the pressure without health risk can be judged (Xuan et al., 2018).

2.3. Data collection method

A total of 301 questionnaires were received in this survey, including one invalid questionnaire, and the recovery rate of the questionnaire was100%.

2.4. Statistical treatment

SAS software (version 9.1.3) was used for statistical analysis. The quantitative variables of skew distribution were described by median and interquartile spacing. Wilcoxon rank sum test was used for two-level inter group comparison (the statistics is Z value). Kruskal Wallis "h" test was used to make a multi-level ($\geq$2) inter group comparison (the statistics is H value); qualitative variables were statistically described by frequency (percentage), and the constituent ratio was compared between the two groups by χ 2 test or Fisher definite probability method; orderly classified variables were compared between the two groups by Wilcoxon rank sum test. The correlation was analyzed by calculating correlation coefficient through Spearman rank correlation.

3. Results

3.1. Analysis of the results of self-rating anxiety scale

3.1.1. General information and comparison of SAS scores of medical staff

General information and SAS scores of medical staff were compared (Table 1). It showed that there is statistically significance in differences in SAS scores among the six indicators of different levels. These include, gender of medical staff, whether they are worried about being blocked at home, whether they are trained, the degree of worry about possible infection due to exposure to smoke, the degree of worry about possible infection due to contact with blood, and the degree of worry about infection due to sharp instrument injury.

3.1.2. Correlation analysis of SAS scores

The correlation analysis results of SAS scores (Table 2) showed that the correlation between SAS score and stress score, gender, educational background, worry about being blocked at home, training, the possible infection due to exposure to smoke, the possible infection due to exposure to blood, the degree of worry about infection due to sharp instrument injury has statistical significance. These results showed that the female were less educated, the fear of home obstruction, the lack of training, the fear of possible infection, the higher stress score, the higher SAS score of medical staff.

3.1.3. Comparison of general data between two groups of medical staff

According to the self-rating Anxiety Scale (SAS), and Chinese standard norm stipulated that SAS cut off value is 50 points, in which mild anxiety between 50 and 59 points, moderate anxiety ranged between 60 and 69 points, and severe anxiety is higher than 69 points. According to the scores, there is no moderate or severe anxiety in the medical staff. The medical staff was divided into anxiety group and non-anxiety group. The comparison results of the general information of the medical staff in the two groups (Table 3) showed that there were statistical significance in differences in the stress scores of the medical staff in the two groups, the degree of worry about possible infection by contacting blood, and the degree of worry about possible infection by exposing smoke ($P < 0.05$).

3.1.4. Correlation analysis of anxiety of medical staff

According to the correlation analysis results of anxiety (Table 4), there was significant difference in the degree of anxiety of medical staff about possible infection by blood to blood contact, the degree of worry about possible infection by exposing smoke, and the correlation between stress score and anxiety of medical staff. Combined with the results of the previous analysis, the lack of adequate service in infectious diseases department, the more worry about the possibility of infection, increased stress score, and the greater the possibility of anxiety of patients.

3.2. Analysis of the results of pressure perception scale

3.2.1. General information and comparison of stress scores of medical staff

General information and stress scores of medical staff (Table 5) showed that there are statistical significance in differences in stress scores among the seven indicators of gender, educational background, identity, the length of service, training, novel coronavirus knowledge and epidemic situation.

Table 1
Comparison of general information and SAS scores of medical staff.

	Number of Samples (%)	$x \pm s$	$M(P_{25},P_{75})$	Z/H	P
Gender				−3.2216	0.0013
Male	145(48.33)	35.74 ± 6.09	35(32–39)		
Female	155(51.67)	37.17 ± 5.87	37(34–40)		
Educational background				4.0929	0.1292
Junior college	3(1.00)	36.33 ± 2.08	37(34–38)		
Undergraduate	126(42.00)	37.29 ± 5.63	37(34–40)		
Master and above	171(57.00)	35.89 ± 6.27	36(33–39)		
Identity				1.8919	0.0585
Doctor	167(55.67)	35.93 ± 6.26	36(33–39)		
Nurse	133(44.33)	37.17 ± 5.63	37(34–40)		
Length of service				7.3833	0.117
0–3 years	20(6.67)	36.65 ± 5.12	36.5(33–39.5)		
4–6 years	32(10.67)	37.97 ± 5.1	37.5(35–40)		
7–10 years	74(24.67)	35.8 ± 5.08	36(34–38)		
11–15 years	70(23.33)	37.81 ± 5.49	37(34–41)		
>15 years	104(34.67)	35.58 ± 7.12	36(33–39.5)		
Worries about being stuck at home				−3.5261	0.0004
Yes	205(68.33)	37.18 ± 6.13	37(34–40)		
No	95(31.67)	34.98 ± 5.47	35(33–38)		
Training or not				2.6211	0.0088
Yes	288(96.00)	36.3 ± 5.97	36(33–39.5)		
No	12(4.00)	40.75 ± 5.51	39.5(37–43)		
Knowledge of novel coronavirus				2.9832	0.3942
Know little	3(1.00)	32.67 ± 2.31	34(30–34)		
Incomprehension	0(0.00)	—	—		
General	29(9.67)	37.28 ± 5.84	37(34–40)		
	Number of Samples (%)	$x \pm s$	$M(P_{25},P_{75})$	Z/H	P
Understand	200(66.67)	36.36±6.12	36(33–40)		
Know a lot	68(22.67)	36.66±5.88	36.5(34–39)		
Satisfaction of protective measures				7.1295	0.1292
Very satisfactory	61(20.33)	35.34±5.24	35(33–37)		
Satisfactory	107(35.67)	36.52±7.28	37(34–40)		
Generally satisfactory	104(34.67)	37.09±4.79	37(34–40)		
Not satisfactory	23(7.67)	36.83±6.47	35(32–39)		
Quite unsatisfactory	5(1.67)	35.2±5.26	34(32–39)		
Worries about risk of exposure to fumes				20.9499	0.0003
Very worried	98(32.67)	38.66±5.89	38(35–41)		
Worried	132(44)	35.61±6.34	36(33–39)		
General	56(18.67)	35.16±4.69	35(32–38)		
Not worried	12(4.00)	34.75±4.73	35(34–37)		
Quite unworried	2(0.67)	34±0	34(34–34)		
Worries about possible infection in contact with blood				30.8471	<0.0001
Very worried	124(41.33)	38.52±5.68	38(35–41)		
Worried	114(38.00)	35.49±6.47	36(33–39)		
General	48(16.00)	34.35±4.35	34(31–36.5)		
Not worried	11(3.67)	33.55±4.95	35(33–37)		
Quite unworried	3(1.00)	34.33±0.58	34(34–35)		
Worries about infection ofsharp instrumentinjury				22.4488	0.0002
Very worried	133(44.33)	38.02±5.4	38(34–41)		
Worried	103(34.33)	35.99±6	36(33–39)		
General	51(17.00)	34.67±5.01	35(32–37)		
Not worried	12(4.00)	31.5±10.54	35(31–37)		
Quite unworried	1(0.33)	34±.	34(34–34)		

3.2.2. Correlation analysis of stress score

Results of the correlation analysis of stress scores (Table 6) showed that the correlation among gender, age, educational background, identity, the length of service, whether they have received training, knowledge about novel coronavirus, the current situation of novel coronavirus epidemic situation, and the correlation between anxiety score and pressure score has statistical significance.

3.2.3. Comparison of stress data between two groups of medical staff

According to the perceived stress scale, the health risk stress can be judged according to the scale score $\geq$ 26 points (pressure group), and no health risk stress < 25 points (non-pressure group). The comparison results of the general data of the two groups (Table 7) showed that the difference of the satisfaction degree of the two groups' medical staffs protective measures, the worry

Table 2
Correlation Analysis of SAS scores.

Indexes	*rs*	P
Scores of stress	0.2153	0.0002
Gender	0.1864	0.0012
Educational background	−0.1141	0.0484
Worries about being stuck at home	−0.204	0.0004
Training or not	0.1517	0.0085
Worries about risk of exposure to fumes	−0.2589	<0.0001
Worries about possible infection in contact with blood	−0.3207	<0.0001
Worries about infection of sharp instrument injury	−0.2721	<0.0001

degree of sharp injury infection and the PSS score has statistical significance ($P < 0.05$).

3.2.4. Correlation analysis of the pressure of medical staff

The results of correlation analysis of stress (Table 8) showed that the correlation among the satisfaction degree of medical staff on protective measures, the worry degree of sharp instrument injury infection, PSS score and the stress of medical staff has statistical significance. Combined with the results of the previous analysis, the more dissatisfied with the protective measures, the more

Table 3
Comparison of general data between two groups of medical staff.

Indexes	Non-anxiety group	Anxiety group	Z/χ2	P
Gender				0.7154
Male	141(48.12)	4(57.14)		
Female	152(51.88)	3(42.86)		
Age	37(32–43)	35(32–41)	−0.8227	0.4107
Education background				0.4995
Junior college	3(1.02)	0(0.00)		
Undergraduate	122(41.64)	4(57.14)		
Master and above	168(57.34)	3(42.86)		
Identify				0.7037
Doctor	164(55.97)	3(42.86)		
Nurse	129(44.03)	4(57.14)		
Length of service			−0.8393	0.4013
0–3 years	19(6.48)	1(14.29)		
4–6 years	31(10.58)	1(14.29)		
7–10 years	73(24.91)	1(14.29)		
11–15 years	67(22.87)	3(42.86)		
>15 years	103(35.15)	1(14.29)		
Indexes	Non-anxiety group	Anxiety group	Z/χ2	P
Worries about being stuck at home				0.1019
Yes	198(67.58)	7(100.00)		
No	95(32.42)	0(0.00)		
Training or not				0.2508
Yes	282(96.25)	6(85.71)		
No	11(3.75)	1(14.29)		
Knowledge of novel coronavirus			−0.5621	0.574
Know little	3(1.02)	0(0.00)		
Incomprehension	0(0.00)	0(0.00)		
General	28(9.56)	1(14.29)		
Understand	195(66.55)	5(71.43)		
Know a lot	67(22.87)	1(14.29)		
Satisfaction of protective measures			0.0485	0.8257
Very satisfactory	60(20.48)	1(14.29)		
Satisfactory	104(35.49)	3(42.86)		
Generally satisfactory	102(34.81)	2(28.57)		
Not satisfactory	22(7.51)	1(14.29)		
Quite unsatisfactory	5(1.71)	0(0.00)		
Worries about risk of exposure to fumes			−2.347	0.0189
Very worried	92(31.40)	6(85.71)		
Worried	132(45.05)	0(0.00)		
General	55(18.77)	1(14.29)		
Not worried	12(4.10)	0(0.00)		
Quite unworried	2(0.68)	0(0.00))		
worries about possible infection in contact with blood			−2.9087	0.0036
Very worried	117(39.93)	7(100.00)		
Worried	114(38.91)	0(0.00)		
General	48(16.38)	0(0.00)		
Not worried	11(3.75)	0(0.00)		
Quite unworried	3(1.02)	0(0.00)		
worries about infection of sharp instrument injury			1.6518	0.1987
Very worried	128(43.69)	5(71.43)		
Worried	102(34.81)	1(14.29)		
General	50(17.06)	1(14.29)		
Not worried	12(4.10)	0(0.00)		
Quite unworried	1(0.34)	0(0.00)		
Scores of stress	41(37–44)	47(42–52)	2.6674	0.0076

Table 4
Correlation Analysis of anxiety of medical staff Note: *rs* is the orrelation coefficient of Spearman.

Indexes	*rs*	*P*
Working experience in infectious disease department	−0.1224	0.0341
Worries about risk of exposure to fumes	−0.1359	0.0186
Worries about possible infection in contact with blood	−0.1684	0.0034
Scores of stress	0.1544	0.0074

worried about sharp instrument injury infection, and the higher PSS score, the greater the risk of pressure in patients.

4. Discussion

The COVID-19 epidemic not only brought economic losses to the country, but also caused a certain degree of psychological impact on different groups of people (Vijayaraghavan and Sriramkumar, 2020). Therefore, the metal health of medical staff is very important. As medical staff is a special group to counter epidemic, their psychological panic will lead to behavioral barriers to some extent, not only affecting physical and mental health, but also delaying the effective prevention and treatment of the COVID-19. Therefore, their mental health problems should not be under estimated. According to the psychological investigation, the head and neck of the first-line otolaryngology surgical staff in Wuhan, found anxiety even affects their normal sleep (Ya et al., 2020). Jijun et al. (2020) suggested that the first-line clinical nurses to fight against the epidemic had pressure, which was positively correlated with sleep quality. The novel coronavirus infection emergency guideline for psychological crisis intervention was released in January 27, 2020 by National Health Commission of the People's Republic of China and some of this guidance on the possible psychological problems during the epidemic was provided (Hua and Tingyu, 2020). The present study explored the psychological state of the medical staff in the operating room during occupational activities through questionnaire survey, and found that they mainly feared of exposure to environmental infection such as the use of high-frequency electric knife, which produces surgical smoke; feared of contact with the patient's blood and other body fluids; feared of sharp instrument sentimental infection; feared of protective measures; and feared of home obstruction, etc (Rodríguez-Rey et al., 2020). According to the statistics, it is related

Table 6
Correlation Analysis of pressure conditions.

Indexes	*rs*	P
Gender:	−0.1187	0.04
Age(yearling)	0.1653	0.0043
Educational background	0.2457	0
Identity	−0.224	0.0001
Length of service	0.1404	0.015
Training or not about knowledge of novel coronavirus	−0.1383	0.0165
Knowledge of novel coronavirus	0.1822	0.0015
Knowledge of the current epidemic situation of novel coronavirus	0.28	<0.0001
PSS scores	0.2153	0.0002

Table 5
Comparison of general information and stress scores of medical staff.

	Number of Samples (%)	$x \pm s$	$M(P_{25},P_{75})$	Z/H	P
Gender				2.0512	0.0402
Male	145(48.33)	40.78 ± 7.19	42(39–44)		
Female	155(51.67)	39.47 ± 6.82	40(35–44)		
Educational background				18.4393	<0.0001
Junior college	3(1.00)	34.33 ± 7.77	32(28–43)		
Undergraduate	126(42.00)	38.5 ± 7.08	40(34–43)		
Master and above	171(57.00)	41.39 ± 6.69	42(38–45)		
Identity				−3.8724	0.0001
Doctor	167(55.67)	41.32 ± 6.78	42(38–45)		
Nurse	133(44.33)	38.57 ± 7.03	40(34–43)		
Length of service				11.3018	0.0234
0–3 years	20(6.67)	40.6 ± 4.56	39.5(37.5–43)		
4–6 years	32(10.67)	40.03 ± 5.58	40.5(35–44)		
7–10 years	74(24.67)	38 ± 7.79	39(34–43)		
11–15 years	70(23.33)	41.57 ± 6.31	42.5(37–46)		
	Number of Samples (%)	$x \pm s$	$M(P_{25},P_{75})$	Z/H	P
>15 years	104(34.67)	40.54±7.42	42(38–45)		
Training or not				−2.39	0.0168
Yes	288(96.00)	40.26±7.03	41(37–44)		
No	12(4.00)	36.25±5.77	37.5(31.5–41.5)		
Knowledge of novel coronavirus				10.3779	0.0156
Know little	3(1.00)	38.67±1.15	38(38–40)		
Incomprehension	0(0.00)	——	——		
General	29(9.67)	37.9±6.12	38(34–42)		
Understand	200(66.67)	40.13±6.86	41(37–44)		
Know a lot	68(22.67)	41.03±7.81	43(38.5–45)		
Knowledge of epidemic situation				24.9026	<0.0001
Know little	3(1.00)	38.67±1.15	38(38–40)		
Incomprehension	1(0.33)	43±.	43(43–43)		
General	38(12.67)	37.34±5.22	38(35–41)		
Understand	186(62.00)	39.84±7.24	41(36–44)		
Know a lot	72(24.00)	42.26±6.88	43.5(40–46)		

Table 7
Comparison of general data between two groups of medical staff.

Indexes	Non-pressure group	Res-sure group	*Z*	*P*
Satisfaction of protective measures			−2.3456	0.019
Very satisfactory	3(60.00)	58(19.66)		
Satisfactory	2(40.00)	105(35.59)		
Generally satisfactory	0(0.00)	104(35.25)		
Not satisfactory	0(0.00)	23((7.80)		
Quite unsatisfactory	0(0.00)	5(1.69)		
Worries about infection of sharp instrument injury			2.4254	0.0153
Very worried	0(0.00)	133((45.08)		
Worried	2(40.00)	101(34.24)		
General	2(40.00)	49(16.61)		
Not worried	1(20.00)	11(3.73)		
Quite unworried	0(0.00)	1(0.34)		
PSS scores	22(0–26)	37(34–40)	−3.1133	0.0019

Table 8
Correlation Analysis of stress of medical staff.

Indexes	*rs*	*P*
Satisfaction of protective measures	0.1358	0.0186
Worries about infection of sharp instrument injury	−0.1404	0.0149
PSS scores	0.1802	0.0017

to the sex, age, identity, educational background, training, work experience of infectious diseases department, knowledge of virus and understanding of epidemic situation of medical staff. It is suggested that during the epidemic period, through all available ways such as community service or the Internet, the public's understanding of the epidemic related knowledge should be improved, so as to reduce the risk of medical staff being excluded by residents after work, which is a kind of psychological comfort for medical staff and can reduce their anxiety. At the same time, besides enriching knowledge, the people can initially judge their own situation and play a role in urging suspected patients. Ensuring good health, and pay attention to hygiene; consuming well balanced diet, vitamins, and protein from fish, meat, eggs, milk, etc., ensure adequate sleep. Traditional meditations such as yoga, Taijiquan, and reduce stress. This therapy is a stress management therapy based on mindfulness. It can reduce the stress by providing the self-management method of mindfulness meditation training. The procedure mainly includes walking meditation, sitting meditation, mindfulness breathing, body scanning and other practice methods. It adopts the group activity form of 8–10 weeks in a row, once a week. Each group should not exceed 30 people, 2.5–3.0 h (Jing, 2019). At present, the protection of surgical smoke is popular in the protection of operating room. Some studies showed that there are harmful chemical components and tissues damage in the surgical smoke. During the epidemic, it is recommended that hospitals should upgrade the exhaust gas discharge device in operating room (Yıldırım et al., 2020). The surgeons correctly select surgical instruments, or use high-frequency electric knife and other instruments together with the use of suction device. Equipment clean up after the completion of experiment; the pollutant at the head end of the instrument can reduce the generation of surgical smoke. It is suggested that novel coronavirus screening for patients should be conducted before operation, which can guide the selection of surgical materials and infection prevention. Strictly control the use and recording of needle and other sharp instruments, minimize the occurrence of sharp injuries. After operation, all operative instruments and contaminants are sterilized according to the new coronavirus standard to reduce occupational exposure. It is suggested that the hospitals should introduce relevant management systems during the epidemic period, which should be implemented from ordinary departments to specialize departments, and request the experienced medical workers who have participated in the front-line epidemic prevention work to give relevant opinions; leaders and subordinate managers should play a subjective and active role, conduct psychological counseling for medical staff regularly, publicize the situation of protective materials in an open way and give anonymous feedback regularly to understand the satisfaction of medical staff with various measures of the hospital; from the hospital leaders to the hospital nurses, we should carry out all-round coverage without dead space, and carry out appropriate standardized training according to the regulations every month (Reger et al., 2020). Huiling et al. (2020) described the importance of state-of-art training on pandemic which influenced on work pressure of nurses. In this epidemic situation, the availability of medical device is scare in hospitals and health care centers. Hence, hospital authorities should consider using all available resources to solve pandemic situation. In China, the general secretary Xi Jinping stressed the importance of artificial intelligence to handle epidemic monitoring and analysis, resource allocation, prevention and treatment and virus tracing (People's Daily, 2020). Mental health illness in COVID-19 patients has been reported in various countries (Begum et al., 2021; Gasana and Shehab, 2020).

5. Conclusions

The results showed that novel coronavirus epidemic situation caused anxiety and induced stress to medical staff in operation room during occupational activities. This suggests that we should pay more attention to the humanized care of medical staff and try our best to maintain their physical and mental health while paying attention to the development of epidemic situation and carrying out epidemic prevention. In conclusion, this study provides a reliable basis for the mental health of medical staff, which is of great significance to guide prevention of occupational exposure and protect the physical and mental health of medical workers.

Acknowledgment

Supported by the Natural Science Foundation of the Heilongjiang Province of China(No.LH2020H047).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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