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Investigation on the Sub-Health Status of Healthcare Workers during the COVID-19 Pandemic

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Abstract

Background: Coronavirus Disease 2019 (COVID-19) is a viral pneumonia caused by novel coronavirus infection, showing a general susceptibility pattern and extremely high infectivity. It is currently a public health emergency of international concern. As the direct staff to deal with and control the pandemic situation, healthcare workers may experience physical, psychological, and social stresses at different levels. Therefore, it is necessary to investigate the sub-health status of healthcare workers to provide a reference for the formulation, and implementation of related interventions.

Objective: To investigate the sub-health management scale of healthcare workers during the COVID-19 pandemic.

Methods: The present study was designed as a cross-sectional survey. An internet survey was conducted for 241 healthcare workers during the outbreak of COVID-19 using the Sub-Health Measurement Scale V.1.0 (SHMS V1.0). The items for the draft questionnaire were discussed in groups. The scale included three subscales of physical, psychological, and social sub health, with a total of 39 items. SPSS22.0 software was used for data entry and statistical analysis and $p < 0.05$ was considered statistically significant.

Results: The detection rate of sub-health status was 68.465%, the total scale score was 66.912 ± 12.411, and the average score of total items was 1.912 ± 0.355. Among all the subscales, the psychological dimension had the lowest average score, and differences prevailed in the physical dimensions of healthcare workers between different education groups and job groups ($p < 0.05$). Physical dimension subscale of healthcare workers graduated from technical college was higher than that of the healthcare workers had bachelor's degree ($p < 0.05$), whereas it was lower in medical technicians compared to doctors ($p < 0.05$).

Conclusion: The sub-health detection rate of healthcare workers is relatively high during the COVID-19 pandemic. Hence, attention should be paid to the sub-health status of healthcare workers, especially in psychological aspects, and provide appropriate psychological counseling to ensure a better life, adequate sleep and a quiet rest environment

Keywords

COVID-19, Sub-health status, Healthcare workers

Introduction

In the mid-1980s, Berkman, et al. [1], scholars from the former Soviet Union, discovered that the human body exists in an intermediate state between health and disease, which is called the third state that is, sub-health state. Sub-health state refers to an experience between health and disease. Although the body has no definite diseases, various uncomfortable feelings and symptoms appear regarding physical, psychological, and social interactions. Thus, it presents a sub-health state with reduced mobility, responsiveness, and adaptability. This state is mostly caused by low physical, or metabolic functions of the human body. Although it does not reach the level of disease, it seriously affects the efficiency of work and quality of life of relevant people [2].

Most people are susceptible to Coronavirus Disease 2019 (COVID-19), a disease which mainly causes viral pneumonia symptoms. The main clinical manifestations are fever, fatigue, and dry cough. A few patients have

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symptoms such as nasal congestion, runny nose, sore throat, myalgia and diarrhea. In severe cases, dyspnea and/or hypoxemia usually occur one week after the onset of the disease, which can rapidly progress to acute respiratory distress syndrome, septic shock, persistent metabolic acidosis, coagulopathy, multiple organ failure, etc. [3]. Since December 2019, the COVID-19 pandemic has rapidly spread across China, and outbreaks of COVID-19 have also occurred in many other countries [4]. On January 30, 2020, the World Health Organization declared it a public-health emergency of international concern. The new coronavirus is highly infectious. As of April 21, 2020, a total of 2,392,170 cases have been diagnosed with COVID-19 worldwide, resulting in 165,642 deaths. China has accumulatively confirmed 82,758 cases, with 1,587 imported cases, resulting in 4,632 deaths [4]. During this severe epidemic, healthcare workers have to face the occupational exposure, high-intensity rescue work, and death of patients, which causes different levels of physical, psychological, and social stresses. At present, there is still no relevant research on the sub-health status of healthcare workers during the COVID-19 pandemic.

Therefore, it is necessary to investigate the sub-health status of healthcare workers to provide a reference for the formulation, and implementation of related interventions.

Subjects and Methods

Subjects

The present study was designed as a cross-sectional survey. Convenient sampling was used to investigate the sub-health status of healthcare workers during the COVID-19 pandemic. Inclusion criteria: (1) Subjects who participated in the survey completely voluntarily with informed consent provided simultaneously. (2) Healthcare workers (such as doctors, nurses, radiologist, infection control experts, etc.) who worked during the pandemic period. Exclusion criteria: (1) Healthcare workers who were on maternity leave or sick leave during the COVID-19 pandemic. (2) Interns, on-the-job training staff and healthcare workers without professional qualification. This study was approved by the Hospital Ethics Committee (Lot Number: KY-2020-016).

Investigation methods

Investigation tools: 1) General information questionnaire: It was designed by a team of researchers, including: Gender, age, marital status, work department, job title, education, working years, etc.

2) Sub-health measurement scale: This study used the Sub-health Measurement Scale Version 1.0 (SHMS V1.0) developed by Professor Xu Jun [5]. In order to ensure the applicability of the questionnaire, a pilot survey was carried out before the formal survey. The scale has three sub scales which includes physical sub-health, psychological sub-health and social sub-health, with a total of 39 items. The SHMS V1.0 scoring standard uses the internationally accepted 5-point Likert scale, the Cronbach's alpha of the scale was 0.929, and the Kaiser-Meyer-Olkin (KMO) statistic was 0.934. Direct scoring was used for 24 items, the direct scoring items are the same as the original points (items 1-3, 13-19 and 26-39); reverse scoring was used for 15 items, and the reverse scoring items are 6 minus the original points (items 4-12 and 20-25). The four items of the overall evaluation of the sub-health status are subjective assessment rather than objective scores of their own health status. Therefore, the four items of the overall evaluation of the sub-health status are not involved in the score calculation, and the sum of the scores of each subscale and the total scale is the original raw score. The highest theoretical scores of physical, psychological, social, and total sub-health status are 70, 60, 45 and 175 respectively; the lowest theoretical scores are 14, 12, 9, 35. For easy understanding and comparison, the original initial scores of the subscale and the total scale were converted into scores of a percentage system, and the dimension conversion score = (original raw score of the dimension-lowest theoretical score of the dimension)/(the highest theoretical score of the dimension -lowest theoretical score of the dimension) × 100. The total scale conversion score of < 54 points was defined as disease state that of ≥ 54 and ≤ 79 points was defined as sub-health state, and that of > 79 points was defined as health state. There were 39 items in the questionnaire, and the sample size should be 5-10 times the number of items. Therefore, at least 195 questionnaires were needed for this study.

Data collection methods: On March 6-9, 2020, the convenience sampling was adopted to investigate the sub-health status of healthcare workers during the COVID-19 pandemic via sojump.com in Guangdong province, China. The questionnaire indicated the purpose and precautions of filling out the survey and the criteria for questionnaire collecting were established. A total of 302 questionnaires were distributed. 61 questionnaires were excluded due to incomplete information, logical inconsistencies, and too short time for filling out. Finally, 241 valid questionnaires were collected, with an effective collection rate of 79.801%.

Statistical analysis: SPSS22.0 software was used for data entry and statistical analysis. Frequency, composition ratio, mean ± standard deviation was used for statistical description, *t* test and single factor analysis of variance were used to compare the sub-health status of healthcare workers with different characteristics. $P < 0.05$ was considered statistically significant.

Results

General demographic characteristics

In this study, a total of 241 healthcare workers were

surveyed during the outbreak of COVID-19, including 40 males (16.598%) and 201 females (83.402%). The ages were 19 to 57 years, with an average age of 30.241 ± 6.692 years. The working years were 0.5 to 37 years, with an average age of 8.307 ± 6.759 years. The marital status: 122 were unmarried (50.622%), 104 were married and procreated (43.154%), 11 were married but not procreated (4.564%), 4 were divorced (1.660%). Education: 5 graduated from technical secondary school (2.075%), 43 graduated from technical college (17.842%), 176 had bachelor's degree (73.029%), and 17 had master's degree and above (7.054%). Job title: 173 had junior titles (71.784%), 49 had intermediate titles (20.332%), 11 had deputy senior titles (4.564%), 3 had senior titles (1.245%), 5 had other titles (2.075%). Departments participating in the treatment: 93 were in the intensive care unit (38.589%), 41 in the isolation wards (17.013%), 27 in the emergency departments (11.203%), 13 in the fever clinics (5.394%), 26 in the respiratory departments (10.788%), 11 in the infection departments (4.565%), 30 in the imaging departments (12.448%).

Sub-health conditions of healthcare workers during the COVID-19 pandemic

During the COVID-19 pandemic, 31 out of 241 healthcare workers were in disease states (scores: < 54 points), accounting for 12.863%; 165 were in sub-health states (scores: 54-79 points), accounting for 68.465%; 45 people were in healthy states (scores: > 79 points), accounting for 18.672%. In this study, the subjects in the state of disease were mainly nurses (28, 90.3%), 19 (61.3%) of which had junior titles. In addition, the total sub-health score of healthcare workers during the COVID-19 pandemic was 66.912 ± 12.411, and the average score of total items was 1.912 ± 0.355. Among various dimensions, the average score of the physical dimension was the highest, followed by the social dimension, and that of the psychological dimension was the lowest. See Table 1 for details.

The relationship between sub-health status and general information of healthcare workers during the COVID-19 pandemic

The results of univariate analysis showed there were differences in the sub-health scores of the physical dimensions of healthcare workers between different education groups and job groups ($p < 0.05$). The pairwise comparison using the LSD method showed that the sub-health score of healthcare workers who graduated from the technical college was higher than that of healthcare workers who had bachelor's degree ($p < 0.05$). The physical sub-health score of the medical technicians was lower than that of doctors ($p < 0.05$) (Table 2).

Discussion

Sub-health status of healthcare workers during the COVID-19 pandemic

The current study found that the detection rate of sub-health status during the COVID-19 pandemic was 68.465%. It shows that the sub-health status of healthcare workers during the COVID-19 pandemic is more serious than those of previous researches. Cai, et al. [6] conducted a field survey of a total of 10,560 Chinese healthcare workers in 138 hospitals in 26 provinces, cities, and regions with a detection rate of sub-health status of Chinese healthcare workers being 54.7%. Ma, et al. [7] found that the detection rate of the sub-health status of healthcare workers in Xi'an was 54.4%. Jiang, et al. [8] reported a detection rate of 28.9% in the Grade A tertiary hospitals in a city in the northwest China. In this study, the prevalence of sub-health status was higher than that in previous studies. In view of possible reason, the recruited subjects in this study are mainly from the ICU, isolation ward, emergency department, fever clinic and other key epidemic prevention and control departments. Such population may experience higher physiological, psychological and social stresses. Therefore, it is urgent to pay attention to the sub-health status of healthcare workers.

The current study mainly analyzed from three dimensions: physical, psychological, and social. Among all dimensions, the average score of the physical dimension was the highest, followed by the social dimension, and that of the psychological dimension was the lowest. The possible reason may be that the COVID-19 is highly contagious, spreads quickly, and has no specific drugs for the treatment. During the prevention and control of the epidemic, healthcare workers need to come in close contact with a variety of patients, face the risk of occupational exposure at all times, and may face inexperience and incomprehension. With the spread of the epidemic and increased number of infected people, healthcare workers have to face the death of critically ill-patients frequently, worry that they and their relatives will be infected, and thus become anxious or even fearful and

Table 1: Descriptive statistics of sub-health status of healthcare workers during the COVID-19 pandemic ($\bar{x} \pm s$) (n = 241).

Factors	Full score	Number of items	Score ($\bar{x} \pm s$)	Average score of each item ($\bar{x} \pm s$)
Physical dimension	70	14	68.494 ± 14.063	4.892 ± 1.004
Psychological dimension	60	12	63.909 ± 13.043	5.326 ± 1.087
Social dimension	45	9	68.453 ± 16.712	7.606 ± 1.857
Total scores	170	35	66.911 ± 12.411	1.912 ± 0.355

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Table 2: The relationship between sub-health status and general information of healthcare workers during the COVID-19 pandemic.

Items		Physical dimension score			Psychological dimension score			Social dimension score			Total scale score		
		Scores	Statistics	*p*	Scores	Statistics	*p*	Scores	Statistics	*p*	Scores	statistics	*p*
Gender	Male	70.804 ± 12.766	1.138	0.256	64.427 ± 11.967	0.275	0.784	66.458 ± 18.387	-0.826	0.410	67.500 ± 12.121	0.328	0.743
	Female	68.035 ± 14.292			63.806 ± 13.272			68.850 ± 16.379			66.795 ± 12.494		
Age (years)	≤ 25	67.940 ± 13.689	1.290	0.274	62.692 ± 12.335	1.102	0.356	67.179 ± 16.679	0.967	0.426	65.179 ± 16.579	0.994	0.412
	26-30	68.902 ± 13.875			63.364 ± 13.632			66.463 ± 15.282			66.463 ± 15.282		
	31-35	69.789 ± 12.705			66.624 ± 13.485			70.975 ± 19.428			70.975 ± 19.428		
	36-40	71.131 ± 14.685			65.972 ± 11.970			71.528 ± 17.526			71.528 ± 17.516		
	> 40	62.585 ± 17.546			61.111 ± 12.780			70.767 ± 14.610			70.767 ± 14.610		
Working years (years)	≤ 5	69.368 ± 13.379	0.872	0.501	63.602 ± 13.157	0.835	0.526	67.041 ± 15.814	0.836	0.526	66.792 ± 12.124	0.632	0.675
	6-10	67.208 ± 13.613			62.689 ± 12.025			67.845 ± 15.782			65.823 ± 11.628		
	11-15	70.677 ± 13.303			67.489 ± 14.357			70.249 ± 22.174			69.474 ± 13.649		
	16-20	68.192 ± 20.100			64.714 ± 15.032			75.000 ± 14.811			68.750 ± 13.115		
	21-25	64.541 ± 13.687			61.161 ± 11.192			68.056 ± 13.942			64.286 ± 12.044		
	> 25	58.929 ± 23.214			64.583 ± 11.024			75.000 ± 4.811			65.000 ± 13.093		
Marital status	Unmarried	69.174 ± 13.698	2.458	0.064	63.046 ± 12.811	1.662	0.176	68.238 ± 16.838	1.763	0.155	66.832 ± 12.365	2.002	0.114
	Married and procreated	67.359 ± 13.777			64.042 ± 12.934			67.388 ± 16.445			66.229 ± 12.012		
	Married but not procreated	76.136 ± 17.096			72.159 ± 15.060			79.040 ± 17.363			75.519 ± 14.956		
	Others	56.250 ± 16.909			64.063 ± 14.471			73.611 ± 11.453			63.393 ± 12.294		
Education	Technical secondary school	73.357 ± 11.392	3.291	0.021*	59.167 ± 8.149	1.347	0.260	60.556 ± 15.010	0.975	0.405	66.000 ± 8.490	1.958	0.121
	Technical college	73.671 ± 11.820			67.297 ± 12.220			71.641 ± 12.838			70.963 ± 9.867		
	Bachelor's degree	66.873 ± 14.324▲			53.305 ± 12.385			67.850 ± 17.602			65.901 ± 12.958		
	Master's degree and above	70.168 ± 14.324			62.990 ± 11.866			68.954 ± 16.144			67.394 ± 12.016		
Title	Junior	69.354 ± 13.435	0.830	0.507	63.776 ± 12.865	0.298	0.879	67.180 ± 16.455	1.530	0.194	66.883 ± 12.058	0.281	0.890
	Intermediate	65.561 ± 16.313			64.541 ± 14.075			73.186 ± 17.491			67.172 ± 14.089		
	Deputy senior	66.558 ± 15.994			60.984 ± 9.275			65.404 ± 14.612			64.351 ± 11.072		
	Senior	73.214 ± 10.714			68.750 ± 16.271			76.852 ± 11.565			72.619 ± 12.583		
	Others	68.929 ± 7.098			65.833 ± 17.714			67.778 ± 20.469			67.571 ± 13.340		

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Job	Doctor	71.230 ± 11.827	4.256	0.015*	63.657 ± 11.898	0.076	0.927	68.673 ± 18.593	0.194	0.824	67.976 ± 12.122	1.354	0.260
	Nurse	68.520 ± 14.027			63.961 ± 13.205			68.502 ± 16.624			66.952 ± 12.440		
	Medical technician	41.071 ± 12.627*			60.417 ± 5.893			61.111 ± 15.713			52.857 ± 3.030		
Departments	ICU	70.142 ± 15.344	1.285	0.265	63.754 ± 13.861	1.326	0.246	67.563 ± 17.134	0.570	0.754	67.289 ± 13.446	0.811	0.563
	Isolation ward	69.338 ± 11.932			68.039 ± 12.462			69.444 ± 16.655			68.920 ± 11.515		
	Emergency department	66.071 ± 13.252			63.040 ± 13.947			67.181 ± 17.589			65.317 ± 12.972		
	Fever clinic	67.170 ± 16.823			65.224 ± 10.148			64.530 ± 14.965			65.824 ± 11.591		
	Respiratory department	63.118 ± 15.803			59.295 ± 9.758			69.765 ± 14.344			63.516 ± 11.448		
	Infection department	65.097 ± 9.922			61.932 ± 10.295			65.909 ± 12.735			64.221 ± 8.097		
	Others	70.893 ± 10.838			63.681 ± 14.222			72.500 ± 19.013			68.833 ± 12.257		

Note: *$p < 0.05$; ▲indicates that the difference is statistically significant compared with healthcare workers who graduated from the technical college; $p < 0.05$; *indicates that it is compared with doctors.

helpless. Some studies suggest that during the epidemic period, healthcare workers are more prone to various psychological problems such as anxiety, insomnia, depression, sadness, grievances, helplessness, depression, etc. due to long-term stress and infection risk [9,10]. It was also reported that healthcare workers are prone to psychological problems due to heavy work, high pressure, high work intensity, irregular lifestyle, serious doctor-patient conflicts [11].

Relationship between sub-health status and general information of healthcare workers during the COVID-19 pandemic

Education: Pan, et al. [12] reported that higher the education level, the greater the probability of sub-health status. The single factor analysis results of this survey show that the healthcare workers who were graduated from the technical college had a statistically significant higher sub-health score in the physical dimension than those who had bachelor's degree, In other words, compared with those graduated from the technical college, healthcare workers with higher education (bachelor's degree) had a worse physiological sub-health status. The sub-health score of healthcare workers with bachelor's degrees was lower, showing relatively poor status, which can be explained by the reason that this part of healthcare workers serves as the backbone during the pandemic period. These people have a high sense of responsibility to prevent and control the epidemic. To cope with the newly discovered disease, they used their spare time to overcome various difficulties, learn to summarize new knowledge and protective skills for the treatment of COVID-19, and improve their self-esteem and self-worth. As a result, there may be stress at work, loss of appetite, irregular work, and rest time, insomnia, and lack of exercise, which makes them more likely to be in a physically sub-healthy state. Therefore, there was a difference in the physical sub-health status between different educational backgrounds.

Job: Cai, et al. [6] reported that the sub-health state of doctors was 52.3% and that of medical technicians was 44.5%. Hu, et al. [13] found that the healthcare workers engaged in imaging and laboratory jobs during the outbreak of Influenza A had the worst mental health status. Imaging and laboratory examinations, especially CT, are important methods for the diagnosis and evaluation of COVID-19 [14,15]. The results of this survey showed that medical technicians had a lower score in the physical sub-health than doctors during the epidemic ($p < 0.05$), which was statistically significant. The possible reason may be the working environment. The number of patients with asymptomatic infections is increasing, and there is a certain degree of infectivity. Because lots of tests should be carried out timely, medical technicians are busy with work, which requires them to be meticulous without mistake at the same time. Therefore, the percentage of physical sub-health status of

medical technicians was more than that of doctors.

Conclusion

As "a public health emergency of international concern", COVID-19 directly poses a serious hazard to human health. Healthcare workers, as direct workers in response to and handling public health emergencies, have increased workload, work pressure and exposure to risks. Thus, the detection rate of sub-health is relatively high. All healthcare workers with different educational backgrounds and jobs need physical health assistance. It is recommended that relevant managers should optimize the human resource management timely, provide health consultation, healthy behavior guidance, and training content of coping strategies, ensure adequate rest and medical security, and provide suitable sports venues and methods.

Limitations

This study has certain limitations. First, although we strove to mobilize to people from different medical jobs to participate in the survey, because of the jobs were unevenly distributed in the population, the data may be biased. Secondly, the sub-health states of healthcare workers were not tracked at various stages of the "COVID-19" pandemic.

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