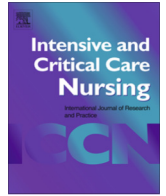




Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Research Article

Psychological stress among health care professionals during the 2019 novel coronavirus disease outbreak: Cases from online consulting customers

Yarong Ma^a, Robert Rosenheck^b, Hongbo He^{a,*}

^aAffiliated Brain Hospital of Guangzhou Medical University (Guangzhou Huiai Hospital), Guangzhou, China

^bDepartment of Psychiatry, Yale School of Medicine, New Haven, CT, USA

ARTICLE INFO

Article history:

Received 21 April 2020

Revised 11 June 2020

Accepted 15 June 2020

Keywords:

COVID-19

Health care professionals

Intensive care units

Psychological distress

Online mental health services

ABSTRACT

Background: During the 2019 novel coronavirus disease (COVID-19) outbreak, online consulting has been widely used to address mental health problems, including health care professionals (HCPs) caring for COVID-19 patients who experienced substantial psychological distress.

Aim: To explore the severity of perceived stress and potential correlates among the HCPs seeking online mental health services during the COVID-19 outbreak.

Methods: A descriptive study was conducted among 34 HCPs to assess levels of psychological distress using the Perceived Stress Scale (PSS-10), Patient Health Questionnaire (PHQ-9), and Generalized Anxiety Disorder (GAD-7) questionnaire. The HCPs working in different departments were compared using χ^2 -test for categorized variables and *t*-test for continuous ones, followed by the analysis of covariate (ANCOVA) to compare the perceived stress. Linear regression for the PSS-10 score was performed to identify potential correlates of stress.

Results: The sample overall ($n = 34$) showed a relatively moderate level of perceived stress (PSS mean = 15.71 ± 4.02) with 38% identified as depressed (PHQ-9 ≥ 5) and 24% as suffering from anxiety (GAD-7 ≥ 5). Those working at intensive care units (ICUs) or in departments of respiratory medicine (RM) demonstrated significantly higher perceived stress than those at other departments (adjusted mean: 17.48 ± 0.96 vs. 13.06 ± 1.25 , $p = .018$, partial $\eta^2 = 0.173$). High perceived stress was most strongly associated with being depressed (beta = 0.486, $p = .002$) and working at ICUs/RM (beta = 0.345, $p = .023$).

Conclusions: The psychological health status of frontline health care professionals during the 2019 novel coronavirus outbreak warrants clinical attention. Online mental health services has played a major role although its effectiveness and barriers to its utilisation require further evaluation.

© 2020 Elsevier Ltd. All rights reserved.

Implications for clinical practice

- Health care professionals (HCPs) at frontline perceived more psychological distress during the COVID-19 outbreak.
- Depression was significantly associated with the high level of stress among frontline HCPs.
- Online mental health services exhibited substantial benefits from subjective feedbacks from HCPs.

Introduction

An outbreak of 2019 novel coronavirus disease (COVID-19) in Wuhan, China spread quickly across the entire nation (Yanping Zhang, 2020). The COVID-19 had a clustered onset and resulted in severe and even fatal respiratory diseases including acute

* Corresponding author at: Affiliated Brain Hospital of Guangzhou Medical University (Guangzhou Huiai Hospital), 36 Mingxin Rd. Liwan District, Guangzhou 510370, China.

E-mail address: hongbo_he@yeah.net (H. He).

respiratory distress syndrome (Chen et al., 2020), leading to an urgent response from respiratory medicine departments and intensive care units (ICUs) (Phua et al., 2020). On 17 February 2020, the China CDC Weekly reported that a total of 3,019 Chinese health workers had been infected with the novel coronavirus, of which, six had died (Li et al., 2020a). Workplace stress on mental health experienced by critical care professionals (Arrogante and Aparicio-Zaldivar, 2017) has been reported to have been adversely affected among those health care professionals (HCPs) caring for patients with COVID-19. HCPs have been reported to be highly vulnerable to experiencing physical exhaustion, sleep problems (Li et al., 2020a), stress/fear of being infected and distributing the virus among relatives (Jansson et al., 2020), and problems during counseling as care for family was hampered by strict precaution measures (Pattison, 2020).

Mental health assessment, support, and treatment are an important part of the response to the COVID-19 outbreak (Xiang et al., 2020), and both national and local policies addressed these mental health problems. Meanwhile, online mental health services related to the stresses incurred by the epidemic have been widely provided by local and national mental health institutions (Li et al., 2020a), to provide support for the general public, including the health care professionals.

Recently, several reports have noted the substantial psychological stresses (Chew et al., 2020; Lai et al., 2020; Li et al., 2020b) as well as physical symptoms (Chew et al., 2020) experienced by HCPs dealing with the COVID-19 outbreak. However, these participants (81.2%) were either from Hubei province, itself, (Lai et al., 2020) or were recruited from those working in other healthcare institutions (Chew et al., 2020; Li et al., 2020b). While online mental health services widely emerged and quickly increased during the pandemic, no studies have focused on the HCPs who sought online consultations. This study reports on HCPs who sought online psychological support from the staff of the Affiliated Brain Hospital of Guangzhou Medical University, and examines the severity of perceived stress and potential psychiatric correlates among HCPs seeking online mental health services during the COVID-19 outbreak.

Methods

Study design and participants

A cross-sectional online survey was conducted among health care professionals who sought online psychological support provided by the staff of the Affiliated Brain Hospital of Guangzhou Medical University (a large psychiatric hospital in southern China). From 22–29 February 2020, we distributed questionnaires to a total of 34 health care professionals (20 physicians, 14 nurses) from Shandong (n = 15), Guangdong (n = 11), Yunnan (n = 3), and Guangxi (n = 3) Provinces. The participants were invited to finish complete self-reported questionnaires prior to the psychological intervention, which included a 30 min discussion of stressful experiences, reactions, and coping mechanisms, with an additional 30 min for questions and answers. Verbal informed consent was provided by all participants prior to their enrollment in the survey. The study protocol was approved by the Affiliated Brain Hospital of Guangzhou Medical University Ethics Committee.

Measures

Demographic characteristics documented included age, sex, marital status, education, occupation, and potentially direct contact with COVID-19 patients. Clinical departments were classified as 1) the intensive care units (ICUs, n = 18) and department of res-

piratory medicine (RM, n = 3), where most suspected or confirmed COVID-19 patients were treated, and as a comparison group of the other departments (n = 13) which saw few COVID-19 infected patients.

The Perceived Stress Scale (PSS-10) (Liu et al., 2011), Patient Health Questionnaire (PHQ-9) (Kroenke et al., 2001), and Generalized Anxiety Disorder (GAD-7) (Löwe et al., 2008) were used to document the level of stress, depression, and anxiety. The PSS-10 scores range from 0 to 13 (low), 14–26 (moderate), and 27–40 (severe perceived stress). The total score of the PHQ-9 ranges from 0 to 27, and scores of 5–9, 10–14, 15–19, and 20–27 indicate mild, moderate, moderately severe, and severe depression, respectively. Scores of less than five on the GAD-7 represents no anxiety, while scores of 5, 10, and 15 are taken as the cut-offs for mild, moderate, and severe anxiety, respectively. For this study, a cut-off greater than or equal to five on the PHQ-9 and GAD-7 were used to classify participants as having any depressive or anxiety symptoms or not.

Statistical analysis

The analysis proceeded in two stages. First, HCPs working in ICUs, RM Departments or elsewhere were compared using chi-square tests for categorical variables and t-tests for continuous variables. Based on Analysis of Covariance (ANCOVA) least-square means adjusted for demographic differences were computed and effect size differences were calculated using η^2 (Richardson, 2011). Eta squared is the proportion of the total variance that is attributed to an effect. Given the exploratory nature of our study, the significant differences for each test were established at $p < .05$, 2-tailed.

Second, stepwise linear regression was used to evaluate predictors of high perceived stress by PSS-10. Independent variables in the model included demographics, $\text{PHQ-9} \geq 5$, $\text{GAD-7} \geq 5$. Statistical analyses were performed using IBM SPSS Statistics for Windows (Version 25.0. Armonk, NY: IBM Corp.)

Results

Among the 34 health care professionals, most were female (71%), with a 73% ranging from 25 to 40 years old. Most were physicians (59%), and most were potentially in direct contact with COVID-19 patients (77%). The comparison between Health care professionals working at ICUs or RM Departments and those at other departments showed the ICUs/RM group had less education ($\chi^2 = 6.476$, $p = .039$); were more often nurses than physicians ($\chi^2 = 14.733$, $p < .001$); and a significantly greater percentage had direct contact with COVID-19 patients (91% vs. 54%, $\chi^2 = 5.988$, $p = .014$). (Table 1)

About one-third (38% vs. 31%) of HCPs in both groups had significant anxiety ($\text{GAD-7} \geq 5$) and one-fourth (24% vs. 23%) had depression ($\text{PHQ-9} \geq 5$). In contrast, analysis of covariance (ANCOVA) showed significantly higher stress in the ICUs/RM group (adjusted mean, 17.47 ± 0.89 vs. 14.63 ± 1.48 , $p = .012$, partial $\eta^2 = 0.206$). (Table 1)

Additionally, the linear regression model indicated that higher perceived stress was significantly associated with being depressed ($\beta = 0.486$, $p = .002$) and being in the ICUs/RM group ($\beta = 0.345$, $p = .023$). (Table 2)

Discussion

To our knowledge, this is the first study to focus on the psychological stress of health professionals who seek online mental health services during the COVID-19 outbreak. Our investigation of the

Table 1
Demographic characteristics, and self-reported symptoms of health care professionals from ICUs/ Respiratory medicine vs. other departments.

| | OverallN = 34 | ICUs/ Resp.21 (62%) | Others13 (38%) | χ^2 | p |
|----------------------------------|---------------|---------------------|----------------|---------------------|-------|
| Female, n (%) | 24 (71%) | 14 (67%) | 10 (77%) | 0.407 | 0.524 |
| Age, years | | | | 4.857 | 0.088 |
| 18 ~ 25 | 9 (27%) | 7 (33%) | 2 (15%) | | |
| 26 ~ 30 | 13 (38%) | 5 (24%) | 8 (62%) | | |
| 31 ~ 40 | 12 (35%) | 9 (43%) | 3 (23%) | | |
| Married, n (%) | 19 (56%) | 12 (57%) | 8 (54%) | 0.035 | 0.851 |
| Education, n (%) | | | | 6.476 | 0.039 |
| Junior college | 8 (24%) | 8 (38%) | 0 | | |
| Bachelor | 18 (52%) | 9 (43%) | 9 (69%) | | |
| Master and above | 8 (24%) | 4 (19%) | 4 (31%) | | |
| Occupation, n (%) | | | | 14.733 | 0.000 |
| Physician | 20 (59%) | 7 (33%) | 13 (100%) | | |
| Nurse | 14 (41%) | 14 (67%) | 0 | | |
| Contact with COVID-19 pts, n (%) | 26 (77%) | 19 (91%) | 7 (54%) | 5.988 | 0.014 |
| GAD-7 \geq 5, n (%) | 12 (35%) | 8 (38%) | 4 (31%) | 0.189 | 0.664 |
| PHQ-9 \geq 5, n (%) | 8 (24%) | 5 (24%) | 3 (23%) | 0.002 | 0.961 |
| PSS-10 | | | | | |
| Mean, SD | 15.71, 4.08 | 16.81, 3.75 | 13.92, 4.09 | t = -2.107 | 0.043 |
| †Least square mean, SE | | 17.48, 0.96 | 13.06, 1.25 | F = 6.291ES = 0.173 | 0.018 |

ICUs, intensive care units GAD-7, General Anxiety Disorder questionnaire; PHQ-9, Patient Health Questionnaire; PSS-10, Perceived Stress Scale.

†Analysis of covariate (ANCOVA), adjusted for the education, occupation, and contact with COVID-19 patients. ES, effect size, calculated by Partial η^2

Table 2
Stepwise linear regression for PSS-10.

| | B | S.E. | Beta | t | Sig. | 95% CI | |
|--------------------------------|--------|-------|-------|--------|-------|--------|--------|
| (Constant) | 12.860 | 0.986 | | 13.036 | 0.000 | 10.848 | 14.872 |
| "PHQ-9 \geq 5" =1 | 4.607 | 1.363 | 0.486 | 3.380 | 0.002 | 1.827 | 7.387 |
| "ICUs/Respiratory medicine" =1 | 2.853 | 1.190 | 0.345 | 2.398 | 0.023 | 0.426 | 5.279 |

PSS-10, Perceived Stress Scale; PHQ-9, Patient Health Questionnaire; CI, confidential interval; ICUs, intensive care units.

psychological stress of these HCPs showed that those who cared for people with confirmed or suspected COVID-19, is especially stressful and that stress was worse among those with concomitant depression. Compared to a multicenter sample of 2,637 Chinese physicians and nurses, prior to the pandemic, of whom 24.5% reported anxiety symptoms and 26.4% depression symptoms in the past week (L. Shi et al., 2020), the current sample demonstrated a higher proportion meeting the cutoff for anxiety (35%) but similar proportions with depression (24%) in both groups. Thus anxiety was common even in a well-trained team that coped well with depression during the pandemic outbreak.

The frontline health care professionals, e.g., working at ICUs and in respiratory departments, were at high risk for infection (Li et al., 2020a), and have been documented to have experienced fear of contagion and, additionally, of spreading the virus to their families, friends, or colleagues (Xiang et al., 2020). Compounding the stress the protective equipment and protective procedures make medical tasks more difficult to perform (Lehmann et al., 2015).

Inconsistent with our findings, higher proportions of HCPs met criteria for depression (PHQ-9 \geq 10, 50.4%) and anxiety (GAD-7 \geq 7, 44.6%) were reported among 1257 health care workers in 34 hospitals, in China, (Lai et al., 2020). The substantially lower proportions among online consulting HCPs may indicate less use of online counseling among this group (J. Shi et al., 2019). Yao and colleagues (Yao et al., 2020) expressed concern about online mental health services and mental health service utilization in China during the COVID-19 epidemic, based a survey of 108 participants with high acute stress during the epidemic, among whom only 3.7% had ever used mental health services since the outbreak.

In the current study, many participants (38%) reported subjective benefit and a desire for additional online mental health services after the interventions. Nevertheless online mental health

services are being used increasingly during the COVID-19 epidemic and are facilitating the development of mental health services across China more generally (Kang et al., 2020), despite the lack of experimental evidence of their effectiveness (Yao et al., 2020).

Strengths and limitations

This study has several limitations. First, it used a cross-sectional observational design with a small sample size and thus could not address the long-term psychological outcomes of treatment provided to this population. Second, the questionnaires were self-administered and information provided on symptoms was not verified by trained professional raters. Finally, the lack of comparison from a non-online consulting group limits the generalizability of the findings.

Despite the above limitations, this study found that health care professionals working in the ICUs or respiratory department experienced more psychological distress than the others during the COVID-19 outbreak. Psychological interventions to promote mental well-being in health care professionals exposed to COVID-19 are necessary and urgent needed. Online mental health services may only catch the less severe cases.

Conclusion

The psychological health status of frontline health care professionals during the COVID-19 outbreak deserves attention and maybe well-served by online mental health services. While online mental health services were widely provided during the pandemic the effectiveness and barriers to utilization of this service need further evaluation.

Ethical approval

The study protocol was determined as an exemption from full ethics review by the Affiliated Brain Hospital of Guangzhou Medical University Ethics Committee.

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.

Acknowledgments

We want to acknowledge all the participants and the essential help from the medical staff of the hospital, key labs et al.

Authorship

HH and RR contributed to the conception and design of the work. YM contributed to the analysis and interpretation of data. YM drafted the manuscript revised by RR. All authors provided the approval for publication of the manuscript.

Disclosure.

Funding sources

None.

References

- Arrogante, O., Aparicio-Zaldivar, E., 2017. Burnout and health among critical care professionals: The mediational role of resilience. *Intensive Crit. Care Nurs.* 42, 110–115. <https://doi.org/10.1016/j.iccn.2017.04.010>.
- Chen, N., Zhou, M., Dong, X., et al., 2020. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet (London, England)* 395 (10223), 507–513. [https://doi.org/10.1016/s0140-6736\(20\)30211-7](https://doi.org/10.1016/s0140-6736(20)30211-7).
- Chew, N.W.S., Lee, G.K.H., Tan, B.Y.Q., et al., 2020. A multinational, multicentre study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak. *Brain Behav. Immun.* <https://doi.org/10.1016/j.bbi.2020.04.049>.
- Jansson, M., Liao, X., Rello, J., 2020. Strengthening ICU health security for a coronavirus epidemic. *Intensive Crit. Care Nurs.* 57, 102812. <https://doi.org/10.1016/j.iccn.2020.102812>.
- Kang, L., Ma, S., Chen, M., et al., 2020. Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: A cross-sectional study. *Brain Behav. Immun.* <https://doi.org/10.1016/j.bbi.2020.03.028>.
- Kroenke, K., Spitzer, R.L., Williams, J.B.W., 2001. The PHQ-9. *J. Gen. Intern. Med.* 16 (9), 606–613. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>.
- Lai, J., Ma, S., Wang, Y., et al., 2020. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. *JAMA Netw Open* 3, (3). <https://doi.org/10.1001/jamanetworkopen.2020.3976>.
- Lehmann, M., Bruenahl, C.A., Löwe, B., et al., 2015. Ebola and psychological stress of health care professionals. *Emerg. Infect. Dis.* 21 (5), 913–914. <https://doi.org/10.3201/eid2105.141988>.
- Li, W., Yang, Y., Liu, Z.-H., et al., 2020a. Progression of Mental Health Services during the COVID-19 Outbreak in China. *Int. J. Biol. Sci.* 16 (10), 1732–1738. <https://doi.org/10.7150/ijbs.45120>.
- Li, Z., Xiang, W., Yuan, Y., et al., 2020b. Study of the Mental State of Medical Staff and its Risk Factors During COVID-19 Pandemic [in Chinese]. *J. Chengdu Med. College* 9, 1–11.
- Liu, C., Wang, Z., Chen, J., et al., 2011. Psychometric Properties of the Chinese Version of the Perceived Stress Scale in Policewomen. *PLoS One* 6, (12). <https://doi.org/10.1371/journal.pone.0028610>.
- Löwe, B., Decker, O., Müller, S., et al., 2008. Validation and Standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the General Population. *Med Care* 46 (3), 266–274. <https://doi.org/10.1097/MLR.0b013e318160d093>.
- Pattison, N., 2020. End-of-life decisions and care in the midst of a global coronavirus (COVID-19) pandemic. *Intensive Crit. Care Nurs.* 58, 102862. <https://doi.org/10.1016/j.iccn.2020.102862>.
- Phua, J., Weng, L., Ling, L., et al., 2020. Intensive care management of coronavirus disease 2019 (COVID-19): challenges and recommendations. *Lancet Respir Med.* [https://doi.org/10.1016/s2213-2600\(20\)30161-2](https://doi.org/10.1016/s2213-2600(20)30161-2).
- Richardson, J.T.E., 2011. Eta squared and partial eta squared as measures of effect size in educational research. *Educ. Res. Review* 6 (2), 135–147. <https://doi.org/10.1016/j.edurev.2010.12.001>.
- Shi, J., Tang, L., Jing, L., et al., 2019. Disparities in mental health care utilization among inpatients in various types of health institutions: a cross-sectional study based on EHR data in Shanghai, China. *BMC Public Health* 19 (1), 1023. <https://doi.org/10.1186/s12889-019-7343-7>.
- Shi, L., Li, G., Hao, J., et al., 2020. Psychological depletion in physicians and nurses exposed to workplace violence: A cross-sectional study using propensity score analysis. *Int. J. Nurs. Stud.* 103, <https://doi.org/10.1016/j.ijnurstu.2019.103493>.
- Xiang, Y.T., Yang, Y., Li, W., et al., 2020. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *The Lancet. Psychiatry* 7 (3), 228–229. [https://doi.org/10.1016/s2215-0366\(20\)30046-8](https://doi.org/10.1016/s2215-0366(20)30046-8).
- Yanping Zhang, E. W. G. f. N. E. R. (2020). The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) in China. *Chinese Journal of Epidemiology*, 41(2), 7.
- Yao, H., Chen, J.H., Xu, Y.F., 2020. Rethinking online mental health services in China during the COVID-19 epidemic. *Asian J. Psychiatr.* 50, <https://doi.org/10.1016/j.ajp.2020.102015>.