



The mental health of healthcare workers in the COVID-19 pandemic: A systematic review

Maryam Vizheh¹ · Mostafa Qorbani^{2,3} · Seyed Masoud Arzaghi⁴ · Salut Muhidin⁵ · Zohreh Javanmard⁶ · Marzieh Esmaeili⁷

Received: 21 August 2020 / Accepted: 21 September 2020 / Published online: 26 October 2020
© Springer Nature Switzerland AG 2020

Abstract

Purpose The novel coronavirus 2019 (COVID-19) is widely spreading all over the world, causing mental health problems for most people. The medical staff is also under considerable psychological pressure. This study aimed to review all research carried out on the mental health status of health care workers (HCWs) to bring policymakers and managers' attention.

Methods A literature search conducted through e-databases, including PubMed, EMBASE, Scopus, and Web of Science (WoS) from December 2019 up to April 12th 2020. All cross-sectional studies published in English which assessed the health workers' psychological well-being during the SARS-CoV-2 pandemic included. Study quality was analyzed using NHLBI Study Quality assessment tools.

Results One hundred relevant articles were identified through systematic search; of which eleven studies were eligible for this review. Their quality score was acceptable. The lowest reported prevalence of anxiety, depression, and stress among HCWs was 24.1%, 12.1%, and 29.8%, respectively. In addition, the highest reported values for the aforementioned parameters were 67.55%, 55.89%, and 62.99%, respectively. Nurses, female workers, front-line health care workers, younger medical staff, and workers in areas with higher infection rates reported more severe degrees of all psychological symptoms than other health care workers. Moreover, vicarious traumatization in non-front-line nurses and the general public was higher than that of the front-line nurses.

Conclusion During SARS-CoV-2 outbreak, the health care workers face aggravated psychological pressure and even mental illness. It would be recommended to the policymakers and managers to adopt the supportive, encouragement & motivational, protective, and training & educational interventions, especially through information and communication platform.

Keywords The novel coronavirus 2019 (SARS-CoV-2) · COVID-19 · Medical staff · Anxiety · Stress · Depression · Psychological effect

Maryam Vizheh
maryamvizheh@yahoo.com

Mostafa Qorbani
mqorbani1379@yahoo.com

Seyed Masoud Arzaghi
dr.arzaghi.sm@gmail.com

Salut Muhidin
salut.muhidin@mq.edu.au

Zohreh Javanmard
zohreh.javanmard44@gmail.com

✉ Marzieh Esmaeili
marzieh.esmaeili@gmail.com

¹ Department of Reproductive Health and Midwifery, School of Nursing and Midwifery, Tehran University of Medical Sciences, Tehran, Iran

² Department of Epidemiology and Biostatistics, Non-communicable Diseases Research Center, Alborz University of Medical Sciences, Karaj, Iran

³ Chronic Diseases Research Center, Endocrinology and Metabolism Population Sciences Institute, Endocrinology and Metabolism Research Institute, Tehran University of Medical Sciences, Tehran, Iran

⁴ Elderly Health Research Center, Endocrinology and Metabolism Population Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran

⁵ Department of Management, Macquarie Business School, Macquarie University, Sydney, New South Wales 2109, Australia

⁶ Department of Health Information Technology, Ferdows school of Paramedical and Health, Birjand University of Medical Sciences, Birjand, Iran

⁷ Department of Health Information Management, School of Allied Medical Sciences, Tehran University of Medical Sciences, 3rd Floor, No.17, Farre Danesh Alley, Qods Street, Enqelab Street, Tehran, Iran

Introduction

A novel coronavirus, named SARS-CoV2, emerging from Wuhan, China, has led to a fast spread outbreak of COVID-19 pneumonia. World health organization has declared COVID-19 as a public health emergency of international concern [1]. By April 26th, 2020, four months after outbreak, more than 2,800,000 confirmed cases and almost 200,000 deaths due to SARS-CoV-2 have been reported [2].

Major epidemic outbreaks pose an increasing demand for healthcare workers [3]. Constant increasing of infected cases, a rise in the rate of deaths, lack of any specific medicine or vaccine, extensive media coverage, massive workload, lack of personal protective equipment, and feelings of inadequate support all can contribute to the mental burden of these health care staff [4]. In these situations, it is expected of HCWs to work long hours while they are under overwhelming pressure. They are at the risk of being infected when treating ill patients. On the other hand, like other individuals, they are exposed to a considerable amount of fake news and rumors all of which increase their anxiety [5]. Reports indicated that several HCWs became infected with SARS-CoV-2 when they were in close contact with infected patients [6]. In the initial phase of the SARS-CoV-2 outbreak, 29% of all hospitalized patients were HCWs [7]. Working in these situations develops the risk of various psychological and mental illnesses as well as physical and emotional distress among medical staff [4, 6].

Research conducted on other infectious diseases, such as severe acute respiratory syndrome (SARS), the Middle East Respiratory Syndrome (MERS) and the Ebola virus, revealed that a considerable number of HCWs suffer from significant emotional distress during the outbreak [8]. A study by assessing 1257 health workers treated SARS-infected patients found that given the fast dissemination of infection in the early stage of the epidemic, feeling of uncertainty, the threat to life, and significant vulnerability characterized by somatic and cognitive symptoms of anxiety were prevalent [9]. On the other hand, even after the outbreak, symptoms, including depression, anxiety, traumatic stress, avoidance, and burnout were reported [8, 9]. While the results of adverse psychological effects of SARS were documented, infected patients of SARS-CoV-2 and related deaths have been several times that of SARS [7]. Some people have been comparing the current situation of rapidly spreading SARS-CoV-2 to “the end of the world.” Hospitals are “overwhelmed,” and there are many concerns about people’s daily lives [10]. This situational framework in all over the world can potentially put healthcare workers in an unprecedented situation, working under severe pressures [10, 11]. Healthcare workers, as a result, are susceptible to experience psychological and mental problems. Thus, in this critical situation the medical staff’ mental health should be considered an urgent public health concern [7].

Given the insights acquired from the previous global outbreaks and their psychosocial impacts, early assessment of medical staff’s mental health and considering appropriate psychological interventions is vital [12, 13]. Accordingly, considering comprehensive and practical actions to protect health care workers’ mental health are critical [14]. Up to now, few studies have evaluated the mental health of health care workers dealing with COVID-19 patients. Hence, this study designed to investigate the articles addressing the status of HCWs’ mental health during the SARS-CoV-2 outbreak. Moreover, several psychological interventions are provided to improve the overall mental health of this target group.

Methods

This review was presented based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [15].

Information sources and search strategy

An electronic search was conducted through four e-databases including PubMed, EMBASE, Scopus, and Web of Science (WoS). The search strategy was designed by two authors (M.E. & M.V.) consisted of three concepts regarding to the aim of the study: (1) The 2019 novel coronavirus disease, (2) Psychological impact, (3) Healthcare workers. It is also limited to the English-language articles published from December 2019 up to April 12th, 2020. The steps of building the search query in PubMed with the keywords and their synonyms are shown in Table 1. A similar approach was taken for other databases.

Eligibility criteria

According to the review’s objectives, the inclusion criteria outlined as follow:

- Published in the English language
- Cross-sectional studies
- Study population including healthcare workers who engaged in caring for patients with the COVID-19 infection
- Reported the psychological-related outcomes such as depression, stress, anxiety, distress, fear, phobia, sleep disorders, etc. relating to healthcare workers

Study selection and data extraction

Primary research articles evaluating the various aspects of HCWs’ psychological status due to the SARS-CoV-2 outbreak were included in this study. The process of search and

Table 1 PubMed search query

No.	Search query
1.	“covid 19” [Title/Abstract] OR “covid-19” [Title/Abstract] OR “*covid-19*” [Title/Abstract] OR “*covid*” [Title/Abstract] OR “*SARS-CoV-2*” [Title/Abstract] OR “*2019-nCoV*” [Title/Abstract] OR “*novel coronavirus*” [Title/Abstract] OR “*new coronavirus*” [Title/Abstract] OR “*coronavirus*” [Title/Abstract]
2.	“stress*” [Title/Abstract] OR “anxiety” [Title/Abstract] OR “depression” [Title/Abstract] OR “fear” [Title/Abstract] OR “worry” [Title/Abstract] OR “panic” [Title/Abstract] OR “paranoia” [Title/Abstract] OR “phobia” [Title/Abstract] OR “psycholog*” [Title/Abstract] OR “distress” [Title/Abstract] OR “compulsive behav*” [Title/Abstract] OR “mental*” [Title/Abstract] OR “emotion*” [Title/Abstract]
3.	“health work*” [Title/Abstract] OR “healthcare work*” [Title/Abstract] OR “hospital work*” [Title/Abstract] OR “health staff*” [Title/Abstract] OR “healthcare staff*” [Title/Abstract] OR “medical staff*” [Title/Abstract] OR “hospital staff*” [Title/Abstract] OR “resident*” [Title/Abstract] OR “specialist*” [Title/Abstract] OR “clinician*” [Title/Abstract] OR “nurse*” [Title/Abstract] OR “physician” [Title/Abstract] OR “treatment staff*” [Title/Abstract] OR “medical team” [Title/Abstract] OR “frontline” [Title/Abstract] OR “midwife*” [Title/Abstract]
4.	#1 AND #2 AND #3
Filters	English; Publication date from 2019 up to April 12th 2020;

screening the titles and abstracts were performed by two authors (M.E. & M.V.). After identifying all relevant articles, full texts were evaluated to extract the relevant data. Then, the content of retrieved data was assessed by all authors.

Methodological quality (risk of bias) assessment

The Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies published by the National Heart, Lung and Blood Institute (NHLBI) [16] was used to assess the quality of the included articles. The quality assessment was conducted independently by two authors (M.E. & M.V.). This tool consists of 14 items - each of which could be marked as Yes, No, or Not Reported. The score 1 assigns to Yes and the score 0 to all other answers. In other words, the total score would be the number of affirmative responses. To qualitative evaluation of the final scores, scores higher than 12 deemed good, those lower than 9 considered as the week, and those fell in the range of 9 to 12 represent fair studies [17].

Outcome of interest

The mental health of HCWs dealing with COVID-19 patients was the interested outcomes in this systematic review.

Results

One hundred relevant articles identified through systematic search of four electronic databases including PubMed ($n = 21$), EMBASE ($n = 28$), Scopus ($n = 34$), and WoS ($n = 17$). Additionally, Google Scholar and references of the included studies were reviewed manually. After excluding 37 duplicated studies, the remained titles and abstracts were assessed, of

which eleven studies were eligible for this review; seven articles were found through systematic search and four preprint articles were added manually (Fig. 1). The eligible articles had a mean NHLBI Quality assessment score of 11.81/14 (10–13/14). The study characteristics, outcome characteristics, findings, and quality score of all selected papers are shown in Table 2.

The characteristics of the included studies showed that most of the studies exclusively evaluated the psychological status of HCWs under SARS-CoV-2 pandemic. Three studies address both general populations and HCWs. Nurses composed the main proportion of medical staff evaluated in these studies. Moreover, most of the respondents in all studies were female. Nine studies were performed in China as the first country struggling with SARS-CoV-2. Italy and Spain were the other settings that assessed the mental health of HCWs.

The most studied outcomes were anxiety (9 /11) followed by depression (6/11), stress (5/11), insomnia (2/11), and distress (4/11). Furthermore, fear, self-efficacy, sleep quality, risk perception, death anxiety, social desirability, and social support, separately were the main outcome in one study (Table 2).

The prevalence of anxiety reported by health care workers in included studies varied from 24.1% [7], 25.5% [18], to 44.6% [4]. In another study, the total anxiety score was 32.19 ± 7.56 points, which was significantly higher than the standard of national points ($29.78 + 0.46$), ($t = 4.27$, $p < 0.001$). This study also revealed that anxiety positively correlated with total stress load score and all its dimensions [19].

In various studies, 12.1% [18], 13.5% [7], and 50.4% [4] of HCWs expressed degrees of moderate and severe depression. Moreover, stress was a prevalent mental problem in HCWs. In a study by Zhu et al. 29.8% of HCWs reported stress [7]. The overall prevalence of psychological disturbance in HCWs was

Table 2 The psychological outcomes of the included studies (based on severity, sex, and population)

#	Study characteristics		Outcome characteristics			Findings			QS (0–14)		
	Study [ref] Country	Population/ sample size	Type of mental health	Measurements tool (range of score)	Definition of outcome	Measure	Total	By severity of outcome		By sex	By population
1	Lai et al. [4] China	Medical staff T: 1257 P: 493 (39.22%) N: 764 (60.77%)	Depression Anxiety Insomnia Distress	PHQ-9 (0–27) GAD-7 (0–21) ISI-7 (0–28) IE-22 (0–88)	PHQ-9, normal (0–4), mild (5–9), mod (10–14), severe (15–21) GAD-7, normal (0–4), mild (5–9), mod (10–14), severe (15–21) ISI, normal(0–7), sub (8–14), mod (15–21), severe (22–28) IES-R, normal (0–8),mild (9–25), mod (26–43), severe (44–88)	Prevalence (%)	Depression 50.4% Anxiety 44.6% Insomnia 34.0% Distress 71.5%	Depression Mild: 35.6% Mod: 8.6% Severe: 6.2% Anxiety M: 41.7% F: 53.2% Insomnia M: 35.5% F: 47.4% Distress M: 29.1% F: 35.5% Subthreshold: 26.2% Mod: 6.8% Severe: 1.0% Distress Mild: 36.5% Mod: 24.5% Severe: 10.5%	Depression N: 53.5% P: 45.6% Anxiety N: 47.1% P: 40.6% Insomnia N: 38.2% P: 27.4% Distress N: 74.5% P: 66.9%	13	
2	Kang et al. [14] China	Medical staff T: 994 P: 183 N: 811	Mental health disturbances	PHQ-9 (0–27) GAD-7 (0–21) ISI-7 (0–28) IE-22 (0–88)	According to these four questionnaires by Ward method and using cluster analysis	Prevalence (%)	63%	Mild 34.4% Mod 22.4% Severe 6.2%	M: 56.9% F: 64.1%	N: 64.11% P: 58.46%	11
3	Lu et al. [18] China	Medical staff P + N: 2042 Administrative staff: 257	Fear Anxiety Depression	NRS (0–10) HAMA (0–70) HAMD (0–85)	Fear scale, 0–3 (no/mild) 4–6 (moderate) 7–10 (severe/extreme) HAMA, 0–6 (no) 7–13 (mild/moderate) ≥14 (severe/extreme) HAMD, 0–6 (no) 7–23 (mild/moderate) ≥24 (severe/extreme)	Prevalence (%)	Fear 70.6% Anxiety 25.5% Depression 12.1%	Fear no/mild: 29.4% Mod: 43.9% severe/extreme: 26.7% Anxiety mild/mod: 22.6% severe/extreme: 2.9% Depression no: 87.9% mild/moderate: 11.8% severe/extreme: 0.3%	NR Medical staff: 70.6% Administrative staff: 58.4% Anxiety Medical staff: 25.5% Administrative staff: 20% Depression Medical staff: 12.1% Administrative staff: 8.2%	12	
4		Medical staff		SDS SAS	NA		SDS	NR	NR	SDS	11

Table 2 (continued)

#	Study characteristics		Outcome characteristics			Findings			QS (0–14)	
	Study [ref] Country	Population/ sample size	Type of mental health	Measurements tool (range of score)	Definition of outcome	Measure	Total	By severity of outcome		By sex
	Liang et al. [23] China	T: 59 COVID-19 department's staff: 38 Other department's staff: 21	Anxiety Depression			Mean score ± SD	30.23 ± 7.98 SAS 28.34 ± 5.16			COVID-19 department's staff: 29.61 ± 8.02 Other department's staff: 31.36 ± 7.92 SAS COVID-19 department's staff: 27.88 ± 5.32 Other department's staff: 29.20 ± 4.52 NR
5	Xiao et al. [6] China	Medical staff T: 180	Anxiety Self-efficacy Stress Sleep quality Social support	SSRS (7–56) SAS (0–80) GSES (10–40) SASR (0–150) PSQI (0–21)	NA	Mean score ± SD	SSRS 34.172 ± 10.263 GSES 2.267 ± 0.767 SAS 55.256 ± 14.183 SASR 77.589 ± 29.525 PSQI 8.583 ± 4.567	NR	NR	12
6	Li et al. [12] China	Medical staff T: 740 GP: 214 FLN: 234nFLN: 292	Vicarious trauma		NA	Median (25th–75th)		NR	NR	GP 75.5 (62–88.3) FLNs 64 (52–75) nFLNs 75.5 (63–92) NR
7	Mo et al. [19] China	Nurse N: 180	Anxiety Stress	SOS (22–110) SAS (20–80)	NA	Mean score ± SD	SOS 39.91 ± 12.92 SAS 32.19 ± 7.56	NR	NR	
8	Dai et al. [20] China	Medical staff T: 4357 N: 2343 (53.77%) P: 1419 (32.56%) Technician: 437 (10%)	Psychological distress	GHQ-12 (0–12)	GHQ ≥ 3	Prevalence (%)	39.1%	NR	M: 32.2% F: 41.2%	P: 39% N: 41.3% Technician: 30.7% Support staff: 30.4%

Table 2 (continued)

#	Study characteristics		Outcome characteristics			Findings			QS (0–14)		
	Study [ref] Country	Population/ sample size	Type of mental health	Measurements tool (range of score)	Definition of outcome	Measure	Total	By severity of outcome		By sex	By population
9	Zhu et al. [7] China	T: 5062 P: 1004 N: 3417 Technician: 641	Stress Depression Anxiety	PHQ-9 GAD-7 IES-R	PHQ-9 ≥ 10 GAD-7 ≥ 8 IES-R > 33	Prevalence (%)	Stress 29.8% Depression 13.5% Anxiety 24.1%	NR	Depression M: 71 (9/36%) F: 610 (14.17%) Anxiety M: 137 (18.07%) F: 1081 (25.11%) Psychological stress M: 153 (20.18%) F: 1356 (31.5%)	Depression P: 11.35% N: 14.31% Technician: 12.16% Anxiety P: 23.1% N: 25.25% Technician: 19.18% Psychological stress P: 24.2% N: 33.06% Technician: 21.21%	13
10	Simione and Gnagnarella la [22] Italy	T: 353 GP: 186 Medical staff: 167	Stress Anxiety Existential concerns Socially desirable manner COVID-19-related experience and personal opinion	PSS (4–20) STAI (6–24) ECQ (5–20) M&C (9–54)	NA	Mean score	ECQ 8.92 PSS 6.58 STAI 14.06	NR	NR	ECQ Med: 9.05 GP: 8.81 PSS Med: 6.62 GP: 6.55 STAI Med: 14.08 GP: 14.06	11
11	Odirozola- González et al. [21] Spain	T: 3550 GP: 3204 (90.3) Med: 346 (9.7%)	-the 21-item version of the Depression Anxiety Stress Scales -the Impact of EventScale (IES)	DASS-21 (0–63) IES (0–75)	NA	Mean score ± SD	Depression 5.06 ± 4.76 Anxiety 3.15 ± 3.76 Stress 6.50 ± 4.69 Depression 55.89% Anxiety 67.55% Stress	NR	NR	NR	12

Table 2 (continued)

#	Study characteristics		Outcome characteristics		Findings			QS (0–14)
	Study [ref]	Population/sample size	Type of mental health	Measurements tool (range of score)	Definition of outcome	Measure	Total	
							62.99%	

QS: Quality score; **T:** Total; **P:** Physician; **N:** Nurse; **FLN:** Front-line nurses; **nFLNs:** Non-front-line nurses; **GP:** General public; **Med:** Medical staff; **mod:** Moderate; **sub:** Subthreshold; **NA:** Not applicable; **NR:** Not reported; *****: not peer-reviewed; **SD:** Standard deviation; **PHQ-9:** The 9-item Patient Health Questionnaire; **GAD-7:** The 7-item Generalized Anxiety Disorder scale; **ISI-7:** The 7-item Insomnia Severity Index; **IE-22:** The 22-item Impact of Event Scale-Revised; **NRS:** The numeric rating scale on fear; **HAMA:** Hamilton Anxiety Scale; **HAMD:** Hamilton Depression Scale; **SDS:** Self-rating depression scale; **SAS:** Self-rating anxiety scale; **GSES:** The General Self-Efficacy Scale; **SASR:** The Stamford Acute Stress Reaction questionnaire; **PSQI:** The Pittsburgh Sleep Quality Index; **SSRS:** The Social Support Rate Scale; **GHQ:** General Health Questionnaire; **PSS:** The 4-item Perceived Stress Scale; **STAI:** The 6-item version of State-Trait Anxiety Inventory; **ECCQ:** The death anxiety scale of the Existential Concerns Questionnaire; **M&C:** The Marlowe & Crowne social desirability scale; **DASS-21:** Depression Anxiety Stress Scale

high. In a study that assessed anxiety, stress, depression, and insomnia, 63% of health care workers reported mental disturbance [14]. Also, in the study conducted by Dai et al. 39.1% of respondents reported GHQ-12 score ≥ 3 , which was significantly higher than normal times [20]. The lowest reported prevalence of anxiety, depression, and stress among HCEs was 24.1% [7], 12.1% [18], and 29.8% [7], respectively. On the other hand, the highest reported prevalence of these problems was attributed to Spain, where 67.55%, 55.89%, and 62.99% of HCWs expressed anxiety, depression, and stress, respectively [21]. (Table 2).

Not surprisingly, a noticeable percentage of medical staff suffered from sleep disturbance and low sleep quality [6]. In one study, 34.0% of respondents complained of insomnia [4]. Anxiety, stress, and self-efficacy as mediating variables were associated with sleep quality and social support. Sleep quality was negatively affected by the levels of anxiety [6]. On the other hand, social support of HCWs was positively associated with self-efficacy and sleep quality and negatively associated with anxiety and stress [6]. Fear was also a psychological problem assessed in a study by Lu et al. [18]. A significant proportion of medical staff experienced moderate and severe fear that was significantly higher than the administrative staff group, 70.6% and 58.4%, respectively [18]. Li et al. [12] with comparing three groups; general public, front-line nurses and non-front-line nurses, found that the severity of vicarious traumatization caused by the SARS-CoV-2 pandemic in non-front-line nurses and the general public was higher than that of the front-line nurses who were responsible for close care for COVID-19 patients. The fact that people in Wuhan were in guarantee and were deprived of face to face contact with others was the possible reason for this finding [12].

These studies showed that various factors were associated with mental pressures experienced by the HCWs. Working in areas with a high incidence of infection was significantly associated with higher stress and psychological disturbance. These results were more highlighted when HCWs worked in Wuhan which is supposed to be the origin of SARS-CoV-2 infection with the highest concentration of infected cases in China. HCWs in these areas expressed higher mental disturbance than those in other regions [4, 20]. Also, medical staff working in North Italy with the highest number of patients reported higher levels of anxiety and stress than HCWs or the general public from other regions of Italy [22].

Moreover, nurses [4], women [4, 7, 20], front-line health care workers [4], and younger medical staff [23] reported more severe degrees of all psychological symptoms except the vicarious traumatization than other health care workers. Also, being the only child in their families, the severity of patients, working hours per week, diet, and sleep status influenced HCWs' stress [19].

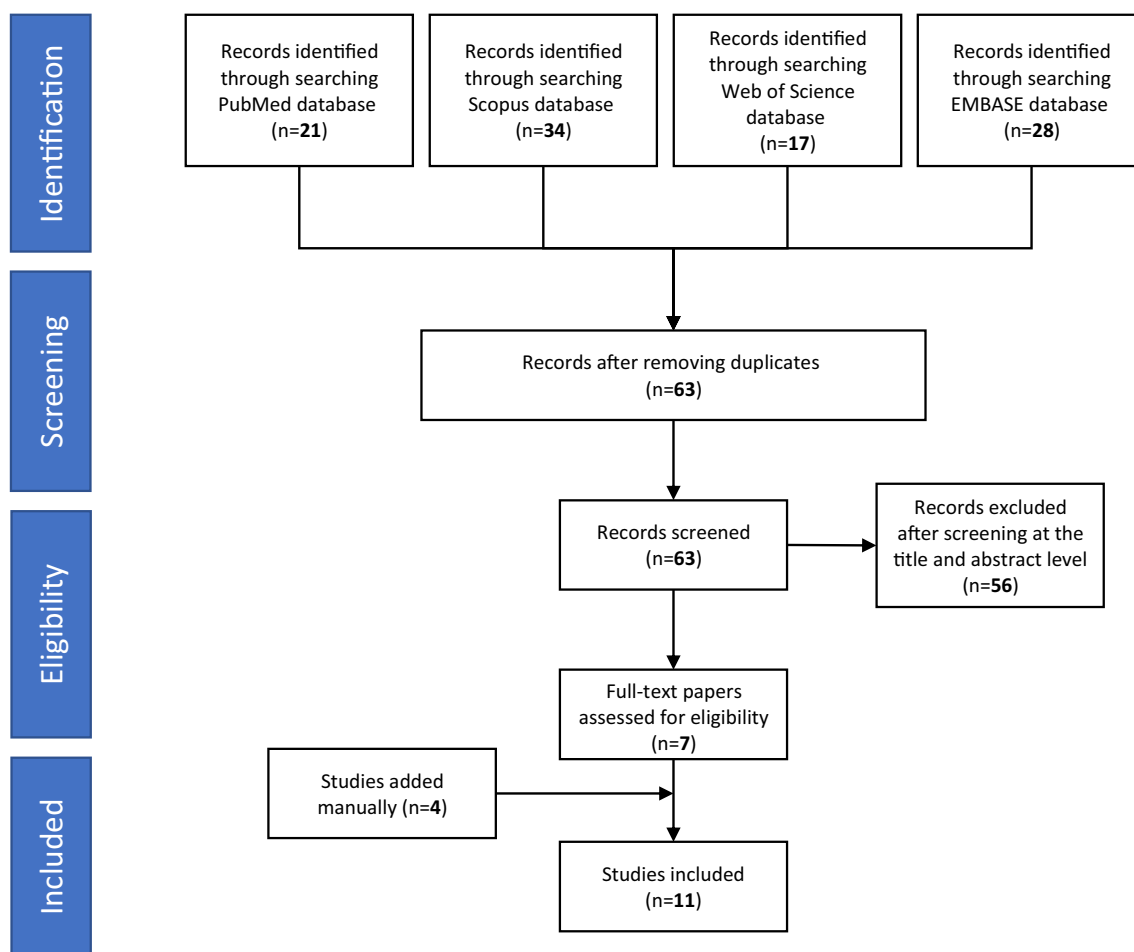


Fig. 1 PRISMA diagram for searching resources

Discussion

In March 2020, SARS-CoV-2 was declared as a pandemic by the WHO, while more than 200 countries are currently struggling with this infectious disease [24]. This poses a tremendous pressure on the HCWs [25].

During the viral epidemics, the mental health of HCWs confronts serious challenges [7]. HCWs face the death of their colleagues and threats to their lives. Moreover, the fear of becoming infected, the absence of an effective social support system, and the high workload all increase mental disorders [26]. However, few studies have addressed the psychiatric morbidity and mental health problems of HCWs during the SARS-CoV-2 pandemic. Based on data retrieved from included studies, a substantial proportion of the analyzed sample showed degrees of psychological symptoms.

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is a member of the coronaviruses family that can lead to a common cold to a Severe Acute Respiratory Syndrome (SARS) and the Middle East Respiratory Syndrome (MERS) diseases [27]. Reports of these infections' acute psychological impact on hospital workers, indicated that

high levels of distress, depression, anxiety, fear, and frustration were common [13, 28]. One of the best-documented outbreaks occurred over the last decade was the SARS outbreak as an emerging infectious disease, observed first in China in 2002 and then spread to 29 countries [29]. A study found that 89% of health care workers during this outbreak reported psychological disorders [4]. Also, in another study assessed the psychological impact of SARS, the prevalence of anxiety and worries, depression, somatic symptoms, and sleep problems in HCWs were 77.4%, 74.2%, 69.0%, and 52.3%, respectively [9]. Tam et al. (2004) [30] using the GHQ-12 questionnaire, found that 57% of medical staff suffered from psychological distress due to SARS outbreak. Similarly, in initial stages of the MERS outbreak, HCWs showed higher distress when measured by the Impact of Event Scale-Revised (IES-R) [8]. Although these results indicated the high-risk of psychological problems in HCWs, our results found the lower prevalence of mental health problems in HCWs dealing with SARS-CoV-2 patients. This could be the result of the lower fatality rate of SARS-CoV-2 compared to SARS and MERS.

A global pandemic can be a significant source of fear and concern [31]. During the SARS epidemic, HCWs reported

anxiety and fear and some preferred to resign from their jobs [32]. Compared to the year of 2003, these days the fast spread of news might cause public fear, panic, and distress [7]. Health fear is created in the result of circumstances in which HCWs care of patients with contagious diseases, including SARS, MERS, and SARS-CoV-2. They are not only responsible for their patients but also are concerned of becoming infected and also transmitted the disease to their family members [32]. During the SARS outbreak, quarantined HCWs experienced fear, stigma, and frustration [33]. Isolation and working in high-risk departments and contact with infected people were considered the most causes of trauma [14]. Consistent with these findings, a considerable proportion of HCWs in this study reported fear (70.6%) [18]. Furthermore, studies have demonstrated that HCWs experienced emotional disturbance during the MERS outbreak. Medical staff suffered from the anxiety and nervousness, though at varying degrees [34]. The fact of human to human transmission of the SARS-CoV-2 infection and the presence of infected asymptomatic people are the common sources of anxiety and fear in HCWs [5].

These studies also found that mental disturbances were more common in nurses compared to the physicians. Nurses in SARS-affected hospitals also showed more distress than other hospital workforce [28]. Nurses are the largest occupational groups that directly and intensively are in constant contact with their patients [28]. Working in high-risk departments was another main reason of poor mental health in these studies. Being at the high-risk of contagion in such environments will increase the psychological problems, including fear, anxiety, stress, etc. furthermore, being quarantined as a result of working in high-risk wards was another source of mental disorders [29]. In a study conducted by Maunder et al. in Toronto, HCWs who during SARS outbreak worked in close contact with ill patients showed higher total IES score compared to the other medical staff [28]. The higher rate of psychiatric morbidities in HCWs in the result of SARS was three times higher than the general public, 75.3% and 24%, respectively [9].

HCWs as the frontiers in any outbreaks, suffer from mental distress during and even years after epidemics. These results were evident from the Ebola virus and SARS outbreak [34]. Similar concerns now have been voiced out about the psychological well-being of HCWs in facing the SARS-CoV-2 outbreak [4]. The number of COVID-19 patients is increasing dramatically. This leads to a heavier workload in life-threatening situations disturbing the psychological health of hospitals' workforces [18]. Given the high transmission rate of the virus and the lack of any vaccine or medicine, infection's control is a serious challenge [35]. High morbidity and mortality of SARS-CoV-2 can aggravate the risk perception in HCWs. Furthermore, the increasing number of patients and the shortages of protective equipment contribute to the high pressure on health care workers [4].

Interventions for providing HCWs' mental health in the SARS-CoV-2 pandemic

Although the present study found that psychological disorders are prevalent in the HCWs in these setting struggling with a highly infectious disease, most HCWs are working in isolated wards without receiving adequate training to improve their mental health. Therefore, regular psychological care is urgently required to address these needs [36]. In order to minimize mental distress and worries of health care providers, we propose some interventions. These solutions not only could be beneficial in facing this SARS-CoV-2 pandemic but could also be considered for the potential future outbreaks of infectious diseases.

The interventions acquired from the literature review will be described in several sections:

Supportive interventions

This category includes: support of HCWs mostly provided by family members [37, 38], the government [37, 39], society/community [6], organizations [40], and colleagues and supervisors [38, 41]; providing a peer support system [38]; assigning professional psychotherapy teams [6]; devoting attention to personnel opinions and ideas about various issues related to SARS-CoV-2 via an array of input and feedback channels [40]; provision of the support for emotional and psychological needs [40]; providing online psychological services [36, 42], as well as face-to-face psychological crisis intervention [43]; being confident of receiving in time treatment and care for their infected family members [25, 40, 44]; and regarding HCWs' infection at work as the work-related injuries [45].

Encouragement & motivation interventions

Recognizing the HCWs efforts by hospital managers as well as the government and the society [39, 40]; activating the sense of responsibility and purpose and awakening the spirit of activity of them by managers and supervisors [44]; encouraging HCWs to engage in relaxation techniques such as yoga, meditation, and other relaxation techniques [46]; providing therapists' visit to care their psychological suffers and frustrations [46]; and implementing effective measure to reduce the number of COVID-19 patients [39] are suggested.

Protective interventions

Furthermore, protective interventions are suggested. These interventions include: providing adequate and effective protective equipment [25, 39, 40, 44]; addressing HCWs physical needs; such as access to healthy meals and hydration [18, 25, 40], considering regular rest breaks [25, 41, 44, 45]; designing

a safe place for their rest [18]; considering shorter working hours and rotating shifts especially for those working in high-risk departments [41, 44]; accommodation and lodging for staff working in high-risk areas and those who are on rapid-cycle shifts that not live in close proximity to the hospital [40]; provide support for childcare needs [40]; dispatching fresh medical teams from other areas with less number of patients [45]; keep monitoring and check on HCWs' physical and mental well-being [37, 40, 46]; teamwork with following standard operating procedures (SOP) [47]; identifying staff who are burnout or have psychological distress [37].

Educational & Training interventions

These interventions include: providing online psychological and mental health education via communication programs [36, 37, 42]; development and publish the relevant guidelines [37, 39, 42, 45], books [36], handbooks [48], directives and manuals documents [38, 41, 42], online educational articles/videos [42]; provision of the critical incident stress management [38]; mindfulness training; assertiveness training [46]; self-awareness training [38, 46]; and protection training [20].

Using the platform of technology and online services

In these critical situations in which face to face contacts increases the risk of infection transmission and considering quarantine in many areas, information technology and online services have been widely adopted [37, 41]. Now, most supportive, educational, and psychological interventions in the SARS-CoV-2 pandemic are performed using internet and online tools [36]. In this situation, telemedicine technology is also practical [49]. This technology can be applied for reducing unnecessary visits, decreasing the risk of HCWs infection, reducing HCWs workload, and optimizing their time to caring for patients with acute conditions [25, 49]. This technology is implemented using video conferencing platforms, Hotline/Telephone, social media, and mobile phones [25, 48]. Video conferencing platforms such as zoom can be utilized to counselling, educate, and control disease transmission [41]. Also, Hotline, social media, and smartphones can be considered for counselling [48].

One of the practical technologies that can be used to minimize health staff's work pressure is mHealth (mobile health) [41]. This technology is used for notifications and reminder of the time of care [44]; online mental health education [36, 41, 50]. Online psychological counseling services and also online psychological self-help intervention systems [36].

Artificial intelligence technology is another technology that can be applied in these circumstances. This technology can be utilized to recognize people and medical staff in the danger of suicide or other crises [36]. AI program Tree Holes Rescue with assessing psychological messages in spaces such

as Tree Holes, can calculate the possibility of suicide in people and provide necessary alarms [51]. Therefore, these technologies can facilitate providing psychological interventions to HCWs.

Conclusions

Consistent with Chong et al. (2004) that called SARS as a bio-disaster, we also suppose that the SARS-CoV-2 pandemic can be called a bio-disaster [9]. While outbreaks of emerging infectious diseases occur regularly, they provoke an intense response of medical staff. During the outbreaks, thousands of HCWs should fight with the disease in the front-line. The results of this study revealed that a considerable percentage of medical staff experience mental disorders. Now, we are in the midst of this pandemic. Addressing the psychological well-being of HCWs and also considering approaches to improve their mental health is essential.

Limitation

The limitation of this study is its small sample size. Furthermore, we excluded possible articles published in Chinese due to language strain.

Authors' contributions M.V. and M.E. significantly contributed to the study conception, literature searching, screening, and data extraction. M.Q. and S.M.A. considerably contributed to data extraction and analyzing them. Also, the methodology was examined and approved by all authors. The first draft of the manuscript was written by M.V., M.E., S.M., and Z.J.. Finally, all authors critically revised the final manuscript and approved it.

Data availability Not applicable.

Compliance with ethical standards

Conflict of interest The authors declare no conflicts of interest.

Code availability Not applicable.

References

1. Wilder-Smith A, Chiew CJ, Lee VJ. Can we contain the COVID-19 outbreak with the same measures as for SARS? *Lancet Infect Dis*. 2020. [https://doi.org/10.1016/S1473-3099\(20\)30129-8](https://doi.org/10.1016/S1473-3099(20)30129-8).
2. WHO. Coronavirus disease 2019. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>. Accessed 27 Apr 2020.
3. Chen Q, Liang M, Li Y, Guo J, Fei D, Wang L et al. Mental health care for medical staff in China during the COVID-19 outbreak. *Lancet Psychiatry*. 2020;7(4):e15–e6.
4. Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors associated with mental health outcomes among health care workers exposed to

- coronavirus disease 2019. *JAMA Netw Open*. 2020;3(3):e203976. <https://doi.org/10.1001/jamanetworkopen.2020.3976>.
5. Schwartz J, King C-C, Yen M-Y. Protecting healthcare workers during the coronavirus disease 2019 (COVID-19) outbreak: lessons from Taiwan's severe acute respiratory syndrome response. *Clin Infect Dis*. 2020. <https://doi.org/10.1093/cid/ciaa255>.
 6. Xiao H, Zhang Y, Kong D, Li S, Yang N. The Effects of Social Support on Sleep Quality of Medical Staff Treating Patients with Coronavirus Disease 2019 (COVID-19) in January and February 2020 in China. *Medical science monitor : international medical journal of experimental and clinical research*. 2020;26:e923549. <https://doi.org/10.12659/msm.923549>.
 7. Zhu Z, Xu S, Wang H, Liu Z, Wu J, Li G et al. COVID-19 in Wuhan: Immediate Psychological Impact on 5062 Health Workers. *medRxiv*. 2020. <https://doi.org/10.1101/2020.02.20.20025338>.
 8. Lee SM, Kang WS, Cho A-R, Kim T, Park JK. Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients. *Compr Psychiatry*. 2018;87:123–7.
 9. Chong M-Y, Wang W-C, Hsieh W-C, Lee C-Y, Chiu N-M, Yeh W-C et al. Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. *Br J Psychiatry*. 2004;185(2):127–33.
 10. Lima CKT, de Medeiros Carvalho PM, Lima IdAS, de Oliveira Nunes JVA, Saraiva JS, de Souza RI et al. The emotional impact of Coronavirus 2019-nCoV (new Coronavirus disease). *Psychiatry Res*. 2020:112915.
 11. Greenberg N, Docherty M, Gnanapragasam S, Wessely S. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *BMJ*. 2020. <https://doi.org/10.1136/bmj.m1211>.
 12. Li Z, Ge J, Yang M, Feng J, Qiao M, Jiang R, et al. Vicarious traumatization in the general public, members, and non-members of medical teams aiding in COVID-19 control. *Brain, behavior, and immunity*. 2020. <https://doi.org/10.1016/j.bbi.2020.03.007>.
 13. Xiang YT, Yang Y, Li W, Zhang L, Zhang Q, Cheung T, et al. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *Lancet Psychiatry*. 2020;7(3):228–9. [https://doi.org/10.1016/S2215-0366\(20\)30046-8](https://doi.org/10.1016/S2215-0366(20)30046-8).
 14. Kang L, Ma S, Chen M, Yang J, Wang Y, Li R, et al. 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, behavior, and immunity*. 2020. <https://doi.org/10.1016/j.bbi.2020.03.028>.
 15. Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev*. 2015;4(1):1.
 16. NIH. Quality Assessment Tool for Observation-al Cohort and Cross-Sectional Studies. National Heart, Lung, and BloodInstitute. <https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools>. Accessed 15 April 2020.
 17. Ma L-L, Wang Y-Y, Yang Z-H, Huang D, Weng H, Zeng X-T. Methodological quality (risk of bias) assessment tools for primary and secondary medical studies: what are they and which is better? *Military Medical Research*. 2020;7(1):1–11.
 18. Lu W, Wang H, Lin Y, Li L. Psychological status of medical workforce during the COVID-19 pandemic: a cross-sectional study. *Psychiatry Res*. 2020;288:112936. <https://doi.org/10.1016/j.psychres.2020.112936>.
 19. Mo Y, Deng L, Zhang L, Lang Q, Liao C, Wang N, et al. Work stress among Chinese nurses to support Wuhan for fighting against the COVID-19 epidemic. *J Nurs Manag*. 2020;28:1002–9. <https://doi.org/10.1111/jonm.13014>.
 20. Dai Y, Hu G, Xiong H, Qiu H, Yuan X. Psychological impact of the coronavirus disease 2019 (COVID-19) outbreak on healthcare workers in China. *medRxiv*. 2020. <https://doi.org/10.1101/2020.03.03.20030874>.
 21. Odriozola-González P, Planchuelo-Gómez Á, Irurtia-Muñiz MJ, de Luis-García R, González M, Planchuelo-Gómez R. Psychological symptoms of the outbreak of the COVID-19 crisis and confinement in the population of Spain. *PsyArXiv*. 2020. <https://doi.org/10.31234/osf.io/mq4fg>.
 22. Simone L, Gnagnarella C. Differences between health workers and general population in risk perception, behaviors, and psychological distress related to COVID-19 spread in Italy. 2020.
 23. Liang Y, Chen M, Zheng X, Liu J. Screening for Chinese medical staff mental health by SDS and SAS during the outbreak of COVID-19. *J Psychosom Res*. 2020;133:110102. <https://doi.org/10.1016/j.jpsychores.2020.110102>.
 24. Montemurro N. The emotional impact of COVID-19: from medical staff to common people. *Brain Behav Immun*. 2020;87:23–4. <https://doi.org/10.1016/j.bbi.2020.03.032>.
 25. Adams JG, Walls RM. Supporting the health care workforce during the COVID-19 global epidemic. *JAMA*. 2020;323(15):1439–40. <https://doi.org/10.1001/jama.2020.3972>.
 26. Ji D, Ji Y-J, Duan X-Z, Li W-G, Sun Z-Q, Song X-A et al. Prevalence of psychological symptoms among Ebola survivors and healthcare workers during the 2014-2015 Ebola outbreak in Sierra Leone: a cross-sectional study. *Oncotarget*. 2017;8(8):12784.
 27. Muhidin S, Moghadam ZB, Vizheh M. Analysis of Maternal Coronavirus Infections and Neonates Born to Mothers with 2019-nCoV; a Systematic Review. *Archives of Academic Emergency Medicine*. 2020;8(1):49.
 28. Maunder RG, Lancee WJ, Rourke S, Hunter JJ, Goldbloom D, Balderson K et al. Factors associated with the psychological impact of severe acute respiratory syndrome on nurses and other hospital workers in Toronto. *Psychosom Med*. 2004;66(6):938–42.
 29. Brooks SK, Dunn R, Amlôt R, Rubin GJ, Greenberg NJ, Joe, medicine e. A systematic, thematic review of social and occupational factors associated with psychological outcomes in healthcare employees during an infectious disease outbreak. *J Occup Environ Med* 2018;60(3):248–57.
 30. Tam CW, Pang EP, Lam LC, Chiu HF. Severe acute respiratory syndrome (SARS) in Hong Kong in 2003: stress and psychological impact among frontline healthcare workers. *Psychol Med*. 2004;34(7):1197–204.
 31. Shah K, Kamrai D, Mekala H, Mann B, Desai K, Patel RS. Focus on mental health during the coronavirus (COVID-19) pandemic: applying learnings from the past outbreaks. *Cureus*. 2020;12(3):e7405.
 32. Chen R, Chou K-R, Huang Y-J, Wang T-S, Liu S-Y, Ho L-Y. Effects of a SARS prevention programme in Taiwan on nursing staff's anxiety, depression and sleep quality: a longitudinal survey. *Int J Nurs Stud*. 2006;43(2):215–25.
 33. Robertson E, Hershenfield K, Grace SL, Stewart DE. The psychosocial effects of being quarantined following exposure to SARS: a qualitative study of Toronto health care workers. *Can J Psychiatr Nurs*. 2004;49(6):403–7.
 34. Khalid I, Khalid TJ, Qabajah MR, Barnard AG, Qushmaq IA. Healthcare workers emotions, perceived stressors and coping strategies during a MERS-CoV outbreak. *Clin Med Res*. 2016;14(1):7–14.
 35. Khosravi M. Perceived Risk of COVID-19 Pandemic: The Role of Public Worry and Trust. *Electron J Gen Med*. 2020;17(4):em203. 2020.
 36. Liu S, Yang L, Zhang C, Xiang Y-T, Liu Z, Hu S, et al. Online mental health services in China during the COVID-19 outbreak.

- Lancet Psychiatry. 2020;7(4):e17–e8. [https://doi.org/10.1016/S2215-0366\(20\)30077-8](https://doi.org/10.1016/S2215-0366(20)30077-8).
37. Zhang J, Wu W, Zhao X, Zhang W. Recommended psychological crisis intervention response to the 2019 novel coronavirus pneumonia outbreak in China: a model of West China hospital. *Precision Clinical Medicine*. 2020;3(1):3–8. <https://doi.org/10.1093/pmedi/pbaa006>.
 38. Chan AOM, Huak CY. Psychological impact of the 2003 severe acute respiratory syndrome outbreak on health care workers in a medium size regional general hospital in Singapore. *Occup Med*. 2004;54(3):190–6. <https://doi.org/10.1093/occmed/kqh027>.
 39. Cai H, Tu B, Ma J, Chen L, Fu L, Jiang Y et al. Psychological Impact and Coping Strategies of Frontline Medical Staff in Hunan Between January and March 2020 During the Outbreak of Coronavirus Disease 2019 (COVID-19) in Hubei, China. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*. 2020;26:e924171–1.
 40. Shanafelt T, Ripp J, Trockel M. Understanding and Addressing Sources of Anxiety Among Health Care Professionals During the COVID-19 Pandemic. *JAMA*. 2020;323(21):2133–4. <https://doi.org/10.1001/jama.2020.5893>.
 41. Ho CS, Chee CY, Ho RC. Mental health strategies to combat the psychological impact of COVID-19 beyond paranoia and panic. *Ann Acad Med Singap*. 2020;49(1):1–3.
 42. Li W, Yang Y, Liu Z-H, Zhao Y-J, Zhang Q, Zhang L, et al. Progression of mental health services during the COVID-19 outbreak in China. *Int J Biol Sci*. 2020;16(10):1732–8. <https://doi.org/10.7150/ijbs.45120>.
 43. Jiang X, Deng L, Zhu Y, Ji H, Tao L, Liu L, et al. Psychological crisis intervention during the outbreak period of new coronavirus pneumonia from experience in Shanghai. *Psychiatry Res*. 2020;286:112903. <https://doi.org/10.1016/j.psychres.2020.112903>.
 44. Liu Y, Wang H, Chen J, Zhang X, Yue X, Ke J, et al. Emergency management of nursing human resources and supplies to respond to coronavirus disease 2019 epidemic. *International Journal of Nursing Sciences*. 2020;7:135–8. <https://doi.org/10.1016/j.ijnss.2020.03.011>.
 45. Kang L, Li Y, Hu S, Chen M, Yang C, Yang BX, et al. The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. *Lancet Psychiatry*. 2020;7(3):e14. [https://doi.org/10.1016/S2215-0366\(20\)30047-X](https://doi.org/10.1016/S2215-0366(20)30047-X).
 46. Patel RS, Bachu R, Adikey A, Malik M, Shah M. Factors related to physician burnout and its consequences: a review. *Behavioral Sciences*. 2018;8(11):98. <https://doi.org/10.3390/bs8110098>.
 47. Brennan P, Oeppen R. Safe healthcare teams during the coronavirus outbreak. *Br J Oral Maxillofac Surg*. 2020;58(3):254. <https://doi.org/10.1016/j.bjoms.2020.03.011>.
 48. Bao Y, Sun Y, Meng S, Shi J, Lu L. 2019-nCoV epidemic: address mental health care to empower society. *Lancet*. 2020;395(10224):e37–e8. [https://doi.org/10.1016/S0140-6736\(20\)30309-3](https://doi.org/10.1016/S0140-6736(20)30309-3).
 49. Moazzami B, Razavi-Khorasani N, Moghadam AD, Farokhi E, Rezaei N. COVID-19 and telemedicine: immediate action required for maintaining healthcare providers well-being. *J Clin Virol*. 2020;126:104345. <https://doi.org/10.1016/j.jcv.2020.104345>.
 50. Ma X, Li S, Yu S, Ouyang Y, Zeng L, Li X, et al. Emergency Management of the Prevention and Control of novel coronavirus pneumonia in specialized branches of hospital. *Acad Emerg Med*. 2020;27(4):312–6. <https://doi.org/10.1111/acem.13958>.
 51. Wang Y. The Chinese suicides prevented by AI from afar. *BBC World Service*. <https://www.bbc.com/news/technology-50314819>. Accessed 10 Apr 2020.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.