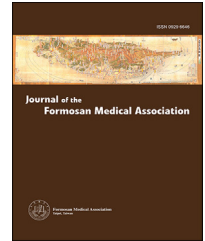


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## Review Article

# Mental health among healthcare personnel during COVID-19 in Asia: A systematic review

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## KEYWORDS

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The COVID-19 pandemic has been associated with an insidious wave of psychological stress among healthcare personnel (HCP) in Asia. Mental exhaustion, burnout, fear, depression, anxiety, insomnia, and psychological stress among HCPs have intensified a daunting challenge during the COVID-19 pandemic. The consequences of such stress may negatively impact patient and HCP safety. This review article reports the associations of mental health status attributed to the COVID-19 pandemic among HCP and their impact on patient safety, and infection prevention and control practices during pandemics.

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## Introduction

The COVID-19 pandemic is a global healthcare emergency and economic catastrophe on a scale not seen in more than a century. COVID-19 is highly contagious and the transmission dynamics are associated with intercontinental spread.<sup>1,2</sup> As of September 2, 2020, nearly 570,000 healthcare personnel (HCP) have infected with COVID-19

and more than 2500 have succumbed to the virus in the Americas.<sup>3</sup> While, as of June 11, 2020, at least 12,454 HCP have been infected and 171 HCP have died in countries across Asia–Pacific region.<sup>4</sup>

Front-line HCP are exposed to hazards include pathogen exposure, long working hours, burnout, fatigue, disorders of mental health (e.g., fear, anxiety, depression), occupational stigma, and physical and psychological violence with potential negative impact on patient safety and occupational health.<sup>1</sup> Moreover, infected HCP with previous psychiatric disorder may have a higher mortality rate compared with those with no psychiatric disorders.<sup>5</sup> We, therefore, provide a review of the medical literature to date that informs on HCP mental health status associated

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with the COVID-19 pandemic in Asia as well as the impacts of mental health status on both patient safety and infection prevention and control practices during COVID-19 pandemics.

## Methods

We performed a structured literature search in PUBMED from December 1, 2019 to September 20, 2020 to identify studies that reported HCP' mental health status, as well as infection prevention and control (IPC) practices during the COVID-19 pandemic. Key search and string terms were ("Coronavirus OR COVID-19") AND ("health care workers OR healthcare worker OR healthcare OR medical workforce OR hospitalist OR manager") AND ("Psychological OR fear OR anxiety OR mental health OR emotion\* OR Psychiatr\* OR neuropsychiatr OR stress\* OR infection control") AND "Asia". We included only studies published as a full article, regardless of design, language restrictions and publication status. Two investigators (A.T. and A.A.) examined titles, abstracts and articles independently with identical definitions, data abstraction forms and selection criteria. Any problems raised in the data extraction and quality assessment were resolved by discussion between the two reviewers. The exclusion criteria were duplicated articles, and lack of both prevalence and risk factors of mental health status disorders in HCP. The following data were extracted: study location, prevalence of mental health status disorder, study design, risk factors of mental health status disorder and frequency of IPC practices (e.g., hand hygiene, wearing personal protective equipment [PPE], physical distancing, as well as potential solutions to mental health status disorders reported in the literature. Descriptive analyses were used to determine the frequency of each mental health status disorders reported in the literature as well as strategies to solve mental health status disorders.

## Results

The search yielded 81 potentially eligible reports; none were non-English language articles. Records identified through database searching 77 articles for the nine-month reporting period. Manual searching of the reference lists of these articles identified 4 additional articles. Of these, 30 articles were excluded after a first screening based on title and/or abstract. Of the 51 articles for full-text review, 19 were subsequently excluded. In total, 32 reports (30 prevalence and risk factor analyses, and 2 papers on psychological support) met eligibility criteria and were included in the review (Fig. 1).<sup>6–35</sup> Data came from East Asia (20; China 19 and South Korea 1), West Asia (6; Saudi Arabia 2, and one each from Israel, Jordan, Palestine, and Turkey), Southeast Asia (3; Singapore 2 and Thailand 1), and South Asia (3; India 2 and Pakistan 1). There were 2 multicenter studies (Singapore and India,<sup>25</sup> and main data from Pakistan and Saudi Arabia<sup>32</sup>). Nine papers focused on specialties such as dentistry,<sup>25,27</sup> radiology,<sup>11,23</sup> frontline staffs,<sup>14,15</sup> emergency rooms,<sup>16</sup> ophthalmology,<sup>26</sup> physical therapy.<sup>33</sup>

The associations of mental health status disorders in HCP and IPC practices during the COVID-19 pandemic are summarized in Table 1.<sup>6–35</sup> The pooled mean of depression,

anxiety, insomnia, and fear rates in Asian HCP were 27.2% (10,617/39,014),<sup>6,9,10,13–16,18,19,26,28,31–33</sup> 25.9% (6305/24,297),<sup>6,8–15,18,19,25,28,30–34</sup> 35.0% (2072/5919),<sup>6,14,15</sup> and 77.1% (2743/3558).<sup>9,25,29,34</sup> The incidence and type of mental health disorders are compared among Chinese versus non-Chinese HCP. Table 2 compares the pool mean of mental health status disorders among Chinese versus non-Chinese HCP together with risk factors associated with mental health disorders.

The risk factors of mental health status disorders of HCP during COVID-19 pandemic were summarized as female,<sup>7,12,13,17,28,35</sup> frontline HCP,<sup>6,9,14,15</sup> younger age,<sup>26,28,35</sup> older age,<sup>11,12,33</sup> nurse,<sup>10,11</sup> divorced,<sup>28</sup> direct contact treating infected patients,<sup>8,18</sup> worked for fewer years,<sup>12,16</sup> longer working time,<sup>12,16</sup> lack of IPC's knowledge,<sup>35</sup> and lack of PPE,<sup>11,18</sup> while psychological resilience,<sup>11,21–23</sup> and family or committed relationship<sup>20,27</sup> were identified as a protective factors. Risk factors of mental health status disorders were differed among Chinese versus non-Chinese HCP (Table 2).

Notably, during the COVID-19 pandemic, the frontline medical staff had greater mental health status disorders (fear, anxiety and depression score) than the administrative staff. The high-risk contacts (working in department of respiratory, emergency, ICU and infectious disease) staffs were twice more likely to suffer anxiety ( $p = 0.01$ ) and depression ( $p = 0.02$ ) than the non-clinical staff (working in administrative, technical operation). High risk and low risk (working in the other clinical departments) clinical staff had more fear than the non-clinical staff (aOR [adjusted odds ratio] = 1.4;  $p = 0.03$ ).<sup>9</sup> In one study, 90% of HCP felt fearful for COVID-19 and HCP who self-reported being overwhelmed with mental health status disorders were less likely to be willing to see admitted patients (aOR = 0.45; 95% confidence interval [CI] = 0.14–0.89) or to accept new admissions during the pandemic (aOR = 0.65; 95% CI = 0.24–0.96).<sup>34</sup> Notably, compared to HCP who did not report mental health status disorders, HCP overwhelmed with fear and anxiety reportedly had significant higher rates of hand hygiene (aOR = 12.4; 95% CI = 1.5–69.9) and appropriate PPE compliance (aOR = 7.8; 95% CI = 1.2–45.9).<sup>34</sup> Although HCP mental health status disorders were not found to be associated with physical distancing practices, physical distancing at the hospital was reported at high rate (93.1%, 148/160).<sup>34</sup>

Special interventions to promote mental well-being in HCP exposed to COVID-19 need to be immediately implemented, with front-line HCP.<sup>6</sup> Suggestions to improve anxiety and fear including improvement of the hospital policy on PPE (114 of 160, 71%), ongoing reliable infection prevention education during epidemics (124 of 160, 77%), and mindfulness practices (89 of 160, 55%). From data in Asia, psychological crisis interventions included three key points: 1) understanding the mental health status in different populations influenced by the COVID-19 outbreak; 2) identifying people who are at high risk of suicide and aggression, and 3) providing appropriate psychological interventions for those in need.<sup>36,37</sup> Psychological first aid is a tailored psychological intervention based on the needs of individual staff to mitigate risk rather than something such as debriefing, which has been found to be ineffective and in



## PRISMA 2009 Flow Diagram

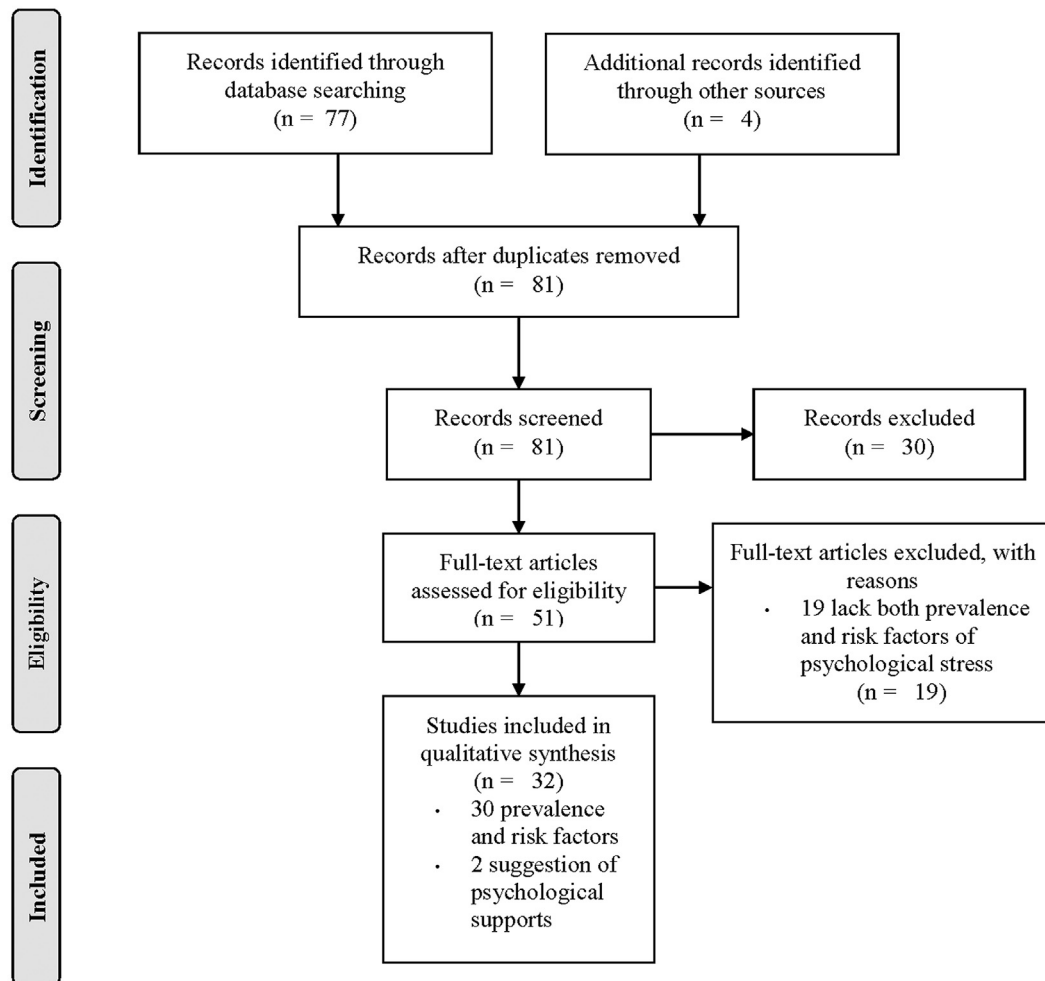


Figure 1 PRISMA flow diagram.

some cases to worsen post-traumatic stress disorder.<sup>36,37</sup> Clear communication with staff, sufficient access to PPE, adequate provision of PPE, protocols and continuous programs of education and training in PPE donning and doffing, adequate rest, and psychological interventions were all associated with reduced mental health status disorders. Recommendations for alleviation of HCP mental health status disorders are summarized in Table 3.<sup>36,37</sup>

## Discussion

During COVID-19 outbreak, questions arise around the equipoise between a physician's duty to provide care to patients, their obligations to protect their family, and their right to protect their own health. During the first nine months of the COVID-19 pandemic, report of HCP mental health status disorders has been reported in studies from Asia. Notable, HCP were often overwhelmed with mental

health status disorders (e.g., fear, anxiety and panic) which may in turn compromised the patient safety.

HCP providing care COVID-19 patients are being more severely affected by mental health status disorders associated with depression, anxiety, distress and insomnia, stress, and indirect traumatization than other occupational groups.<sup>38,39</sup> In a meta-analysis, severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) in general populations had suffered mental health status disorders and psychiatric repercussions both acute and post-illness stage (follow-up duration varied from 60 days to 12 years). The pooled mean of depressed mood, anxiety, impaired memory, and insomnia rates were 42%, 46%, 44%, and 54% during acute illness stage, and 35%, 21%, 44%, and 34% in the post-illness stage.<sup>40</sup> In this review, the pooled mean of depression, anxiety, insomnia, and fear rates in Asian HCP were 27.2%, 25.9%, 35.0%, and 77.1%. Comparing with non-Chinese HCP, Chinese HCP had a higher anxiety (25.9% vs 12.5%), similar depression (27.8% vs

**Table 1** Mental health status reported in healthcare personnel (HCP) and associated infection prevention and control (IPC) practices during COVID-19 pandemic.

Country (number of HCPs) <sup>reference</sup>	Prevalence	Risk factors and IPC practices
China (1,257) <sup>6</sup>	Psychological distress (71.5%) Depression (50.4%) Anxiety (44.6%) Insomnia (34.0%)	Risk factor was front-line HCP who had higher risks of depression (odds ratio [OR] = 1.52; $p = 0.01$ ), anxiety (OR = 1.57; $p < 0.001$ ), insomnia (OR = 2.97; $p < 0.001$ ), and distress (OR = 1.60; $p < 0.001$ ). - Risks factors were female or participants from cities (more severe anxiety and fear). - “The more fear or angry, the more problem-focused coping”, <sup>a</sup> “The more angry, the more emotion-focused coping”, <sup>b</sup> and “The more problem-focused coping, the more anxious, fear, sadness, or angry”
China (802) <sup>7</sup>	Not available	
China (512) <sup>8</sup>	Anxiety (12.5%)	Risks factors were direct contact treating infected patients, suspect cases, and Hubei province - Medical staff unfolded greater fear, anxiety and depression than the administrative staff - The front line medical staff working in department of respiratory, emergency, ICU and infectious disease, were twice more likely to suffer anxiety and depression than the non-clinical staff
China (2,299) <sup>9</sup>	Fear (70.6%) Anxiety (25.5%) Depression (12.1%)	
China (863) <sup>10</sup>	Anxiety (13.9%) Depression (13.6%) Stress (8.6%)	- Risks factor of anxiety was nurses - Posttraumatic stress compared with depression, anxiety and stress scales were positively correlated to perceived threat and passive coping strategies but negatively correlated to perceived social support and active coping strategies. - Risk factors of anxiety were age older than 30 years, a nursing role, a lack of protective materials, presence of suspected symptoms in the participant, and high susceptibility to emotions and behaviors of people around them, whereas psychological resilience was identified as a protective factor.
China (364) <sup>11</sup>	Anxiety (23.4%)	
China (176) <sup>12</sup>	Anxiety (77.3%)	- Risk factors of anxiety among frontline clinical nurses were female, older age, divorced, length of service (<5 years), and clinical working time ( $\geq 4$ weeks). - Risk factors associated with high-level depression, somatic symptom, and SSI were female, single, Tujia minority, educational background of junior or below, designated or county hospital, need for psychological assistance before or during the epidemic, unconfident about defeating COVID-19, ignorance about the epidemic, willingness of attending parties, and poor self-rated health condition
China (8,817) <sup>13</sup>	Somatic symptoms (46.2%) Depression (30.2%) Anxiety (20.7%) Suicidal and self-harm ideation (SSI; 6.5%)	
China (2,346) <sup>14</sup>	Any mental problem (43.3%) Insomnia (38.5%) Depression (12.2%) Anxiety (11.6%)	Frontline HCPs had significantly higher rates of any mental problem (52.6% vs. 34.0%), anxiety symptoms (15.7% vs. 7.4%), and insomnia (47.8% vs. 29.1%) than non-frontline HCP. - Frontline HCP were more likely to depression, anxiety, insomnia, and stress than non-frontline HCP.
China (2,316) <sup>15</sup>	Stress (69.1%) Depression (46.9%) Anxiety (41.1%) Insomnia (32%)	
China (14,825) <sup>16</sup>	Depression (25.2%) Post-traumatic stress disorder (PTSD; 9.1%)	- Risk factors of depressive symptoms and PTSD were men, middle aged, worked for fewer years, longer daily work time, and lower levels of social support among emergency department medical staffs. - Risk factor was female
China (371) <sup>17</sup>	Post-traumatic stress symptoms (3.8%)	
China (958) <sup>18</sup>	Depression (58.0%) Anxiety (54.2%)	- Risk factors of depression and anxiety were insufficient protective equipment and contact with cases.

(continued on next page)

Table 1 (continued)

Country (number of HCPs) <sup>reference</sup>	Prevalence	Risk factors and IPC practices
China (548) <sup>19</sup>	Obsessive-compulsive (37.2%) <sup>c</sup> Anxiety (34.1%) <sup>c</sup> Somatization (33.0%) <sup>c</sup> Depression (29.7%) <sup>c</sup>	- Risk factors were the degree of suspicion that they were infected, the level of concern whether they and their family members had been infected, age, whether they have supported in affected areas in Hubei Province, and whether family members support them working on the front line.
China (4,618) <sup>20</sup>	Emotional distress (anxiety, depression, and/or suicidal ideation; 24.2%)	- Risk factors were HCP who worried about their physical health or had COVID-19 infected friends or close relatives. - Protective factor was family relationship. - In coping strategies, HCP without emotional distress were significantly more likely to cope by "adhering to IPC," "just accepting the risks," "keeping a positive mindset," "keeping a healthy lifestyle," "avoiding thinking about the risks," "avoiding traveling," and less "taking vitamins, herbs, or other complementary substances" than HCPs with emotional distress.
China (1,472) <sup>21</sup>	Psychological distress (7%)	- Resilience could partially mediate the effect of social support on mental health among HCP as well as younger HCP.
China (1,521) <sup>22</sup>	Psychological abnormality (14.1%)	- Resilience, social support, and high levels of training and professional experience were necessary to HCP who are first taking part in public health emergence.
China (587) <sup>23</sup>	Not available	- Resilience was associated with the high total perceived stress score, female, less knowledge of COVID-19 including IPC, and lack of protective materials.
China (105) <sup>24</sup>	Not available	- COVID-19 infected HCP believed (44.2%) and were considered (32.6%) cause of infection due to insufficient the personal protective equipment (PPE) - In routine work, hand hygiene (77.7%) and wearing and removing of PPE (53.4%) - High risk of nosocomial infection departments had utilization of masks (96.9% vs. 52.1%) and gloves (78.1% vs. 39.4%), strict hand hygiene procedure (81.3% vs. 76.1%), and wearing and removing protective equipment (84.4% vs. 39.4%) higher than low risk of nosocomial infection departments. - Compared with before outbreak, the training was significantly intensified in "Wearing protective clothing", "Wearing goggles or face shield", "Isolation of suspected infectious patients", and "Wearing isolation clothes". - Improvements for IPC, staffs' opinions for fighting COVID-19: 84.5% chose "Medical staff protection", followed by "Emergency plan and work flow" (68.0%) and "Pay attention to the health of Medical staff" (66.0%).
Global survey <sup>d</sup> (669) <sup>25</sup>	Anxiety (90%) Fear (87%) Depression (32.6%)	- Hand washing (94%), aware of the proper authority to contact with a suspected COVID-19 infection (80%) among dentists
India (2,355) <sup>26</sup>	Depression (32.6%)	- Risk factor of depression was younger age among ophthalmologists.
Israel (338) <sup>27</sup>	Psychological distress (11.5%)	- Risk factors were background illness, fear of contracting COVID-19 from patient, and a higher subjective overload among dentists and dental hygienists. - Protective factors were a committed relationship and having higher scores for self-efficacy.
Jordan (1,163) <sup>28</sup>	Depression (21.2%) Anxiety (11.3%)	- Risk factors of depression were female, age less than 50 years, divorced, lower income, and pulmonologist.
Palestine (430) <sup>29</sup>	Fear (91.6%) Stress (74.0%)	- Risk factors of anxiety were female, and lower income. - Risk factor of stress was HCP who did not have training on the outbreak response
Saudi Arabia (582) <sup>30</sup>	Anxiety (11.0%)	- HCP had more (41.4%), similarly (41.4%) and less (17.5%) anxiety level from COVID-19 than MERS-CoV or seasonal influenza.



**Table 1** (continued)

Country (number of HCPs) <sup>reference</sup>	Prevalence	Risk factors and IPC practices
Singapore (296) <sup>31</sup>	Anxiety (10.8%) Depression (8.1%) Stress (6.4%) PTSD (5.7%)	- Not available
Singapore and India (906) <sup>32</sup>	Anxiety (8.7%) Depression (5.3%) Psychological distress (3.8%) Stress (2.2%)	- The prevalence of physical symptoms was bi-directionally associated with psychological outcomes.
South Korea (65) <sup>33</sup>	Anxiety (32.3%) Depression (18.5%)	- Risk factors of anxiety and depression were living with younger child and older age (30s–50 s years) in physical therapist, respectively.
Thailand (160) <sup>34</sup>	Fear (90%) Anxiety (42.5%)	- Hand washing (95.6%), wearing mask and PPE (93.1%), willing to see admitted patients during epidemics (48.7%), willing to accept new patients during epidemics (45.1%), social distancing in hospital (82%), social distancing in community (78%) - To improve anxiety and fear including improvement of hospital policy on increase adequacy of PPE (71%), ongoing reliable IPC education during epidemics (77%) and mindfulness practices (55%).
Turkey (270) <sup>35</sup>	Not available	- Risk factors of depression and anxiety were female, younger age, and fewer knowledge about COVID-19.

HCP, healthcare personnel; IPC, infection prevention and control; PPE, personal protective equipment; PTSD, post-traumatic stress disorder.

Note.

<sup>a</sup> Problem-focused coping = active coping, planning, and use of instrumental support.

<sup>b</sup> Emotion-focused coping = use of emotional support, acceptance, positive reframing, religion, humor, substance use, self-distraction, self-blame, denial, behavior disengagement, and venting.

<sup>c</sup> Percentage of HCP with higher SCI -90 factor scores than national normal level.

<sup>d</sup> Data from 30 countries, a large number from Pakistan and Saudi Arabia (more than 50% of the responses).

23.0%), and lower fear (70.6% vs 91.2%) rates during COVID-19 pandemic. Compared with non-Asian countries, there were higher rates of depression in the United States (48%),<sup>41</sup> and anxiety in both the United States (33%)<sup>41</sup> and Italy (46.4%).<sup>42</sup> Notable, the fear rate in Italy (42.4%)<sup>42</sup> was lower than Asian countries. The incidence of somatizations and obsessive-compulsive traces was higher in situations involving front-line HCPs.<sup>38</sup> The main risk factors of mental health status disorders among Chinese HCP during COVID-19 pandemic were frontline HCP, female, older age, nurse, divorced, direct contact treating infected patients, worked for fewer years, longer daily work time, while younger age,

female, divorced, lower income, fewer knowledge about COVID-19 were the risk factors of mental health status disorders among non-Chinese HCP.

From December 2019 through 27 March 2020, the pooled mean incidence of confirmed or suspected COVID-19–infected HCP was 2.58% (284/10,997) among Chinese HCP as high as 32% of infected HCP who involved in direct contact with COVID-19–infected patients.<sup>43</sup> Risk factors for COVID-19 in HCP included insufficient handwashing, longer work hours, and improper use of PPE.<sup>43</sup> Unsafe working due to inadequate PPE resulted in extended use or reuse of N95 respirators among HCP during COVID-19 pandemic.<sup>44</sup> Among

**Table 2** Type and risk factors for mental health status disorders among Chinese and non-Chinese healthcare personnel (HCP).

	Depression	Anxiety	Insomnia	Fear	Risk factors
Chinese HCP	27.8% (9519/34,229)	25.9% (5307/20,456)	35.0% (2072/5919)	70.6% (1623/2299)	Frontline HCP, female, older age, nurse, divorced, direct contact treating infected patients, worked for fewer years, longer daily work time.
non-Chinese HCP	23.0% (1098/4785)	12.5% (395/3172)	Not available	91.2% (538/590)	Younger age, female, divorced, lower income, fewer knowledge about COVID-19

NOTE: The number represent pooled mean (total cases/total number of HCP); HCP = healthcare personnel.

**Table 3** Recommendations to deal with healthcare system and psychological support in team leaders, infection prevention and control (IPC) team, and healthcare personnel (HCP) in COVID-19 outbreaks.

Role	Healthcare system	Psychological support
Team leader	National guidelines for clinical care and IPC, revised for COVID-19 Clear communication with staff and accept coping difference Administrative team for HCP prevention	Recognition of staff efforts Minimizing time in quarantine Access to psychological interventions, address grief Incentive or reward
IPC team	Appropriate work shifts and regular breaks Availability of hospital security to help deal with uncooperative patients Enforcement of IPC measures and regular training focus on how disease transmitting and prevention for HCP Nationally standardized trainings for disease understanding and donning and doffing of personal protective equipment for HCP Clear direction and enforcement of IPC procedures Screening stations to direct patients to relevant infection treatment clinics Sufficient personal protective equipment and medication stockpiles Redesigning nursing care procedures that pose high risks for spread of infections, reducing the density of patients on wards Improving safety such as a better ventilation system or constructing or negative pressure rooms to isolate patients	Training to deal with identification of and responses to psychological problems Avoidance of compulsory assignment to caring or mindfulness practices for patients Rearranging hospital infrastructure, such as redeployment of wards and human resources Supporting staff in quarantine
HCP, colleagues and community	Video facilities for staff to keep in contact with families and alleviate their concerns Alternative accommodation for staff who are concerned about infecting their families Guaranteed food and daily living supplies Attention to media portrayal of HCP and rely on trusted sources Minimization of stigma and discrimination, and community engagement	Increased support and stay connected from family and friends (avoid isolation) Encouragement among peers Staff "buddy" system Self-care and sufficient rest and time off Opportunities for reflection on the effects of stress and ask for help

HCP, healthcare personnel; IPC, infection prevention and control.

Chinese infected HCP ( $n = 1257$ ), there was high prevalence of symptoms reported for depression (50.4%), anxiety (44.6%), insomnia (34.0%), and distress (71.5%).<sup>6</sup> In one study, staff in contact with affected patients had greater levels of both acute and posttraumatic stress ( $OR = 1.71$ ) and psychological distress ( $OR = 1.74$ ) compared with lower risk controls (defined as being more junior, being the parents of dependent children, or having an infected family member).<sup>36</sup>

Safety culture of organization plays an important role for HCPs compliance to IPC guidelines during pandemics. In addition, individual factor is also important and include HCP adherence with IPC guidelines for respiratory infectious diseases. HCP believed that they followed strict IPC guidance when they saw the value of it. Some HCP focused on the IPC guidance because of the fear of infecting themselves or their families. They felt responsible for their

patients. The resilience level among non-local HCP who sent to Wuhan, China was positively associated with active coping ( $\beta = 1.31$ ) and training/support provided by the respondent's permanent hospital ( $\beta = 3.51$ ) while negatively correlated with depression ( $\beta = -0.81$ ) and anxiety ( $\beta = -1.09$ ).<sup>45</sup> The presence of institutional COVID-19 approach protocols and availability of PPE may affect the psychological interactions and preparedness among doctors (e.g., feel safe at work), as well as the level of confidence in patient care.<sup>46</sup> Suggestions to improve HCP anxiety and fear also include improvement of hospital preparedness policy, reliable IPC education on diseases transmission and prevention during COVID-19 epidemics, assuring adequate of PPE, workshops to share knowledge on diseases preventions and mindfulness practices.<sup>34</sup> HCP should remain sober-minded decision beyond coronaphobia, paranoia and panic.

There are some limitations to this systematic review. First, this systematic review uses qualitative and descriptive analysis rather than meta-analysis because the data collected were uniformly defined and limited information (e.g., self-reported survey, organization culture, different cut-off point of younger and older age, prior SARS endemic countries versus non-endemic countries, before and after the peak of COVID-19 pandemic, the relation between incidence of COVID-19 and the severity of mental health, different specialties among HCP as well as different measuring instrument for mental health status disorders). Second, most of the published data came from Chinese ethnicity together with the small sample size and Asian culture make it difficult to generalize the results on both mental health status disorders and solutions to alleviate mental health disorders among HCP working in other continents. Moreover, there is still not a clear reason why the Chinese HCP had a higher anxiety, with lower fear rates. Nevertheless, this systematic review provides useful data on both risk factors and suggestions to solve mental health disorders during pandemics in Asia.

In conclusion, COVID-19 makes alert and self-awareness especially on appropriate IPC practices among HCP. Supportive HCP mental health disorders becomes critical during COVID-pandemics and our review call for structure interventions to help alleviate HCP mental health disorders with the hope to maintain a high adherence to IPC practices as well as high standard quality of care during COVID-19 pandemic. Future studies to evaluate strategy targeted at-risk HCP for mental health disorders and improvement of institutional preparedness plan to reduce HCP mental health disorders will help maintain high standard of care and patient safety, while not compromising HCP safety during pandemic.

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## Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

## References

- World Health Organization. *WHO calls for healthy, safe and decent working conditions for all health workers, amidst COVID-19 pandemic*. Available from: <https://www.who.int/news-room/detail/28-04-2020-who-calls-for-healthy-safe-and-decent-working-conditions-for-all-health-workers-amidst-covid-19-pandemic>. [Accessed 12 September 2020].
- Tin SS, Wiwanitkit V. Uncommon atypical presentations of COVID-19: important and should not be under recognized! *J Health Sci Med Res* 2020;38:153–8.
- Pan American Health Organization, the Americas of the World Health Organization. *COVID-19 has infected some 570,000 health workers and killed 2,500 in the Americas, PAHO Director says*. Available from: <https://www.paho.org/en/news/2-9-2020-covid-19-has-infected-some-570000-health-workers-and-killed-2500-americas-paho>. [Accessed 20 September 2020].
- Butt K. *Asia-Pacific health workers hit hard by COVID-19*. Available from: <https://www.aa.com.tr/en/asia-pacific/asia-pacific-health-workers-hit-hard-by-covid-19/1873247>. [Accessed 20 September 2020].
- Li L, Li F, Fortunati F, Krystal JH. Association of a prior psychiatric diagnosis with mortality among hospitalized patients with Coronavirus disease 2019 (COVID-19) infection. *JAMA Netw Open* 2020;3:e2023282.
- 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:e203976.
- Huang L, Lei W, Xu F, Liu H, Yu L. Emotional responses and coping strategies in nurses and nursing students during COVID-19 outbreak: a comparative study. *PLoS One* 2020;15:e0237303.
- Liu CY, Yang YZ, Zhang XM, Xu X, Dou QL, Zhang WW, et al. The prevalence and influencing factors in anxiety in medical workers fighting COVID-19 in China: a cross-sectional survey. *Epidemiol Infect* 2020;148:e98.
- Lu W, Wang H, Lin Y, Li L. Psychological status of medical workforce during the COVID-19 pandemic: a cross-sectional study. *Psychiatr Res* 2020;288:112936.
- Si MY, Su XY, Jiang Y, Wang WJ, Gu XF, Ma L, et al. Psychological impact of COVID-19 on medical care workers in China. *Infect Dis Poverty* 2020;9:113.
- Huang L, Wang Y, Liu J, Ye P, Chen X, Xu H, et al. Factors influencing anxiety of health care workers in the radiology department with high exposure risk to COVID-19. *Med Sci Mon Int Med J Exp Clin Res* 2020;26:e926008.
- Li R, Chen Y, Lv J, Liu L, Zong S, Li H, et al. Anxiety and related factors in frontline clinical nurses fighting COVID-19 in Wuhan. *Medicine (Baltim)* 2020;99:e21413.
- Xiaoming X, Ming A, Su H, Wo W, Jianmei C, Qi Z, et al. The psychological status of 8817 hospital workers during COVID-19 Epidemic: a cross-sectional study in Chongqing. *J Affect Disord* 2020;276:555–61.
- Cai Q, Feng H, Huang J, Wang M, Wang Q, Lu X, et al. The mental health of frontline and non-frontline medical workers during the coronavirus disease 2019 (COVID-19) outbreak in China: a case-control study. *J Affect Disord* 2020;275:210–5.
- Lin K, Yang BX, Luo D, Liu Q, Ma S, Huang R, et al. The mental health effects of COVID-19 on health care providers in China. *Am J Psychiatr* 2020;177:635–6.
- Song X, Fu W, Liu X, Luo Z, Wang R, Zhou N, et al. Mental health status of medical staff in emergency departments during the Coronavirus disease 2019 epidemic in China. *Brain Behav Immun* 2020;88:60–5.
- Yin Q, Sun Z, Liu T, Ni X, Deng X, Jia Y, et al. Posttraumatic stress symptoms of health care workers during the corona virus disease 2019. *Clin Psychol Psychother* 2020;27:384–95.
- Xiao X, Zhu X, Fu S, Hu Y, Li X, Xiao J. Psychological impact of healthcare workers in China during COVID-19 pneumonia epidemic: a multi-center cross-sectional survey investigation. *J Affect Disord* 2020;274:405–10.
- Xing J, Sun N, Xu J, Geng S, Li Y. Study of the mental health status of medical personnel dealing with new coronavirus pneumonia. *PLoS One* 2020;15:e0233145.
- Dong ZQ, Ma J, Hao YN, Shen XL, Liu F, Gao Y, et al. The social psychological impact of the COVID-19 pandemic on medical staff in China: a cross-sectional study. *Eur Psychiatr* 2020;63:e65.
- Hou T, Zhang T, Cai W, Song X, Chen A, Deng G, et al. Social support and mental health among health care workers during Coronavirus Disease 2019 outbreak: a moderated mediation model. *PLoS One* 2020;15:e0233831.
- Cai WP, Lian B, Song XR, Hou TY, Deng GH, Li HF. A cross-sectional study on mental health among health care workers during the outbreak of Corona Virus Disease 2019. *Asian J Psychiatr* 2020;51:102111.



23. Huang L, Wang Y, Liu J, Ye P, Cheng B, Xu H, et al. Factors associated with resilience among medical staff in radiology departments during the outbreak of 2019 novel Coronavirus disease (COVID-19): a cross-sectional study. *Med Sci Mon Int Med J Exp Clin Res* 2020;26:e925669.
24. Jin YH, Huang Q, Wang YY, Zeng XT, Luo LS, Pan ZY, et al. Perceived infection transmission routes, infection control practices, psychosocial changes, and management of COVID-19 infected healthcare workers in a tertiary acute care hospital in Wuhan: a cross-sectional survey. *Mil Med Res* 2020;7:24.
25. Ahmed MA, Jouhar R, Ahmed N, Adnan S, Aftab M, Zafar MS, et al. Fear and practice modifications among dentists to combat novel Coronavirus disease (COVID-19) outbreak. *Int J Environ Res Publ Health* 2020;17:2821.
26. Khanna RC, Honavar SG, Metla AL, Bhattacharya A, Maulik PK. Psychological impact of COVID-19 on ophthalmologists-in-training and practising ophthalmologists in India. *Indian J Ophthalmol* 2020;68:994–8.
27. Shacham M, Hamama-Raz Y, Kolerman R, Mijiritsky O, Ben-Ezra M, Mijiritsky E. COVID-19 factors and psychological factors associated with elevated psychological distress among dentists and dental hygienists in Israel. *Int J Environ Res Publ Health* 2020;17:2900.
28. Naser AY, Dahmash EZ, Al-Rousan R, Alwafi H, Alrawashdeh HM, Ghoul I, et al. Mental health status of the general population, healthcare professionals, and university students during 2019 coronavirus disease outbreak in Jordan: a cross-sectional study. *Brain Behav* 2020;10:e01730.
29. Maraqa B, Nazzal Z, Zink T. Palestinian health care workers' stress and stressors during COVID-19 pandemic: a cross-sectional study. *J Prim Care Community Health* 2020;11:2150132720955026.
30. Temsah MH, Al-Sohime F, Alamro N, Al-Eyadhy A, Al-Hasan K, Jamal A, et al. The psychological impact of COVID-19 pandemic on health care workers in a MERS-CoV endemic country. *J Infect Public Health* 2020;13:877–82.
31. Tan BYQ, Chew NWS, Lee GKH, Jing M, Goh Y, Yeo LLL, et al. Psychological impact of the COVID-19 pandemic on health care workers in Singapore. *Ann Intern Med* 2020;173:317–20.
32. Chew NWS, Lee GKH, Tan BYQ, Jing M, Goh Y, Ngiam NJH, et al. A multinational, multicentre study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak. *Brain Behav Immun* 2020;88:559–65.
33. Yang S, Kwak SG, Ko EJ, Chang MC. The mental health burden of the COVID-19 pandemic on physical therapists. *Int J Environ Res Publ Health* 2020;17:3723.
34. Apisarnthanarak A, Apisarnthanarak P, Siripraparat C, Saengaram P, Leeprechanon N, Weber DJ. Impact of anxiety and fear for COVID-19 toward infection control practices among Thai healthcare workers. *Infect Control Hosp Epidemiol* 2020;41:1093–4.
35. Yildirim TT, Atas O, Asafov A, Yildirim K, Balibey H. Psychological status of healthcare workers during the Covid-19 pandemic. *J Coll Physicians Surg Pak* 2020;30:26–31.
36. Kisely S, Warren N, McMahon L, Dalais C, Henry I, Siskind D. Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis. *BMJ* 2020;369:m1642.
37. Dehnavieh R, Kalavani K. Management-supportive measures for managers of healthcare organizations during the COVID-19 epidemic. *Infect Control Hosp Epidemiol* 2020;41:878.
38. da Silva FCT, Neto MLR. Psychiatric symptomatology associated with depression, anxiety, distress, and insomnia in health professionals working in patients affected by COVID-19: a systematic review with meta-analysis. *Prog Neuro-Psychopharmacol Biol Psychiatry* 2021;104:110057.
39. Vindegaard N, Benros ME. COVID-19 pandemic and mental health consequences: systematic review of the current evidence. *Brain Behav Immun* 2020;89:531–42.
40. Rogers JP, Chesney E, Oliver D, Pollak TA, McGuire P, Fusar-Poli P, et al. Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the COVID-19 pandemic. *Lancet Psychiatry* 2020;7:611–27.
41. Shechter A, Diaz F, Moise N, Anstey DE, Ye S, Agarwal S, et al. Psychological distress, coping behaviors, and preferences for support among New York healthcare workers during the COVID-19 pandemic. *Gen Hosp Psychiatr* 2020;66:1–8.
42. Consolo U, Bellini P, Bencivenni D, Iani C, Checchi V. Epidemiological aspects and psychological reactions to COVID-19 of dental practitioners in the northern Italy districts of Modena and Reggio Emilia. *Int J Environ Res Publ Health* 2020;17:3459.
43. Chou R, Dana T, Buckley DI, Selph S, Fu R, Totten AM. Epidemiology of and risk factors for Coronavirus infection in health care workers: a living rapid review. *Ann Intern Med* 2020;173:120–36.
44. Kobayashi LM, Marins BR, Costa P, Perazzo H, Castro R. Extended use or reuse of N95 respirators during COVID-19 pandemic: an overview of national regulatory authority recommendations. *Infect Control Hosp Epidemiol* 2020;41:1364–6.
45. Cao J, Wei J, Zhu H, Duan Y, Geng W, Hong X, et al. A study of basic needs and psychological wellbeing of medical workers in the fever clinic of a tertiary general hospital in Beijing during the COVID-19 outbreak. *Psychother Psychosom* 2020;89:252–4.
46. Suleiman A, Bsisu I, Guzu H, Santarisi A, Alsatari M, Abbad A, et al. Preparedness of frontline doctors in Jordan healthcare facilities to COVID-19 outbreak. *Int J Environ Res Publ Health* 2020;17:3181.