



HHS Public Access

Author manuscript

Harv Public Health Rev (Camb). Author manuscript; available in PMC 2021 January 05.

Published in final edited form as:

Harv Public Health Rev (Camb). 2020 ; 28: .

Psychological Impact of COVID-19 Pandemic on Frontline Health Workers in Low- and Middle-Income Countries

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Abstract

Healthcare systems in many countries have been overwhelmed by the coronavirus disease (COVID-19) pandemic, with increasing demands to contain and respond to the virus. The result has been increased pressure on frontline health workers. As the pandemic unfolds, the impact on health systems in low-income and middle-income countries (LMICs) is becoming apparent. In lower resource settings, the detrimental effects on frontline health workers will likely be significant due to fragmented infrastructure, low compensation, and significant shortages of necessary resources such as personal protective equipment. These high stress conditions, coupled with risk of infection and fears and anxieties among patients, can result in grave psychosocial consequences for frontline health workers, who play a vital role in delivering the bulk of primary care services in LMICs. In this narrative review, we consider the psychological impact of the COVID-19 pandemic on frontline health workers in LMICs. We describe the important role of frontline health workers, summarize existing literature on burnout and risks to mental health in this essential workforce, and consider how public health emergencies exacerbate these concerns to showcase their vulnerability to mental health impacts of COVID-19. We explore emerging research on the detrimental effects of the COVID-19 pandemic on health workers and consider possible approaches to mitigate these consequences. This review draws from existing studies and emerging evidence to highlight the critical need to consider the wellbeing of frontline health workers, and to address these challenges as health systems respond to the pandemic.

Introduction

Since the first reported case of coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARSCoV-2), occurred in Wuhan, China at the end of 2019, the virus quickly spread and was declared a pandemic by the World Health Organization (WHO) on March 11th, 2020. As the coronavirus disease (COVID-19) pandemic continues to unfold, and the number of COVID-19 cases to show rapid increases in several low-income and middle-income countries (LMICs), frontline health workers are playing a critical role in responding to and containing the pandemic. The result has been substantial increases to an already intense workload, managing the anxieties and fears of

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patients, and experiencing a psychologically stressful working environment. Frontline health workers, such as community health workers (CHWs), represent the backbone of most health systems in LMICs and are essential for the delivery of primary health care services in rural and underserved settings. However, there has been traditionally limited consideration of the psychological needs and wellbeing of this workforce. Therefore, in this perspective article, we highlight the important role of these frontline health workers in LMICs, summarize existing studies describing the mental health burden and stressors experienced by CHWs and frontline health workers, and explore how pandemics and serious crises can exert and exacerbate these detrimental impacts. Finally, we review the emerging impact of COVID-19 on the mental health of frontline health workers and consider promising solutions and new opportunities to address these serious challenges for health systems in low-resource settings.

Essential role of community health workers in low-income and middle-income countries

To deliver efficient high-quality care in LMICs, a decentralized, effective, and supported system of health workers is critically needed. As the world's population continues to rise, coupled with growing demands for health care services due to trends in population aging in many countries, the global shortage of health providers will increase (up by 80% in the next two decades according to WHO's projection), driving interest in the investment and development of an effective and efficient cadre of healthcare providers that can be scaled across entire countries. CHWs have thus been proposed and envisioned to be the key component of the primary health care structure and could potentially enable achievement of Universal Health Coverage (UHC) specified by Sustainable Development Goal (SDG) target 3.8 (Maher & Cometto, 2016; United Nation, 2017).

CHWs (sometimes referred to as lay health workers, frontline health workers, or *promotores*) are broadly defined as providers of basic public health services and medical care, without specialized training (such as nurses or doctors) and are typically members of the communities in which they serve (Pallas et al., 2013). Their services range from educating community members about healthy behaviors to averting health risks, providing longitudinal care interventions and facilitating connections between communities and specialized healthcare facilities (Black et al., 2017; Lewin et al., 2010; Perry et al., 2014; Bhutta et al., 2015). The familiarities with their respective communities can establish a deeper trust with patients and often position them for more effective delivery of essential primary healthcare services. Many CHWs receive fewer than 2 years of formal training and do not typically obtain professional healthcare certifications. In some settings, CHWs work in either a volunteer capacity or as paid employees of primary healthcare systems. Given the basic training requirements for CHWs, compared to certified healthcare professionals, CHWs are potentially more sustainable and scalable in LMICs without sufficient professional training programs, healthcare infrastructure, personnel or funding (Lewin et al., 2010; Pallas et al., 2013). Successful incorporation of CHWs in the primary healthcare system of LMICs can produce numerous positive impacts. Examples include reduction of neonatal and child mortality, increased adherence to and completion of HIV and tuberculosis treatment protocols, as well as wide implementation of mental health

counseling and immunization (Baqui et al., 2008; Clarke et al., 2004; Glenton et al., 2011; Hoefl et al., 2018; Sazawal & Black, 2003; Torpey et al., 2008). Overall CHWs serve an indispensable role in the health systems of LMICs to enhance accessibility of critical interventions, reduce health inequities, and meet the vast community health needs in places where physician to population ratio is significantly lower than WHO recommendations (McCullum et al., 2016).

Given the positive effects of CHW initiatives, many recent efforts have focused on ways to improve performance of CHWs by evaluating and strengthening CHW programs via different approaches such as supportive supervision, mentoring and coaching, and use of quality improvement methods (Vasan et al., 2016). Yet while there is a growing recognition and focus on enhancing the role of CHWs, relatively little is known about the psychological stressors and risk of burnout experienced the CHW workforce, particularly in the context of LMICs.

Mental health and wellbeing of frontline health workers is often overlooked

Burnout in healthcare workers is widely understood as having three separate dimensions, sometimes referred to as three sub-syndromes: emotional exhaustion (EE), which is described as feelings of being exhausted or overextended; cynicism (CY), or depersonalization, which is the phenomenon that health workers distance themselves from recipients of their care; and reduction in personal achievement (PA), which manifests as feelings of incompetence and dissatisfaction (Freudenberger, 1974; Selamu et al., 2019). Burnout can have a variety of negative consequences that threaten the well-being of health workers including physical health problems such as cardiovascular diseases, the hypothalamic–pituitary–adrenal (HPA) axis dysregulation and chronic fatigue, as well as psychological health problems such as suicidality, depression, and substance abuse (Dyrbye et al., 2014; Melamed et al., 1992; Penz et al., 2018; Rath et al., 2015; Rose et al., 2017). Burnout has been extensively studied in physicians and nurses due to the widely known high burnout rates in healthcare professionals, particularly in high-income countries (Shanafelt et al., 2015). Studies have demonstrated prevalence of burnout to be as high as 70% for physicians and 50% for nurses in some high-income countries (Aiken, 2002; Lamothe et al., 2014). For LMICs, fewer studies have been conducted to systematically study burnout among health workers. There have been recent studies in China, India and Brazil documenting high rates of burnout among physicians and nurses (Cubero et al., 2016; Ding et al., 2014; Lo et al., 2018; Dugani et al., 2018; Silva et al., 2015). And a recent review of studies of burnout in physicians and nurses in sub-Saharan African countries such as South Africa, Nigeria, Ghana and Ethiopia estimated burnout rates ranging from 40–80% (Dubale et al., 2019). It is worth noting that these estimates often vary greatly from study to study and are difficult to compare across different countries due to potentially different metrics or measurements, different ways of reporting burnout scores and categorizing burnout severity, and different cultural interpretations of the three domains and potential influence of social desirability bias (Dubale et al., 2019; Selamu et al., 2019). Further, there might be differences between rates of burnout in different healthcare professions (e.g., physicians vs. nurses), different healthcare settings (public vs. private) and among different patient populations (acute care vs. non-acute care). Nevertheless, through different studies, high

levels of burnout are clearly reported in all types of healthcare professionals in countries of all stages of economic development.

In comparison, few data are available for psychological burnout in CHWs, despite them being the cornerstone of primary healthcare delivery in LMICs. As emphasized above, growing recognition of the importance of CHWs in recent decades has resulted in expanded programming across many LMICs, there remains a paucity of research on CHW provider burnout. This gap in the literature will prevent policymakers from understanding how best to develop and implement a productive roadmap for successful integration of CHWs into existing healthcare systems.

Drawing from the few existing studies of CHW burnout in LMICs, there appears to be a similarly prevalent trend of high burnout among CHWs as observed among nurses and physicians. Using Maslach Burnout Inventory (MBI), a widely used tool to assess burnout in healthcare settings, studies in China, rural Ethiopia, Iran, and South Africa were able to separate the three dimensions of burnout and explore each one individually (Engelbrecht et al., 2008; Ge et al., 2011; Malakouti et al., 2011). It was shown that time pressure, heavy workload, interpersonal conflict, younger age or fewer years in practice, and lower work satisfaction can all contribute to higher distress levels in the EE dimension (Calgan et al., 2011; Engelbrecht et al., 2008; Ge et al., 2011). For the CY domain, lack of perceived support and few available resources along with time pressure of workload are salient risk factors (Akintola et al., 2013; Calgan et al., 2011). Lastly for the PA domain, similar risk factors such as lack of support, higher time pressure, overwhelming nature of patient's disease and professional uncertainties have been reported (Akintola et al., 2013; Calgan et al., 2011; Ge et al., 2011).

Studies from countries in sub-Saharan Africa, including Cameroon and Malawi, also show a strong positive correlation between CHWs' likelihood to quit their job and higher level of burnout (Kim et al., 2018; Mbangwa et al., 2018). In fact, burnout has been shown to be implicated in lower CHW motivation, increased risk of leaving the position, higher number of medical errors or self-reported sub-optimal choices during patient care, increased work absenteeism and ultimately, lower quality service to their patients (Khamisa et al., 2015; Kim et al., 2018; Suñer-Soler et al., 2014; West et al., 2006). These negative impacts are particularly pronounced in LMICs and have been linked to an annual monetary loss of 15.86 billion US dollars due to physician migrations from LMICs to high-income countries, and severely impede the progress of achieving SDG goals in LMICs (Saluja et al., 2020).

It should be brought to attention that in addition to difficulties in comparability of findings that exist in assessing burnout of physicians and nurses, there may be other limitations with the studies focusing on CHW burnout in LMICs. For instance, many studies directly apply burnout thresholds used in high income countries without consideration of contextually appropriate diagnostic criteria. To better understand the global landscape of CHW burnout in low-resource settings, more comprehensive studies need to be conducted that look at longitudinal changes in burnout, associations with psychological stressors and likely choices of management, training and intervention.

Impact of public health crises on mental health and wellbeing of frontline health workers

Public health crises such as infectious disease outbreaks, in the form of either epidemic or pandemic, can often bring about high levels of acute and chronic stress in both the victims and frontline health workers. Posttraumatic stress disorder (PTSD) is defined by Diagnostic and Statistical Manual of Mental Disorder, 5th edition (DSM-5) as a constellation of emotional and behavioral changes in response to traumatic events. Individuals with PTSD often experience recurrent flashbacks, nightmares, and uncontrollable anxiety. After a series of epidemics such as SARS, MERS, H1N1 and Ebola, it is clear that frontline health workers face a disproportionate share of the burden and risk of developing mental, psychological and psychosomatic disorders, either as an isolated disorder or as part of PTSD symptoms (Preti et al., 2020). Here we summarize relevant studies that have examined the psychological impact of previous public health emergencies on frontline health workers, which can shed light on how the COVID-19 pandemic may similarly contribute to detrimental effects among health workers.

Among recent infectious disease crises, the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003 is arguably the best studied in terms of its impact on psychological distress among healthcare workers. Studies from China, Canada and Singapore have shown that healthcare workers generally suffered from decreased vitality, poorer emotional and social functioning, and experienced worsening mental health than non-healthcare workers (Nickell, 2004; Phua et al., 2005; Su et al., 2007). One study found that during the month after the end of SARS outbreak, 93.5% of healthcare workers perceived SARS as stressful, 19.3% of them presented with PTSD symptoms and 47.8% had minor psychiatric morbidity (Lin et al., 2007). Another study, conducted 3 years after the SARS outbreak, showed that 14% of healthcare workers still reported moderate depressive symptoms, while 8.8% of them presented with a high depressive symptom level, while another study, similarly conducted 3 years post-SARS, showed a 10% PTSD symptom prevalence among healthcare workers (X. Liu et al., 2012; Wu et al., 2009). For insomnia and sleep quality-related assessment, healthcare workers in the SARS units had the highest insomnia rate at 50%, followed by SARS ICUs at 23% (Su et al., 2007). These studies suggest that even after the SARS outbreak, negative psychiatric symptoms persisted for some health workers, highlighting that it can also become a chronic debilitating illness that limits life qualities for an extended period of time. Burnout is yet another long-term consequence of the SARS outbreak. It was shown that 1–2 years following the epidemic, 30.4% of the healthcare workers reported a high level of burnout, particularly in the EE dimension (Maunder et al., 2006). Similar to the SARS outbreak, the 2014–2016 Ebola outbreak in Sierra Leone also left a deep psychological impact on frontline health workers, including obsession-compulsion, interpersonal sensitivity, depression and paranoia (Ji et al., 2017; Li et al., 2015). Another study found that providers who worked in primary health care facilities during the Ebola outbreak reported feelings of loneliness, ostracization, fear and other negative emotional well-being (McMahon et al., 2016). Furthermore, in many LMICs during response to public health crises, frontline health workers such as CHWs often take on more than what they are certified to do in order to compensate for shortages of healthcare professionals; thus,

evaluations of both the short-term and long-term psychological health outcomes could be critical in guiding how structural support should be offered to CHWs to ensure productive continuations of their work and to prevent burnout and minimize exhaustion.

Impact of COVID-19 pandemic on mental health and wellbeing of frontline health workers

The COVID-19 pandemic is caused by a novel coronavirus, which is biologically similar to SARS coronavirus, though its epidemiological features, fast transmission patterns through asymptomatic and pre-symptomatic patients and potentially lethal clinical presentation have combined to create a serious public health impact of an unprecedented scale (Rana et al., 2020). Furthermore, the unpreparedness of public health facilities, the sudden loss of social connections and mass quarantine and the lack of effective governmental response in many countries, have collectively contributed to widespread emotional distress and increased risk for psychiatric illness associated with COVID-19 (Pfefferbaum & North, 2020). Popularization of the internet also contributes to the spread of irrational panic and misinformation, likely making the global mental health burden of COVID-19 more severe than many of the infectious disease outbreaks that have occurred in recent years. Multitudes of psychological distress, including fear and anxiety have also bred stigma and marginalization as evidenced by the increasing anti-Asian sentiment. Therefore, frontline health workers, serving as a critical workforce in containing and responding to COVID-19, faced increased burden and stressors in their work, making them susceptible to a wide range of severe and potentially chronic mental health problems (Rana et al., 2020).

We searched Pubmed (MEDLINE) and EMABSE to identify studies documenting the psychological effects of the COVID-19 pandemic on health workers from LMICs, with particular attention to frontline health workers such as CHWs. We used search terms pertaining to “mental disorders” or “stress” or “psychological wellbeing”, and combined these with search terms for “community health worker” or “frontline health worker” or “primary care”, and relevant search terms for COVID-19. We summarized studies that included a range of different types of health workers in LMICs given the limited number of studies focused specifically on CHWs. All of the early studies that we identified were from mainland China, with 12 studies in total, looking mostly at anxiety, depression, insomnia, and PTSD among health workers (Table 1). These studies all used cross-sectional design, and sometimes applied different cut-off scores for categorization of mental distress (Pappa et al., 2020). Therefore, the reported results vary greatly between studies and should be interpreted with caution, especially as the pandemic remains in the acute phases in many regions of the globe, and is still only emerging in several LMICs.

The findings from the included studies reveal consistent trends related to the psychological impact of the pandemic on frontline health workers. In one study, the prevalence of PTSD was shown to be 9.1% among respondents, while the prevalence of depressive symptoms was 25.2% among healthcare workers (Song et al., 2020). Another study whose participants included mostly healthcare workers in Wuhan, the epicenter of the pandemic, found a much higher proportion of reported depression at 50.4%, anxiety at 44.6%, insomnia at 34.0%

and post-traumatic stress symptoms at 71.5% (Lai et al., 2020). Another study, however, showed a relatively consistent rate of insomnia at 38.4%, but lower depression and anxiety prevalence, at 13% and 12.2% respectively (Zhang et al., 2020). A meta-analysis of multiple studies showed pooled prevalence of depression, anxiety and insomnia at 22.8%, 23.2% and 38.9% respectively (n=12 studies on anxiety, n=10 studies on depression and n=5 studies on insomnia) (Pappa et al., 2020).

Risk factor or subgroup analysis appear to reveal relatively consistent results. Multiple studies reported higher prevalence of mental health symptoms among health workers who are in direct contact with patients with COVID-19, as well as among health workers with fewer years of work experience (Kisely et al., 2020; C.-Y. Liu et al., 2020). Additionally, a higher prevalence of affective symptoms was observed among female health workers than in their male counterparts, and similarly among nurses compared to medical staff (Du et al., 2020; Guo et al., 2020). All of these studies were conducted in the cultural background of China, and generalizability to populations in other parts of the world remains to be explored. Though, drawing from these findings and the experiences in prior pandemics, it can be expected that there will be similar effects on the mental health of frontline health workers in LMICs.

Due to social determinants, COVID-19 has disproportionately affected poor and underprivileged population groups. As a result, CHWs have drawn attention for their roles in potentially responding to the pandemic in low-resource regions and more generally, in LMICs (Ballard et al., 2020). Similar to their roles in resource-limited healthcare systems, effective CHW programs that equip, train and support CHWs could be a practical way to stem the pandemic in LMICs. Immediate investment has been advocated to protect CHWs before they are deployed, to lead widespread community-centered testing efforts in hopes to disrupt transmission, to maintain access to essential non-COVID-19 primary care services (such as immunizations, maternal and child health, HIV care, and management of chronic conditions), and to support community self-isolation by providing food, social and medical support (Ballard et al., 2020). However, while these proposals would be tremendously important and helpful for a decisive action to blunt the impact of the pandemic in LMICs, limited attention is paid to the mental health and wellbeing of CHWs, who share very similar, if not worse working conditions with other healthcare providers on the frontline. In contrast to physicians and other specialist healthcare providers, CHWs by definition usually come from the underrepresented communities that they serve, which make CHWs themselves potentially more susceptible to COVID-19 due to the same set of systemic health inequities that threaten their communities. They are also mostly women, often paid less, and thus more likely to experience gender inequality and have a more tenuous social support system than more well-compensated healthcare workers. These factors together suggest that CHWs are at risk of experiencing an even more severe psychological impact due to the COVID-19 pandemic compared to other cadres of specialized healthcare workers.

Opportunities to address mental health concerns among frontline health workers during the COVID-19 pandemic

The near ubiquitous access to internet and information has arguably worsened the psychological impact of COVID-19 pandemic due to the spread of misinformation, mistrust, and politicized rhetoric about the virus (Cuan-Baltazar et al., 2020; Tasnim et al., 2020). However, simultaneously, the internet could also offer unique opportunities to address these mental health burdens, particularly among frontline health workers. Psychological interventions can be effective when delivered using digital devices, such as smartphones or online platforms. For instance, supports such as digitally delivered psychological therapies, telepsychiatry visits in the forms of virtual clinics, crisis text lines, digital technology that monitors risks as well as delivering psycho-education online, could all be offered to a large number of frontline health workers in an efficient and low-cost way (Pappa et al., 2020).

Resilience strategies have also gained interest in recent literature (Chan et al., 2006; Heath et al., 2020; Hou et al., 2020), and could provide an approach for supporting frontline health workers responding to the COVID-19 pandemic. This refers to a strategy that aims at coaching healthcare workers to build adaptive characteristic qualities such as emotional intelligence, altruism and active coping style when confronting a potential stressor (Jackson et al., 2007; Maunder et al., 2010). It is known that some attributes can be developed and/or learned such as enhanced self-care and strengthening traits to terminate chronic or acute maladaptive response, decrease the likelihood of burnout, and increasing post-traumatic growth (Charney, 2004; Schreiber et al., 2019). The development of cognitive coping strategies prior to the stressful events can be protective against adverse psychological outcomes (Schreiber et al., 2019). Furthermore, organizational resilience, which refers to building reserves before a crisis and establishing workplace cultures, by effective leadership and organizational justice, can also buffer potential stressors and improve psychological health (Chan & Huak, 2004; Maunder et al., 2008). Several specific recommendations in programs intended to increase physician self-care have included physical activities, good sleep hygiene, building meaningful and supportive social networks, developing self-awareness and mindfulness/stress management (Callahan et al., 2018; Kelly et al., 2020; Murali et al., 2018; West et al., 2016). Following the 2003 SARS outbreak, researchers identified four variables that mediate stress response: confidence in support and training; ability to respond adaptively; coping style; and interpersonal relationships. A computer-based resilience training module was developed to address these four aspects and the findings showed that it could lead to better stress response (Maunder et al., 2010). Alternatively, didactic education sessions focused on coping skills resulted in participants reporting that they feel better prepared to cope with the pandemic (Aiello et al., 2011).

During the ongoing COVID-19 pandemic, the WHO has released guidelines for various psychological interventions, including psychological first aid (PFA) and an overview of essential knowledge that humanitarian health actors should know about mental health and psychosocial support (MHPSS) in humanitarian emergencies for frontline health workers. Additionally, the WHO has also developed an evidence-based self-help intervention called Self-Help Plus (SH+), based on principles of Acceptance Commitment Therapy, that can

be adopted in a virtual format (Yang et al., 2020). Psycho-education or training-based interventions such as the Ultra-Brief Psychological Intervention (UBPI) was also adapted to the needs of COVID-19, and enabled practitioners of UBPI to deliver specific psychological skills to clients in Malaysia (Ping et al., 2020). There remain few studies evaluating these types of interventions to address psychological distress among frontline health workers in LMICs, highlighting an urgency to advance research in this area to bolster frontline health workers and support the COVID-19 response efforts.

Lastly, despite a plethora of platforms and resources, clarity in organizational guidelines and rapid responsive leadership remain critical in ensuring successful management of mental health challenges faced by frontline health workers during the pandemic. Particularly, preparation for moral dilemmas as well as routine assessment, reasonable task shifts and implementation of peer or buddy support systems are approaches that health systems can adopt to protect frontline health workers from added psychological stressors throughout the COVID-19 pandemic (Greenberg et al., 2020).

Conclusion

The COVID-19 pandemic has exposed many of the systemic insufficiencies in healthcare systems of many countries. In many LMICs, where the pandemic is only emerging, the burden on frontline health workers may be especially severe given the existing resource constraints, and underfunded and understaffed health facilities. One of the most salient problems being highlighted is not only the lack of mental health literacy among frontline health workers in utilizing skills such as self-resilience, but also the lack of mental health support from their governmental agencies and institutions. With frontline health workers such as CHWs representing the essential workforce for primary care in LMICs, more studies focused on the mental health and wellbeing of these health workers during and after containment of COVID-19 will be needed. Investigations into how to sustain this workforce and best prevent burnout should be prioritized and appropriate changes in policies and practice should be implemented. Furthermore, with the anticipated economic aftermath from the pandemic, LMICs could potentially increase support of CHW training programs to respond to shortages of primary care physicians in resource-limited environments. Lastly, leveraging the availability of digital platforms for psycho-education and resilience training for physicians can also be a viable strategy for supporting CHW training programs and offering mental health support to CHWs. More research, practice, and policy efforts will be needed to carefully evaluate the efficacies of digital resources in terms of both their short term and long term impacts on CHWs. The mental health and wellbeing of frontline health workers will be central to ensuring a sustainable response to this global health crisis.

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Table 1.

Author	Location	Participant Profile	Design	Measurement	Main Result
Sun et al. 2020	Both Wuhan and outside of Wuhan, China	Seventy-four (16.7%) male and 368 (83.3%) female individuals participated in this study. A total of 53 doctors, 348 nurses, 18 administrative and logistics staff and 23 other types of health workers participated in this study. In all, 337 subjects lived with their families, 27 subjects lived in dormitories and 38 subjects lived alone	Cross-sectional	Impact of Event Scale (IES) and a nine-question questionnaire	After the outbreak of 2019-nCoV, 395 (89.4%) of the 442 subjects thought that medical work was very risky. There were 381(86.2%) health workers who think they have more work pressure than before. The average score of high arousal dimension was 5.15 (S.D. = 4.71), and the median score was 4.0 (IQR 2.0, 7.0). The high arousal score of health workers in males was higher than that in females. The quarantined health workers have a higher score for high arousal.
Zhang et al. 2020	Online survey in China	A total of 2,182 Chinese subjects participated.	Cross-sectional	Insomnia Severity Index (ISI), the Symptom Check List-revised (SCL-90-R), and the Patient Health Questionnaire-4 (PHQ-4), which included a 2-item anxiety scale and a 2-item depression scale (PHQ-2).	Compared with nonmedical health workers (n = 1,255), medical health workers (n = 927) had a higher prevalence of insomnia (38.4 vs. 30.5%, $p < 0.01$), anxiety (13.0 vs. 8.5%, $p < 0.01$), depression (12.2 vs. 9.5%; $p < 0.04$), somatization (1.6 vs. 0.4%; $p < 0.01$), and obsessive-compulsive symptoms (5.3 vs. 2.2%; $p < 0.01$). They also had higher total scores of ISI, GAD-2, PHQ-2, and SCL-90-R obsessive-compulsive symptoms ($p < 0.01$)
Song et al. 2020	Both Wuhan and outside of Wuhan, China	A total of 14,825 emergency department medical staff from 31 provinces in mainland China were surveyed.	Cross-sectional	The social support of participants was measured by the Perceived Social Support Scale (PSSS). The Center for Epidemiologic Studies Depression Scale (CES-D) was used to assess depressive symptoms. PTSD was assessed by the PTSD Checklist for DSM-5 (PCL-5)	The prevalence rates of depressive symptoms and post-traumatic stress disorder (PTSD) were 25.2% and 9.1%, respectively. Men were more likely to have depressive symptoms and PTSD than women. Those who were middle aged, worked for fewer years, had longer daily work time, and had lower levels of social support were at a higher risk of developing depressive symptoms and PTSD. Working in the Hubei province was associated with a higher risk of depressive symptoms, while those working in the Hubei province but residing in another province had a lower risk of depressive symptoms and PTSD. Being a nurse was associated with a higher risk of PTSD.
Mo et al. 2020	Wuhan, China	180 nurses from Guangxi who are involved in fighting against COVID-19 in Wuhan, those who have entered the clinical front line to participate in the rescue work and those who volunteered to participate in this study.	Cross-sectional	Data collection tools, including the Chinese version of the Stress Overload Scale (SOS) and the Self-rating Anxiety Scale (SAS), were used.	The SOS (39.91 ± 12.92) and SAS (32.19 ± 7.56) scores of this nurse group were positively correlated ($r = 0.676$, $p < .05$). Multiple regression analysis showed that only children, working hours per week and anxiety were the main factors affecting nurse stress ($p = .000, .048, .000$, respectively).
Lai et al. 2020	Both Wuhan and outside of Wuhan, China, but more hospitals in Wuhan were selected	1257 health care workers in 34 hospitals from January 29, 2020, to February 3, 2020, in China. Health care workers in hospitals equipped with fever clinics or wards for patients	Cross-sectional	The degree of symptoms of depression, anxiety, insomnia, and distress was assessed by the Chinese versions of the 9-item Patient Health Questionnaire, the 7-item Generalized Anxiety Disorder scale, the 7-item Insomnia Severity Index,	A considerable proportion of participants reported symptoms of depression, anxiety, insomnia, and distress. Nurses, women, frontline health care workers, and those working in Wuhan, China, reported more severe degrees of all measurements of mental health symptoms than other health care workers.

Author	Location	Participant Profile	Design	Measurement	Main Result
		with COVID-19 were eligible.		and the 22-item Impact of Event Scale-Revised, respectively.	
Zhu et al. 2020	Gansu Province, China	A total of 79 doctors and 86 nurses participated in the survey.	Cross-sectional	A cross-sectional survey was conducted in Gansu (China), with a questionnaire packet which consisted of the self-rating anxiety scale (SAS), self-rating depression scale (SDS), and the simplified coping style questionnaire (SCSQ).	The prevalence rates of anxiety and depression symptoms among doctors was 11.4% and 45.6%, respectively. The prevalence rate of anxiety and depression symptoms among nurses was 27.9% and 43.0%, respectively.
Du et al. 2020	Wuhan, China	Participants were frontline HCWs from two Wuhan-based hospitals (n = 200) and HCWs in the outreach team (n = 110) deployed to Wuhan from two outside hospitals.	Cross-sectional	Perceived stress via Perceived Stress Scale (PSS), depression via Beck Depression Inventory- II (BDI-II), and anxiety via Beck Anxiety Inventory (BAI).	the prevalence of elevated depressive (BDI-II scores 14) and anxiety symptoms (BAI scores 8): 12.7% and 20.1% of HCWs had at least mild depressive and anxiety symptoms, respectively. More than half (59.0%) had moderate to severe levels of perceived stress (PSS scores 14).
Qi et al. 2020	Hubei Province, China	A total of 1306 subjects (801 Frontline medical workers and 505 non-frontline medical workers) were enrolled from multiple hospitals in Hubei Province, China	Cross-sectional	An online questionnaire, including Pittsburgh Sleep Quality Index (PSQI), Athens Insomnia Scale (AIS) and Visual Analogue Scale (VAS), was used to evaluate sleep disturbances and mental status. Sleep disturbances were defined as PSQI>6 points or/and AIS>6 points. We compared the scores of PSQI, AIS, anxiety and depression VAS, as well as prevalence of sleep disturbances between FMW and non-FMW.	Compared to non-FMW, FMW had significantly higher scores of PSQI (9.3 ± 3.8 vs 7.5 ± 3.7 ; $P < 0.001$), AIS (6.9 ± 4.3 vs 5.3 ± 3.8 ; $P < 0.001$), anxiety (4.9 ± 2.7 vs 4.3 ± 2.6 ; $P < 0.001$) and depression (4.1 ± 2.5 vs 3.6 ± 2.4 ; $P \frac{1}{4} 0.001$), as well as higher prevalence of sleep disturbances according to PSQI > 6 points (78.4% vs 61.0%; relative risk [RR] $\frac{1}{4}$ 1.29; $P < 0.001$) and AIS > 6 points (51.7% vs 35.6%; RR $\frac{1}{4}$ 1.45; $P < 0.001$).
Liu et al. 2020	Both Wuhan and outside of Wuhan, China	512 participating healthcare staff included doctors, nurses and administrative workers at hospitals equipped with a fever clinic or a COVID-19 ward in different regions in China. Administrative staff work in administration and did not directly engage in the treatment or care of infected patients.	Cross-sectional	Zung Self-rating Anxiety Scale (SAS) to assess anxiety, with the criteria of normal (≤ 49), mild (50–59), moderate (60–70) and severe anxiety (≥ 70).	The prevalence of anxiety was 12.5%, with 53 workers suffering from mild (10.35%), seven workers suffering from moderate (1.36%) and four workers suffering from severe anxiety (0.78%). After adjusting for sociodemographic characteristics (gender, age, education and marital status), medical staff who had had direct contact treating infected patients experienced higher anxiety scores than those who had not had direct contact (β value = 2.33, confidence interval (CI) 0.65–4.00; $P = 0.0068$). A similar trend was observed in medical staff from Hubei province, compared with those from other parts of China (β value = 3.67, CI 1.44–5.89; $P = 0.0013$).
Kang et al. 2020	Wuhan, China	994 medical and nursing staff	Cross-sectional	Patient health questionnaire-9, Generalized Anxiety Disorder, Insomnia Severity Index and the Impact of Event Scale-Revised	36.9 % had subthreshold mental health disturbances, 34.4 % had mild disturbances, 22.4 % had moderate disturbances, and 6.2 % had severe disturbances
Xiao et al. 2020	Wuhan, China	180 medical and nursing staff	Cross-sectional	Self-Rating Anxiety Scale, the General Self-Efficacy Scale, the Stanford Acute Stress Reaction Questionnaire,	Levels of social support were significantly associated with self-efficacy and sleep quality and negatively associated with the degree of anxiety and stress

Author	Location	Participant Profile	Design	Measurement	Main Result
				the Pittsburgh Sleep Quality	
Liang et al. 2020	Guangdong Province, China	59 medical and nursing staff	Cross-sectional	Zung's self-rating depression scale (SDS), Zung's self-rating anxiety scale (SAS)	Several staff were experiencing clinically significant depressive symptoms

Footnote: We used the following search stratag in Pubmed (Medline) and EMBASE: Mental Disorders (“mental illness” OR “mental health” OR “mental disorder” OR “depression” OR “anxiety” OR “affective disorder” OR “psychological well-being” OR “psychological” OR “psychological distress” OR “stress” OR “post-traumatic stress disorder” OR “ptsd” OR “stress disorder” OR “mental disorders”[MeSH Terms] OR “Anxiety Disorders”[Mesh] OR “Stress Disorders, Traumatic”[Mesh] OR “Mood Disorders”[Mesh] OR “Depressive Disorder”[Mesh] OR “Stress, Psychological”[Mesh] OR “Psychological Distress”[Mesh]) AND COVID-19 (“COVID-19” OR “sars cov” OR “nCOV” OR “coronavirus 2” OR “novel coronavirus” OR “Severe Acute Respiratory Syndrome”[Mesh] OR “SARS” OR “severe acute respiratory syndrome coronavirus 2” OR “COVID-19” [Supplementary Concept]) AND Community Health Worker (“Community Health Worker” OR “Frontline Health Worker” OR “health care worker” OR “personnel” OR “clinician” OR “nurse” OR “midwife” OR “midwives” OR “first responder” OR “Community Health Workers”[Mesh] OR “Health Personnel”[Mesh]). The search was conducted on July 1st, 2020, and yielded 496 entries after removal of duplicates and studies published before 2020 (as this could not have reported on COVID-19). In total, 12 studies reported on the mental health impacts among frontline health workers in LMICs, all coming from China.