The Mental Health Impact of COVID-19 Pandemic on Health Care Workers and Coping Strategies: A Systematic Literature Review

https://doi.org/10.3991/ijoe.v17i09.24791

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Abstract—In December 2019, the COVID-19 outbreak originated in Wuhan, China. Since then, this virus has spread at a very rapid rate affecting many countries. The World Health Organization (WHO) subsequently declared a global pandemic, and a range of precautions have been implemented to reduce the spread of the virus. Some of these precautions included social distancing, self-isolation, and quarantine of those who have contracted or potentially contracted COVID-19. Healthcare workers (HCWs) are at high risk because of the constant contact with infected patients for extended periods or by exposure to a patient's environment or biological samples. This may cause fear of transmitting the infection to their families. Also, the extended working hours put them under severe stress, fatigue, and adverse social life. All of these factors affect their behaviors and attitudes. to explore the mental health impact of COVID-19 on HCWs as this will be reflected on their performance on such crisis. Besides, we aim to investigate HCWs' coping strategies during the pandemic and provide coping recommendations based on evidence. A systematic review using PRISMA methodology was used through three electronic databases, including PubMed, ScienceDirect, and Scopus. All cross-sectional studies that were published in English and that assessed the mental health impact of COVID-19 on HCWs or/and coping strategies adopted by them were included. A total of one hundred and forty articles total were retrieved from the three databases and were reviewed for relevance. reviews for relevance after remove duplicate. We Ended up with twenty-four recent studies from 2020 that were included in the analysis. As COVID-19 has started in China, our review identified many studies that were done there on the subject of HCWs mental health due to the crisis. Italy took the second place in the number of studies. Nurses and physicians were the populations targeted in many studies. COVID-19 has created much pressure on HCWs. This pressure has increased the following mental health complaints: anxiety, depression, insomnia, and stress. Many studies have emphasized the effects of social support as an effective way of coping with COVID-19.

Keywords—COVID-19, Mental Health, Health Care workers, Coping Strategies

1 Introduction

Coronavirus disease 2019 (COVID-19) is a global pandemic caused by the new coronavirus known as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). COVID-19 was discovered for the first time in December 2019 in Wuhan (China) and spread rapidly in almost all global regions. COVID-19 attacked humankind more fiercely compared to SARS, as it resulted in a higher number of cases and an increased death toll after the outbreak [1]. On March 11, 2020, the World Health Organization (WHO) declared COVID-19 as a global pandemic. A range of precautions have been implemented to reduce the virus's spread; some of these precautions included social distancing, self-isolation, and quarantine of those who have contacted or potentially contacted COVID-19 patient.

In the previous viral outbreaks in the past years, such as H1N1 influenza and severe acute respiratory syndrome (SARS), frontline and non-front line healthcare workers (HCWs) were shown to have a high risk of infection and other adverse physical health outcomes (Xiao et al., 2020). On top of that, HCWs were exposed to mental health problems due to their occupational activities even years after epidemics; these symptoms included depression, anxiety, burnout, and post-traumatic stress [2]. Psychological problems are more prevalent and significant among HCWs than other professions during the COVID-19 pandemic [3], [4]. It was reported that at least one in every five HCWs suffered from anxiety and depression, and two in five reported insomnia [5].

The additional uncertainty around the current COVID-19 progression and treatments as well as the challenges of limited resources means that HCWs are indeed facing difficulty in decision making and moral dilemmas during the pandemic; this can lead to moral injury, which can be described as psychological distress which results from actions, or lack of them, which violates someone's moral or ethical code [6]. Overall, pandemic situations require intense and immediate response of healthcare workers as direct HCWs (e.g., physicians, nurses) or indirect HCWs (e.g., aides, laboratory technicians, and medical waste handlers) providing care to patients, fighting at the frontline to address the challenges posed to healthcare systems. However, maintaining a sufficient health care workforce during the current crisis does not require a considerable number of HCWs; yet it is essential to maximize each HCW to care and perform to their full potential for a high volume of patients over an extended time interval.

Besides coping with the societal changes, emotional stressors, greater risk of exposure, extreme workloads, and moral dilemmas faced by HCWs, following coping strategies, which are defined as the thoughts and actions that individuals use to deal with stressful events, will help HCWs to cope better with the pandemic [7], [8].

The mental health impact of the outbreak was shown to be reduced with the availability of updated health information and particular precautionary measures (Wang et al., 2020).

The mental health impact of COVID-19 on HCWs was the subject of many previous researches. Most of the studies were conducted in one geographical area (China), which limited the results' generalizability [3], [9], [10]. The results of studies done in China may not be the same in many developing countries that have a shortage of HCWs [11], [12]. There is an emerging need to explore the evidence available from different

countries to reach generalizable results. Since COVID-19 is not yet a fully understood disease, literature must be visited frequently to provide the most updated data about the issue .

COVID-19 pandemic has mandated researchers to rapidly publish their studies despite the high risk of bias and low methodological quality [2]. Furthermore, the studies included in the previous reviews have some limitations: most of the research used a cross-sectional study design that was done from days to months [13]. It was recommended that future researches should include follow-up studies of the changes over a long period of time. Also, larger sample size is required to identify the extent of mental health problems. Moreover, sampling bias is possible, as many studies have used non-probability sampling like snowball sampling or convenience sampling [14]. The demographic factors such as age and gender were recommended to be studied in future analysis. It was also recommended that other factors, such as intercurrent stressors like life events and personality characteristics, which might affect the psychological responses, must be investigated in future studies [13].

Of the previously published studies, many have relied on subjective measures to assess different aspects of mental health [1]; Shechter et al., 2020). Additionally, most of the published studies used online survey methodology wit**h less concertation on the availability of valid mental health outcome measures [15], [16]. Both methodologies (subjective measures and online survey) have added to the limitations of these studies.

On top of that, there is a debate about using the term HCWs without identifying the diversity that goes under it, not only the difference of professional categories but also the working conditions of the different professional categories. Most of the studies took nurses and doctors as subjects in their studies without declaring the power and domination between them. Moreover, many professionals that have a role in patient care during the COVID-19 pandemic were not included in the studies, such as physiotherapists, psychologists, nutritionists, laboratory workers, the group of workers involved in cleaning and hygiene services at health services and hospitals, and the workforce responsible for transporting patients, like drivers [17].

Moreover, most of the recently published systematic literature review studies reviewed the mental health status of HCWs, and they recommend the review coping styles or strategies to deal with adverse mental health among HCWs and merge between both in one systematic study [18] - [20].

The COVID-19 outbreak has severely impacted people's physical, psychological health and lives, especially the HCWs. It has resulted in various mental health issues, for example, panic disorder, anxiety, and depression. However, no research articles have examined the impact of COVID-19 on HCWs mental health in different countries so far. This study aims to identify the most common mental health problems and their impact on the mental health of HCWs from different countries and specialties during a pandemic like COVID-19.

Due to the scarcity of generalizable data about successful coping strategies to combat the pandemic's adverse mental health impact on HCWs, this study aims to establish appropriate mental health intervention policies to efficiently and effectively cope with the mental health problems during pandemics .

This study will help in guiding inputs for conducting policies about maintaining HCWs well-being during crises. Moreover, this study will also guide the administrators, health organizations, and society to support the HCWs with an effective coping strategy and style, which in turn has an advantage in facilitating the HCWs mental and physical health and thus sustaining their working capabilities during any crisis. Besides, this will aid in reducing short and long terms effects of adverse mental health on HCWs work and social life.

Furthermore, this study will open the floor for countries to determine the pandemic's impact on the mental health of the front and second line HCWs in different specialties. Moreover, to examine the effectiveness of successful coping strategies from previously published studies or new innovative strategies on HCWs during the crisis using an experimental study. Studying the impact of Covid-19 among HCWs is also needed to improve mental health care and HCW treatment planning, as the results of this study will serve in forming the fundamental bases of preventive measures and procedures during a potential pandemic crisis.

2 Review Methodology

2.1 Search Strategy

This review was done based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [21]. We aimed to investigate the mental health impact of COVID-19 on HCWs and the coping strategies used. We have searched three electronic databases (PubMed, ScienceDirect and Scopus) for relevant studies published in 2020. We have searched databases for the following keywords: COVID AND mental health AND health care workers AND coping. Other keywords were also searched: Coronavirus disease 2019 AND healthcare worker AND coping AND psychological distress AND support.

2.2 Eligibility Criteria

According to the study objectives, the inclusion criteria outline:

1. Cross sectional studies.
2. Study population including HCWs from any country.
3. Studies published in English language.
4. Study title must contain the following keywords in the title: (healthcare workers OR healthcare providers OR health care professionals OR medical staff or nursing staff) AND (COVID-19 OR pandemic OR CORONAVIRUS) AND (mental health OR mental status OR psychological distress OR psychological impact OR psychological comorbidities) AND/ OR (behaviour OR coping).
5. Quantitative studies with reported mental health outcomes such as anxiety, fear, depression, sleep disorder, etc. or/ and coping strategies related to HCWs.

Review articles (systematic, narrative, and literature reviews), studies where full text was not available, and studies involving general population or HC students or residents were not included in the review.

2.3 Study Selection

Research studies evaluating the mental health of HCWS or/and coping strategies in various aspects during the COVID-19 pandemic were included in this study. All the researchers performed the process of searching and screening the titles and abstracts. The full text was then evaluated to extract the relevant data more toward studies based on valid outcome measures in evaluating mental health. The content of relevant data was then assessed.

The study selection process is outlined in a flowchart (Figure1). One hundred and fifty-six relevant studies were identified through a systematic search of three electronic databases, including PubMed (n=61), Scopus (n=46) and ScienceDirect (n=49). Then sixteen duplicated articles were excluded. The remaining (n=140) articles were screened for relevance through titles and abstracts. After screening, only thirty- two articles met the inclusion criteria. Eligible articles were reviewed through full-text screening done by all the researchers. According to that, eight were excluded, four due to the unavailability of outcome measures and the other four were including HCW students or residents. Thus, we have ended up with 24 articles that were ready for analysis [1], [8], [9], [14], [22] - [41].

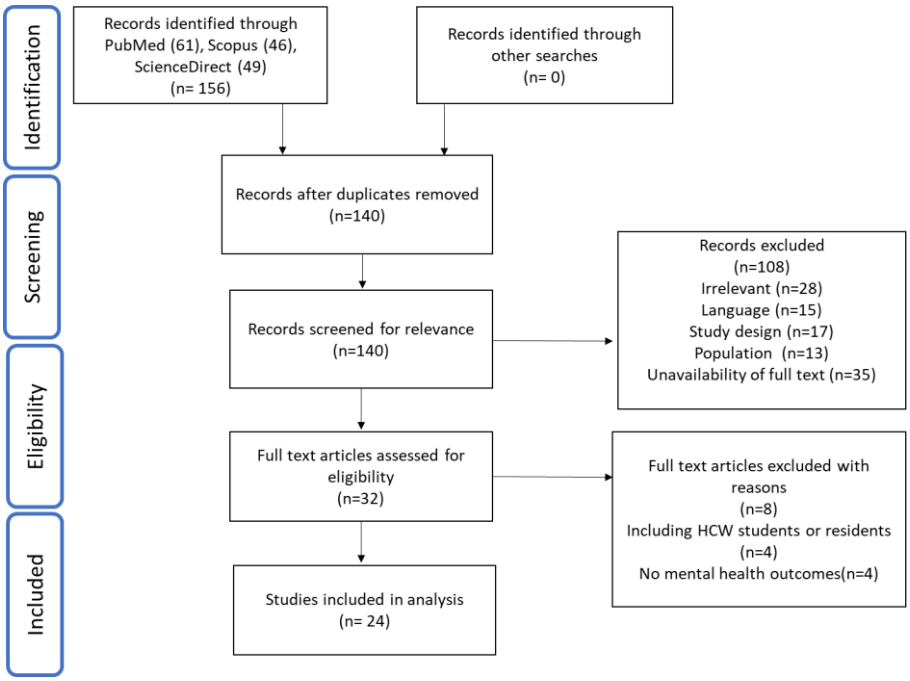

Fig. 1. PRISMA diagram for searching resources

3 Result

3.1 Characteristics of Included Studies

Articles were published in 10 different countries. Most of the articles were published in China (n=12). This could be justified by the disease first occurrence that was in China. Italy took second place in the number of published articles (n=3). Only two articles were published in Gulf Cooperation Council countries, and both were published in Saudi Arabia (Table1).

Table 1. Shows the list of the countries from where our selected articles were done.

Serial no	Country	Number of articles
1	Croatia	1
2	China	12
3	Italy	3
4	Spain	1
5	KSA	2
6	USA	1
7	Brazil	1
8	Malaysia	1
9	Turkey	1
10	Pakistan	1

Based on the three databases that were searched (PubMed, Scopus, and Science Direct), all of the articles that were selected were published in 2020 from different twenty-two journals as shown in (Table 2). Only one journal, the Archives of Psychiatric Nursing, published two articles about HCWs mental health and coping during Covid19 pandemic.

Table 2. Shows the list of the journals from where our selected articles were published.

Serial no	Journal	Number of articles
1	Psychotherapy and Psychosomatics	1
2	JAMA network	1
3	Anesthesia and analgesia	1
4	Brain, behavior, and immunity	1
5	European Psychiatry	1
6	BMC Health Services Research	1
7	Infectious Diseases of Poverty	1
8	Archives of Psychiatric Nursing	2
9	PLOS ONE	1
10	International Journal of Environmental Research and Public Health	1
11	Revista Brasileira de Enfermagen	1

12	Medical Science Monitor Basic Research	1
13	Journal of Affective Disorders	1
14	Journal of Taibah University Medical Sciences	1
15	American Journal of Infection Control	1
16	Neurobiology of Stress	1
17	Journal of Infection and Public Health	1
18	Sustainability	1
19	Social psychiatry and psychiatric epidemiology	1
20	Applied psychology: health and well-being	1
21	Frontiers	1
22	Psychiatr Danubina	1
22	Psychiatry Research	1

Moreover, twenty-two studies out of all the included studies measured the mental health of HCWs during COVID-19, while 12 articles measured coping and or investigated coping strategies or recommendations (Table 3).

Table 3. Number of topics related to the study

	Topics Related to Systematic Review		
	Mental health	***Mental health and coping***	***Coping***
Number of articles (included n=24)	12	10	2

All of the included studies were cross-sectional studies that used quantitative research method or qualitative research method or both through survey. It was mainly online survey in 18 studies as it was the easiest method for data collection [9], [14], [22], [23], [25] - [28], [30] - [32], [34] - [41].

Besides, researches included interview research [1], descriptive research [24], correlational research [8], [33] and observational research [29].

Table 4. List of research methods used in included studies

Serial no	**Research Methods**	**Number of articles**
1	Survey Research	18
2	Descriptive Research	1
3	Correlational Research	2
4	Observational Research	1
5	Interview Research	1

The industry of the researches is shown in (Table 5). All the articles studied the effect of Covid-19 mental health on health care workers (HCWs), mainly on doctors, physicians, and nurses. On the other hand, few other articles have studied the effect of covid-19 on mental health on other health professions such as radiologists, laboratory staff, dentists, midwives, psychologists, pharmacists, and physiotherapists. Besides health care workers, some articles have investigated the mental health impact of Covid-19 on Non-medical health care workers (NMHCWs) such as social health operators, technicians, and administrators in the hospital.

Table 5. the industry or population investigated in the study

Serial no	Industry type	No. of articles
1	Pharmacists	2
2	Nurses	24
3	Non-physician specialists	1
4	Technicians	1
5	Physicians	24
6	Administrators	1
7	Psychologists	1
8	Physiotherapists	1
9	Hospital staff	3
10	Nonmedical health care workers (NMHCWs)	1
11	Medical care workers	24
12	Medical students	1
13	Radiologist	1
14	Biomedical laboratory	1
15	Social health operators	1
16	Dentists	1
17	Midwives	1
18	Frontline emergency HCWs	1
19	Second line medical staff	2

3.2 Mental health of health care workers during COVID-19 pandemic

The study characteristics, outcome characteristics and findings of 22 studies evaluated mental health among health care workers during COVID-19 pandemic is shown in Table 6. Most of studies measured various mental health aspects that included: anxiety (17/22), depression (14/22), stress (8/22), insomnia (3/22). Furthermore, sleep disturbance, fear, sadness, anger, uneasiness, and mental well-being were also studied in few articles.

Outcome measurement tools that were used included: Generalized Anxiety Disorder questionnaires (GAD-7) was used in 5 studies to assess anxiety [22], [27], [28], [37], [38]. Depression was assessed in 6 studies using Patient Health Questionnaire-9 (PHQ-9) [9], [22], [27], [28], [37], [38]. Insomnia was measured in 3 studies using the Insomnia Severity Index (ISI) [27], [37], [40]. Other studies have used different scales to

assess anxiety and depression levels and these were: Self-rating Anxiety Scale (SAS), Depression Anxiety Stress Scale (DASS), State-Trait Anxiety Inventory (STAI) [24], [29], [32], [34], [35], [41].

Total percentage of anxiety reported in 12 studies in China ranged between 13.0% to 63.8%. Depression reported in 8 studies done in China ranged between 12.2% to 50.4% [27], [36] - [40]. While China had the highest rates of anxiety 63.8%, KSA had the highest rate of depression that was 55.2% [22].

In Italy, anxiety prevalence was 23.7%, while depression was not measured [31]. Anxiety and depression rates in KSA were 51.4% and 55.2% respectively [22]. In Croatia, anxiety and depression were more prevalent in nurses compared to physician. Depression and anxiety in nurses were 30.3% and 25.8% while in physician they were 19.4% and18.4% respectively [34]. In Turkey, anxiety prevalence was 36.3% [24]. Anxiety and depression in Malaysia were 29.7%, and 30.2% respectively [32]. In Brazil, the prevalence of anxiety was double the prevalence of depression where they measured 48.9% and 22% respectively [29].

Mental health problems were categorized into different categories based on the severity of symptoms (mild, moderate, or severe). Studies done in China have reported that HCWs had no depression symptoms to mild symptoms (ranging from 30%- 69.8%) [36] - [38]. Similarly reported in European studies (Italy, Spain and Croatia) where 76.3% of HCWs have no depression symptoms and 11% have shown moderate to very severe depression symptoms. [31], [34]. Studies that were done in KSA have reported that the majority of HCWs in these regions have encountered mild symptoms of depression 24.9% [22].

The severity of anxiety in China was variant in different studies. The percentage of mild symptoms ranged from 12.2% to 48.9%. Moderate to severe symptoms raged from 5.3% to 16.3% [28], [36], [37]. In Italy, 76.3% HCWs have not experienced any symptoms of anxiety and only 10.3% have experienced severe anxiety symptoms [31]. Similarly, more HCWs in KSA have reported having mild symptoms of anxiety (25.1%), while 15.3% out of them have reported having severe symptoms [22]. Anxiety was measured in Malaysia using the Depression Anxiety Stress Scale (DASS) and the results were 7.9%, 10.4%, 3% and 8.3% for mild, moderate, severe, and very severe anxiety respectively [32].

The prevalence of stress was higher in nurses than in physicians (49.3% and 39.4% respectively) in Croatia [34]. The prevalence of stress in China ranged between 27.7% to 71.5% [27], [37]. The prevalence of stress in both studies included in the review were 33.1% and 44.9% [25], [31].

In Croatia, 10% of the HCWs were moderately to extremely stressed [34]. In China, more staff were either having mild to no symptoms (36.5% and 87% respectively) [27], [37]. In KSA, frontline nurses working in Hail hospital have perceived themselves as having moderate stress (19.9%) [33]. The results of a study done in Italy revealed that 55.1% of the HCWs had severe stress and 23.2% had no symptoms [31].

Table 6. Mental health results from included studies

	Study characteristics			Outcome characteristics		Findings	
#	Author/Year	Country	Population	Type of mental health	Measurement tool	Total	Severity
1	AlAteeqa et al. 2020	KSA	administrators, nurses, physicians, non-physician specialists, technicians, pharmacists	-Depression -Anxiety	-Patient Health Questionnaire (PHQ-9) -Generalized Anxiety Disorder 7 (GAD-7) questionnaires	Depressive disorder (55.2%) Anxiety disorder (51.4%)	*Depression: mild (24.9%), moderate (14.5%) moderately severe (10%) severe (5.8%) *Anxiety: mild (25.1%) moderate (11%) severe (15.3%)"
2	Salopek-Žiha et al. 2020	Croatia	nurses and physicians	-Depression -Stress -Worried -Anxiety	-Depression Anxiety Stress Scales (DASS-21) -Short form health survey-36 (SF-36) who is a measure of health status	Depression (Nurses 30.3%) (Physicians 19.4%) Anxiety (Nurses 25.8%) (Physicians 18.4%) Stress (Nurses 49.3 %) (Physicians 39.4%)	*(11%) moderate to very severe depression * (17%) moderate to extremely severe anxiety *(10%) moderate to extremely severe stress. *(67%) of the medical staff was very worried
3	Chen, J et al. 2020	China	Healthcare workers	-Depression -Anxiety	-9-item Patient Health Questionnaire (PHQ-9) -The generalized anxiety disorder 7-item scale (GAD-7)	Depression (48.67%) Anxiety (47.01%) Anxiety and depression (32.26%)	*moderate to severe depression (18.29%), mild depression (30.38%) *moderate to severe anxiety (16.63%) mild anxiety (30.38%) *24.50% healthcare workers moderate/severe anxiety and depression at the same
4	GómezSalgado et al. 2020	Spain	physicians, nurses, psychologists, pharmacists, and physiotherapists	-Mental health -Emotional well-being	- General Health Questionnaire's (GHQ-12)	(80.6%) of the healthcare professional had psychic morbidity	*present of psychological distress (80.6%) * Not present of psychological distress (19.4%)
5	Li et al. 2020	china	Healthcare workers	-Depression -Anxiety	-Zung Self-Rating Depression Scale (SDS) -Zung Self-Rating Depression Scale (SDS)	depression (32.93%) anxiety (24.34%)	*Depression: Mild (13.28%) moderate (3.25%) severe (0.27%) *Anxiety: mild (6.23%) moderate (1.36%) severe (1.36%)
6	Bettinsoli et al. 2020	Italy	Doctors, nurses, staff	-Mental well-being &risk of developing psychiatric disorders	-12-item General Health Questionnaire (GHQ-12)	(33.5%) threshold for psychiatric morbidity.	NOT AVAILABLE
7	Kang et al. 2020	China	Medical & nursing staff	-Mental disturbance	- Patient Health Questionnaire-9(PHQ-9)	Mental disturbance (63%)	*(34.4%) mild disturbances *(22.4%) moderate disturbances *(6.2%) severe disturbances
8	Lia et al. 2020	china	Physicians& nurses	-Depression -Anxiety -Insomnia -Distress	- Patient Health Questionnaire-9(PHQ-9) - 22-item Impact of Event Scale–Revised (22-IES) - 7-item Insomnia Severity Index (7-ISI) - Generalized Anxiety Disorder (GAD-7) scale	Depression (50.4%) Anxiety (44.6%) Insomnia (34 %) Distress (71.5%)	*Depression mild (35.6%) moderate (8.6%) severe (6.2%) * Anxiety mild (32.3%) moderate (7%) severe (5.3%) * Insomnia subthreshold (26.2%) moderate (6.8%) severe (1%) *Distress mild (36.5%) moderate (24.5%) severe (10.5%)
9	Zhang et al. 2020	China	Medical doctors Nurses (MHCW) Nonmedical health care workers (NMHCW)	-Anxiety -Insomnia -Somatization -Obsessive compulsive symptoms	-Insomnia Severity Index (ISI) - Symptom Check List-revised (SCL-90-R) - Patient Health Questionnaire-4 (PHQ-4)	MHCW (38.4%) insomnia anxiety (13.0%) depression (12.2%) somatization (1.6%) obsessive-compulsive symptoms (5.3%) NMHCW (30.5%) insomnia Anxiety (8.5%) Depression (9.5%) Somatization (0.4%) obsessive-compulsive symptoms (2.2%)	NOT AVAILABLE

10	Dong et al. 2020	China	Hospital staff members	-Anxiety -Depression -Negative emotions.	-Huaxi Emotional-Distress Index (HEI).	(24.2%) high level of mental issues	*(14.9%) mild negative emotions (5.5%) moderate negative emotions (3.8 %) severe negative emotions
11	Babore et al. 2020	Italy	Nurses, physicians, technical health professionals (namely, radiologists, biomedical laboratory technicians, etc.), social health operators, other healthcare professions (as physiotherapists, dentists, midwives, etc.).	-Stress	-The Perceived Stress Scale (PSS)	Stress (33.185%)	NOT AVAILABLE
12	Chen, H et al. 2020	China	HCWs, including doctors, nurses, administrative staff, and medical technician in the Affiliated Hospital of Xuzhou Medical University, Jiangsu, China	-Post-traumatic stress (PTSS) -Anxiety -Depression -Insomnia	-PTSS Checklist (Civilian version, PCL-C), altruistic behavior, resilience, and job risk assessments, during the outbreak of COVID-19. -PCL-C scale was designed to evaluate the post-traumatic experience of ordinary people in their ordinary lives (in contrast to war). -GAD 7 -PHQ 9 -Insomnia Severity Index (ISI)	PTSS: HHCW (27.7%) LHCW (13%) Anxiety: HHCW (63.8%) LHCW (45.5%) Depression: HHCW (64.8%) LHCW (49.4%) Insomnia: HHCW (35.2%) LHCW (14.3%)	*PTSS: No symptoms: HHCW 72.3%/ LHCW 87% Mild: HHCW 12.8%LHCW 10.4% Severe: HHCW 14.9% /LHCW 2.6% *Anxiety: No symptoms: HHCW 36.2%/LHCW 54.5% Mild: HHCW 48.9%/ LHCW 41.6% Moderate: HHCW 6.4%/ LHCW 3.9% Severe: HHCW 8.5%/ LHCW 0% *Depression: No symptoms: HHCW 35.1%/LHCW 50.6% Minor: HHCW 45.7%/ LHCW 42.9% Moderate: HHCW 10.6%/ LHCW 5.2%, Severe: HHCW 8.5%/ LHCW 1.3% *Insomnia No symptoms: HHCW 64.9%/ LHCW 85.7% Mild: HHCW 27.7%/ LHCW 11.7% Moderate: HHCW 6.4%/ LHCW 2.6% Severe: HHCW 1.1%/ LHCW 0%
13	Gorini et al. 2020	Italy	healthcare professionals from two Italian hospitals	-Perceived risk and fear of infection related to COVID-19 -Mental health status -Psychological distress (Anxiety and Depression)	-four items asking participants to quantify, on a 0–100 slider scale, a) their personal perceived risk of being infected; b) the perceived risk that their family members could be infected; c) their fear of being infected; and d) their fear about the possibility that their family members could be infected. -PHQ-4 questionnaire -Impact of Event Scale-Revised (IES-R)	anxiety and stress PHQ-4 (23.7%) Posttraumatic stress IES-R (44.9%)	*PHQ-4 No symptoms (76.3%) Mild symptoms (13.4%) Severe symptoms (10.3%) *IES-R No symptoms (55.1%) Mild symptoms (16.1%) Moderate symptoms (5.6%) Severe symptoms (23.2%)
14	Pasay-an 2020	KSA	frontline nurses from hospitals of the Hail region,	-The Perceived Vulnerability to COVI-19 -Stress	-The Perceived Vulnerability to Disease (PVD) scale -Perceived Stress scale	nurses on the frontlines perceived themselves as having moderate stress (19.19%).	NOT AVAILABLE

15	Xiaoming et al. 2020	China		-Depression -Anxiety -Severity of somatic symptoms	-PHQ-9, -GAD-7, -PHQ-15, -suicidal and self-harm ideation (SSI),	Depression (30.2%) anxiety (20.7%) somatic symptom (46.2%) and SSI (6.5%)	*PHQ-9 No symptom (69.8%), Minimal symptom (20.8%), Mild symptom (6.2%), Moderate symptom (2.1%), Severe symptom (1.1%) *GAD-7 No symptom (79.3%), Low symptom (15.6%), Medium symptom (3.2%), High symptom (1.9%), N.A. N.A. *PHQ-15 No symptom (53.8%), Low symptom (26.4%), Medium symptom (13.7%), High symptom (6.1%), N.A. N.A. *SSI No symptom (93.5%), Low symptom (6.5%), Medium symptom N.A., High symptom N.A.
16	Wu and Wei 2020	china	Front line medical staff	-Depression -Anxiety -Sleep Quality -Post-traumatic stress	-Self-rating Depression Scale (SDS) -Self-rating Anxiety Scale (SAS) -Pittsburgh Sleep Quality Index (PSQI) -PTSD Checklist-Civilian Version (PCL-C)	Depression (50.13%) Anxiety (45.89%) Sleep Quality (88.34%)	*sleep Quality Moderate insomnia (61.67%) severe insomnia (26.67%)
17	Dal'Bosco et al. 2020	Brazil	Nurses	-Anxiety -Depressing	-Hospital Anxiety and Depression Scale (HAD)	Anxiety (48.9%) Depression (22%)	NOT AVAILABLE
18	Mohd Fauzi et al. 2020	Malaysia	Medical doctors	-Anxiety -Depression -Stress	-Depression Anxiety Stress Scale (DASS)	Depression (30.2%) Anxiety (29.7%) Stress (23.5%)	*Depression Mild (13.7%) moderate (7.2%) severe (6%) very severe (4%) *anxiety Mild (7.9%) moderate (10.4%) severe (3%) very severe (8.3%) *stress Mild (9.5%) moderate (7.5%) severe (4.1%) very severe (2.4%)
19	Huang et al. 2020	China	Nurses	-Anxious -Fear -Sadness -Anger	-positive and negative emotion (PANAS) scale	Anxious (58.5%) Fear (60.3%) Sadness (50.3%) Anger (41.1%)	* Anxious Light (27.9%) Medium (29.5%) serious (29%) * Fear Light (29.4%) Medium (30.7%) serious (29.6%) * sadness Light (25.2%) Medium (24.7%) serious (25.6%) *Anger Light (20.8%) Medium (21.6%) serious (19.5%)
20	Aksoy et al. 2020	Turkey	Nurses and midwives	-Anxiety -Uneasiness -Fear	-State-Trait Anxiety Inventory (STAI) -Intolerance of Uncertainty Scale (IUS-12)	Anxiety (36.3%), uneasiness (31.3%) and fear (19.4%)	NOT AVAILABLE
21	Zhu et al. 2020	China	Medical staff	-Anxiety	- Self-rated Anxiety Scale (SAS)	Anxiety (40.8%)	*(12.2%) had mild anxiety *(28.6%) had moderate and severe anxiety
22	Si et al. 2020	China	Medical care workers	-Depression -Anxiety -Stress	- Impact of Event Scale-6 (IES-6) - Depression, Anxiety and Stress Scale (DASS)	Post-traumatic stress (40.2%)	*Depression (13.6%) *Anxiety (13.9%) *stress (8.6%)

3.3 Coping styles and strategies

Twelve studies out of the total included studies evaluated coping style and strategies. Studies' results were summarized in table 7. Overall, most studies were done in China (n=7), followed by Italy (n=2). The remaining studies were done in Croatia, USA, and Pakistan. Various outcome measure tools were used to measure coping among HCWs were: The 20-item Trait Coping Style Questionnaire (TCSQ)was used in two studies [28], [41]. Ways of Coping Questionnaire (WOC), Brief Resilience Coping scale (BRSC), Coping Self-Efficacy scale (CSE), Pittsburgh Sleep Quality Index (PSQI), Brief COPE, perceived social support scale (PSSS), Simplified Coping Style Questionnaire (SCSQ), Huaxi Emotional-Distress Index (HEI), Social Support Rate Scale (SSRS) and qualitative interviews were used in the other ten studies [1], [8], [23], [25], [26], [27], [30], [34], [35], [39].

Five studies done in China, Croatia, and Italy reported social support among HCWs was made up of family, friends, and peers [8], [25], [34], [35], [41]. The result shows high social support among frontline HCWs in Italy. Adverse psychological symptoms were negatively associated with recognized social support and active coping. Also, SSRS positively affected positive coping (P=0.007). Consequently, societies were encouraged to pay attention to healthcare workers' social support during the crisis by recommending setting support programs for HCWs.

Moreover, three studies done in China reported positive coping styles where a positive action has been taken to manage and reduce adverse mental health, mainly stress. The result shows a high risk of developing anxiety and depression and 6.77 times to have post-traumatic stress syndrome (PTSS)among HCWs who have negative coping style compared to HCWs with positive coping style were able to tackle challenges, improve their psychological state by affecting negatively of anxiety scale scores (P<0.001). [27], [28], [41]. Accordingly, the authors set several recommendations to healthcare workers and the workplace and that are summarized in three points: 1) provide sufficient training for positive coping styles. 2) The workplace should provide psychological support and professional assistance besides emotional skills in dealing with psychopathological issues or adverse mental health as anxiety, depression, and stress. 3) Workplace support should be provided to HCWs during and after the pandemic.

Huang et al. [8] and Salopek-Žiha et al. [34] examined the problem and emotional-focused coping among nurses and physicians in China and Croatia. The result shows that physicians used problem-solving strategies but nurses used coping with complicated emotional strategies. Besides, women used problem-focused coping more than men (P=0.022) in contrast to men who used emotional focused coping more than women(P<0.0001).

Furthermore, Dong et al. [30] have set coping strategies consisting of abiding by infection control procedures, keeping updated about COVID-19, retaining a healthy lifestyle and positive mentality, and avoiding thinking about risks. Besides, continue taking complements as vitamins, etc .

Meanwhile, a study done by Albott et al. [23] in Minnesota, USA. investigated the effectiveness of three levels of psychological resilience interventions involved Battel buddies' system developed by the United States Army, which provide HCWs with peer support as the first level of intervention. The second level focused on unit-level support through mental health consultation in a unit meeting, and the third-level was individual support, one-to-one mental support consultation. While Wu & Wei [39] in 2020 underlined the significance of self-exercising rehabilitation exercises on frontline medical staff's positive sleep status. Hence, they recommended that HCWs to perform strengthening exercises to improve their sleep and mental health.

On the other hand, Munawar & Choudhry [1] studied coping strategies in Pakistan. They have reported that as Pakistan is a Muslim country, religious coping, and passion for serving humanity are commonly employed coping strategies. This was their conclusion after conducting face to face or telephone interview of 15 frontline emergency healthcare workers dealing with corona patients.

Table 7. Coping styles and strategies results from included studies

	Study characteristics			Coping characteristics		Findings	
#	Author/Year	Country	Population	Measurement tool	Type/strategy of coping	Result	Recommendations
1	Salopek-Žiha et al. 2020	Croatia	Nurses and physicians	Ways of Coping Questionnaire (WOC)	- Confrontive Coping - Distancing - Self-Controlling - Seeking Social Support - Accepting Responsibility - Escape-Avoidance - Planful Problem Solving - Positive Reappraisal	There are differences between nurses and physicians coping strategies. physicians used the strategy of planful problem solving, while nurses used coping with difficult emotions strategy Self-control of the emotional reactions takes second place in coping process in both doctors and nurses.	*Reorganization of work place in hospitals according to the instructions of the Crisis Staff of the Ministry of Health. *Provide psychological support to the hospital staff. *Distribution of educational materials on coping with stress. *Daily monitoring of the emotional status of employees using the so-called emotional barometer.
2	Chen, J et al. 2020	China	Health care workers	The 20-item Trait Coping Style Questionnaire (TCSQ)	coping style - positive coping (PC) - negative coping (NC)	HCW who have negative coping style or job burnout are at higher risk to develop anxiety and depression. Helping HCW to move from negative coping to positive coping will effectively improve their psychological state	*Reducing the intensity of the work and burnout will be effective to stabilize the mental state of HCW. *social support is important resources for stress coping.
3	Bettinsoli et al. 2020	Italy	Doctors, nurses, staff	Brief Resilience Coping scale (BRCS) Coping Self-Efficacy scale (CSE)	- Resilience - self-efficacy in coping abilities	coping abilities (resilience and self-efficacy) were negatively related to separation distress and emotional symptoms	*local and national institutions should invest in mental health support for HCW.
4	Wu and Wei 2020	china	Front line medical staff	Pittsburgh Sleep Quality Index (PSQI)	- self-exercising rehabilitation exercise prescription	Medical staff who exercised according to the exercise prescriptions generally had better psychological stress and sleep status than other staff.	*Hospitals should improve emergency management measures, strengthen psychological counseling for clinical front-line medical staff, strengthen exercise intervention, and improve their sleep quality and mental health.
5	Huang et al. 2020	China	Nurses	Brief COPE	- problem-focused coping (active coping, planning, and use of instrumental support) - emotion-focused coping (use of emotional support, acceptance, positive reframing, religion, humor, substance use, self-distraction, self-blame, denial, behavior disengagement, and venting)	More women than men took to problem-focused coping (t (317) = -2.30, p = 0.022). More men than women took to emotion-focused coping (t (264.75) = 4.47, p <0.0001). Nurses in Class II hospitals are more emotionally coping than nurses in Class III hospitals (t(338.74) = 2.539, p = 0.018)	*Hospitals should focus on providing psychological support to nurses and training in coping strategies.
6	Si et al. 2020	China	Medical care workers	perceived social support scale (PSSS) Simplified Coping Style Questionnaire (SCSQ)	-support obtained from family, friends, and significant others two coping styles - active coping (AC) - passive coping (PC), focusing on problem solving and emotional dis-tress, respectively	The adverse psycho-logical symptoms were positively associated with perceived threat and passive coping strategies, while negatively associated with perceived social support and active coping strategies, except the correlation of IES-6with perceived social support ((β= -0.00, P= 0.856) and with active coping (β= 0.06, P= 0.048)	*Preventive measures and mitigation strategies among medical care workers to prevent early traumatic stress reactions developing into chronic PTSD would be beneficial in decreasing adverse psychological outcome
7	Babore et al. 2020	Italy	44.0% nurses, 29.2% physicians, 14.1% technical health professionals (namely, radiologists, biomedical laboratory technicians, etc.), 8.1% social health operators 4.6% other healthcare professions (as physiotherapists, dentists, midwives, etc.).	The COPE-New Italian Version (COPE-NVI-25)	This instrument is based on five independent dimensions: - social support - avoidance strategies - positive attitude - problem solving - turning to religion.	The final model accounted for a significant proportion of the variance in the perceived stress level (Adjusted R2 = .178; F [4,590] = 33.185; P < .001). Lower positive attitude, higher social support, working with COVID-19 patients and higher avoidance strategies predicted higher levels of distress. Problem solving and turning to religion were excluded from the equation as not statistically significant.	*It is necessary to think and plan support programs specifically dedicated to healthcare workers. *In the future, it could be useful to screen medical staff at high risk of stress in order to offer them specific psychological support. This last should be delivered remotely (through social media) and scheduled in order to adapt to the work shifts of the professionals. *Finally, psychological programs for healthcare workers could be realized with the purpose of increasing coping strategies, above all the positive attitude style (that resulted to be the most effective in our study) to face extremely stressful events and possible future epidemics.

8	Dong et al. 2020	China	Health professionals	Huaxi Emotional-Distress Index (HEI)	Coping strategies : -Adhering to infection control procedures -Staying informed about COVID-19 -Just accepting the risks -Keeping a positive mindset -Keeping a healthy lifestyle -Talking to others -Avoiding crowds or people with colds -Avoiding thinking about the risks -Avoiding traveling -Taking vitamins, herbs, or other complementary substances	medical staff without emotional problems were significantly more likely to cope by "adhering to infection control procedures," "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 respondents with obvious emotional problems	*Favorable social support and response strategies are essential for reducing stress provisionally as well as lowering risk of long-lasting effects applying positive coping strategies during this hard time is fundamentally important.
9	Chen, H et al. 2020	China	HCWs, including doctors, nurses, administrative staff, and medical technician in the Affiliated Hospital of Xuzhou Medical University, Jiangsu, China	PTSS Checklist (Civilian version, PCL-C), questionnaires	coping styles: -positive coping -negative coping	Multivariate adjusted logistic regression models proved that the exposure to COVID19 (OR 2.58, 95% CI, 1.45–5.79, P < 0.05), coping styles (OR 6.77, 95% CI, 2.92–15.69, P < 0.05), and work stress (OR 1.77, 95% CI, 1.38–2.12, P < 0.01) were associated with PTSS, indicating that HCWs with the negative coping styles could induce increased risk of 6.77 times to have PTSS when compared with subjects with the positive coping styles.	*Adequate training for positive coping styles and workplace supports should be provided for the first-line HCWs during and after COVID-19 epidemic. *Also, HCWs may require professional assistance for the psychopathological issues.
10	Albott et al. 2020	Minnesota, USA	HCW	Online survey	-Psychological Resilience Intervention (Battel buddies' program) stress inoculation methods Sleep, Rest, Exercise, Nutrition Engaging in Cognitive and Emotional Stress Inoculation develop key cognitive, emotional, and interpersonal skills that faster	Battle Buddy system—is highly scalable, has no cost, and requires very few resources apart from endorsement on the part of unit and department leader, easy to implement and very beneficial	*Ultimately, the data collected will aid in evaluating its effectiveness in addressing the mental health needs of a diverse health care workforce during a large-scale emergency.
11	Munawar and Choudhry	Pakistan	15 frontline emergency HCWs directly dealing with COVID-19 patients	qualitative interviews	-Limiting media exposure -Limited sharing of COVID-19 duty details -Religious coping It is just another emergency/line of duty ALTRUISM/EMPATHY	The findings of thematic analysis revealed that participants practiced and recommended various coping strategies to deal with stress and anxiety emerging from COVID-19 pandemic. It was found that during the pandemic, media was mentioned to be a major source of exacerbating anxiety and stress levels of masses as authenticity of updates or news shared could not be ascertained. Furthermore, religious coping, passion to serve humanity and country, considering this pandemic just an emergency, as well as positive opinions, and views regarding their roles during the pandemic boosted their resilience and coping mechanisms.	*launching of massive and prolonged public awareness programs to improve the information of the general population, aiming on modes of transmission, and situation-specific preventive strategies along with tackling mistrust, myths, and misconceptions. *providing frontline HCWs with essential information about available mental health services to improve their self-esteem, resilience, and capability of HCWs to respond to the pandemic.
12	Zhu et al. 2020	China	Medical staff	Trait Coping Style Questionnaire (TCSQ) Social Support Rate Scale (SSRS)	-Positive coping and -negative coping -Social support	Positive Coping negatively affected Self-rated Anxiety Scale scores ($\beta = -0.23$, $p < 0.001$). Negative Coping positively affected Self-rated Anxiety Scale scores ($\beta = 0.40$, $p < 0.001$). Social Support Rate Scale scores positively affected Positive Coping ($\beta = 0.15$, $p = 0.007$) and negatively affected Negative Coping ($\beta = -0.33$, $p < 0.001$) and Selfrated Anxiety Scale scores ($\beta = -0.18$, $p < 0.001$)	*Protecting healthcare workers by providing psychological support and emotional skills to deal with anxiety is a priority. *Sufficient social support affirmatively reduced the anxiety of healthcare workers. Thus, providing coping skills to healthcare workers may also contribute to decreasing anxiety when a coping style mediates the relationship between social support and anxiety.

4 Discussion

Healthcare workers during COVID-19 pandemic situation are faced with numerus sources of stress, including working hours, changes in the work load and nature, as well as family responsibilities which may put a lot of impact on their mental health [27]. So, the aim of this study was to explore the effect of covid19 pandemic on health care worker mental health and the possible coping strategies to overtake the mental problems.

The articles that fit our inclusion criteria were published in 11 different countries. Most of the articles were published in China this might be due to the huge numbers of positive COVID-19 cases not only between the general populations but also between the health care workers, approximately 3,300 health professionals were infected and 22 lost their lives during the pandemic [17]. Moreover, The COVID-19 outbreak originated from Wuhan in China before expanding throughout the country and thereafter the rest of the world [42]. Italy took the second place in the published article numbers; this might be due to the huge numbers of COVID-19 cases shortly after the discovery of the virus in China. Italy had a big attack, in less than one month it experienced a rapid increase in infection cases and deaths exceeding the Chinese numbers. It is worthy to mention that only two articles were published in GCC countries and both of them were published in Saudi Arabia.

Most of the studies that we have reviewed included nurses and physicians as a sample because these two groups work mainly in the front line facing higher chance of physical and psychological side effects. The frontline nurses and doctors which are engaged in direct diagnosis, treatment, and care of patients with COVID-19 were associated a greater risk of negative mental health outcomes [22]. On the other hand, the second line HCWs like physical therapists, pharmacist, dentists, and dietitian have a minimum contact to COVID-19 patients and this led to less chance of mental problems among them.

Twenty-two studies that investigated the effect of COVID-19 pandemic on HCWs mental health were included in this systematic review. All of them were cross sectional studies. Results showed that during pandemic situations like COVID-19 anxiety, depression, stress, and insomnia were the most commonly studied mental health conditions among HCWs. A recent systematic review includes 59 studies with 54,707 HCWs have similar results, it showed that one or two of every five healthcare professionals reported anxiety, depression, distress and/or sleep problems during the COVID-19 pandemic [2]. These mental health conditions attack the HCWs due to many reasons like the nature of their work that require irregular and long duty hours, witnessing death and physical suffering of the patients in front of their eyes, uncertainty about definitive effective treatment for the patients. Also they are facing difficulties in balancing between their duty to help patients and their desire to protect themselves and their family members from infection which they may bring home [42, 44].

This systematic review identified 12 studies that explored HCWs coping strategies during COVID-19 pandemic. Eleven out of these studies were cross sectional studies with only one qualitative study that measured coping using semi-structured interviews. Most of the studies population were front liners, like nurses and physician. Most of the studies included have investigated coping strategies among front liners, like physicians and nurses, as they become in direct contact with COVID-19 patients and it is important to understand their coping strategies used to enhance the positive ones and eliminate the negative ones.

We found that there are many plausible coping techniques adopted by HCWs. These include: keeping a positive mindset, social support, focusing on religion, self-distraction, maintaining a healthy lifestyle and limiting media exposure. [1], [8], [34], [35], [45], [46]. On the other hand, many studies have discussed the lack of the skills needed

to cope with crisis in HCWs. Thus, a common recommendation in many studies was to provide psychological support and training in coping strategies [8], [26], [27], [43],[47]. Other recommendations included: screening medical staff at high risk of stress to offer them psychological support, daily monitoring of HCWs emotional status, reducing the intensity of work and engaging HCWs in strengthening exercise program [25], [34], [43], [48], [49], [50].

5 Conclusion

Studies done in different countries have shown HCWs risk of developing mental health problems has increased due to the pandemic. China followed by Italy had more studies done on the mental health impact of COVID- 19 on HCWs. Front liners (i.e., nurses and physicians) are at higher risk of developing mental health problems due to the direct contact with affected patients. The most common mental health issues occurring among HCWs were: anxiety, depression, stress, and insomnia. The severity of mental health problems varied widely not only between different countries but within the same country. Studies done in China came with contradicting results sometimes. This comes in an agreement with the uncertainty around the disease and the lack of implementing strategies to deal with the psychological effects of the disease. Many studies that were done on coping have emphasized on social support as an effective way of coping. Other studied coping strategies were: returning to religion, limiting media exposure and self-distraction. There is an urgent need, as recommended in many studies, to provide training of HCWs in the field of coping strategies with crisis.

6 Limitations and Recommendations:

There are some limitations in this systematic review, almost half of the studies that we reviewed were conducted in China, only 3 were conducted in Italy and 2 in KSA, for this reason the results can't be generalize to other countries with different health care system and situation. Also, we include only one type of studies which is the cross-sectional type, no longitudinal studies with follow up periods to study the long-term effects. We didn't study the effect of different demographic factors like age and gender. Moreover, most of the studies include doctors, physicians, and nurses, only few articles have studied the effect on other second line health professions like: radiologists, laboratory staff, dentists, midwives, psychologists, Pharmacists, and physiotherapists. On top of that many researchers did not use valid outcome measure in their studies, so we had to exclude their studies from our review

It is recommended for future researchers to conduct new studies among wider geographical areas. Longitudinal studies that study the long-term effect of COVID-19 on HCWs mental health are required too. Moreover, more focus should be given to the second line HCWs rather than nurses and doctors because most studies focus on these two populations only. In addition, using valid outcome to get more accurate results is needed.

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Article submitted 2021-06-14. Resubmitted 2021-07-05. Final acceptance 2021-07-06. Final version published as submitted by the authors.