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Insomnia and sleep quality in healthcare workers fighting against COVID-19: a systematic review of the literature and meta-analysis

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ABSTRACT

The COVID-19 pandemic has the potential to significantly affect the mental health of healthcare workers, who stand in the frontline of this crisis. Insomnia is often related to exposure to stressful situations, such as the current health crisis, as well as other mental disorders, physical conditions and work-related problems. The objectives of this systematic review were: 1) to examine the impact of the current health pandemic produced by COVID-19 on insomnia and sleep quality of health professionals, and 2) to identify risk factors associated with insomnia. After a literature search in MEDLINE, EMBASE, and PsycINFO, 18 relevant studies were identified. The prevalence of insomnia estimated by random effects meta-analysis was 38% (95%CI= 37 to 39%), being slightly higher in women (29%, 95%CI= 27% to 30%) than in men (24%, 95%CI= 21 to 27%). The main risk factor associated with insomnia was working in a high-risk environment, followed by female sex and having a lower educational level. The high figures of self-reported insomnia and poor sleep quality observed indicate the need to develop interventions aimed at mitigating and caring for the mental health of healthcare workers fighting against this pandemic.

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Key words. healthcare workers; insomnia; sleep quality; COVID-19; systematic review.

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INTRODUCTION

Since its outbreak in December, 2019, in China's Hubei province, the new disease caused by the SARS-CoV-2 coronavirus, COVID-19, has spread quickly around the world[1 2]. It was declared a pandemic in March 2020 by the World Health Organization (WHO)[3]. Recent studies have suggested that the healthcare crisis caused by the pandemic is seriously affecting the mental health of healthcare workers[4-6]. This psychological impact not only affects doctors and nurses in frontline respiratory and intensive care units, but also healthcare workers from other specialties, including surgeons and anesthesiologists[7]. A variety of factors—such as those related to the nature of the disease (its rapid propagation, the potential seriousness of symptoms, and the number of cases and deaths) [8], the low level of knowledge about the disease, constantly having to update protocols[9 10], the high infection rate among healthcare workers[11 12], excessive and exhausting workloads[4 13], shifts changes[14], isolation, and a lack of protective equipment[15]—have been identified as being involved in the development of psychological problems.

According to the international classification of sleep disorders (ICTS-3)[16], insomnia is defined as experiencing persistent trouble falling asleep, staying asleep, or having quality, restful sleep despite having the appropriate circumstances and opportunity to do so along with a noticeable level of bother or detriment to one's social, professional, educational, or academic life; one's behavior; or any other area important to human functioning. Insomnia has been estimated to affect 10-20% of the general population[17 18]. Among its risk factors, the following are notable: having depression, female gender, having a low socioeconomic status, suffering from physical or psychological illnesses, and being single[19].

Additionally, insomnia is associated with the onset of mood disorders, irritability, anxiety, and problems related to concentration and memory, which can make it more difficult to perform daily professional, leisure, and social activities[20 21]. On a physical level, insomnia increases the incidence of cardiovascular morbidity as well as the possibility of suffering from diabetes, obesity, and a wide range of other morbidities[22]. On a professional level, it has been associated with work place accidents, decreased productivity, lower levels of satisfaction with the work performed, and higher levels of workplace absenteeism[23]. All of this has a high cost, both direct, i.e., costs related to treatment, appointments, and procedures, and indirect, i.e., a greater drain on healthcare resources and less workplace productivity[23 24].

The development of sleep disorders, and specifically of insomnia, is closely related to exposure to stressful situations, such as the current one imposed by the COVID-19 healthcare crisis[25 26]. Since its beginning, studies considering the impact of the pandemic on healthcare workers' sleep have been widespread. However, to date, no systematic review has specifically addressed this important component of mental health. To estimate the prevalence of insomnia and to identify associated risk factors is key in order to be able to develop interventions to prevent this mental health issue and mitigate its impact. This systematic review has two objectives: 1) to study the impact that the current COVID-19 pandemic has on sleep quality and insomnia in healthcare workers, and 2) to identify the risk factors associated with insomnia.

MATERIAL AND METHODS

A rapid systematic literature review (registered in PROSPERO CRD42020207239) was performed following the WHO[27] and Cochrane recommendations for rapid reviews in response to COVID-19[28]. PRISMA recommendations were followed to report about the study[28]. The present work is part of a broader systematic review of the literature that examine the impact of providing healthcare in frontline of health emergencies caused by viral epidemic outbreaks on healthcare workers´ mental health[4].

Data Sources and Searches

A search strategy (available in Online Appendix 1) was designed and implemented in MEDLINE (accessed through Ovid), which was adapted for use in EMBASE (Elsevier), and PsycINFO (EBSCO). The search strategies combined MeSH terms with keywords. The searches were carried out on August 3, 2020, with no temporal restrictions. As a source of complementary information, the primary studies included in previous related systematic reviews were also reviewed[30-37]. All the resulting bibliographic references were downloaded and stored in a database created using EndNote X8 ™ software.

Selection criteria

We included primary empirical studies examining the prevalence of insomnia and associated factors in healthcare workers at the frontline of the COVID-19 pandemic. We included observational studies (cross-sectional, case-control, and cohort). All types of settings and healthcare professionals were accepted for inclusion. We excluded systematic reviews, narrative reviews, thesis, editorials, letters to the editor, protocols, and studies not published in peer-reviewed journals. Studies not published in English or Spanish were also excluded.

Study selection

The references were imported into the Rayyan[38] online tool to facilitate the screening and selection process. One reviewer screened the retrieved references on title and abstract selecting those potentially relevant. Subsequently, two reviewers independently screened the full article of previously selected references to confirm their eligibility. Discrepancies between reviewers were resolved by consensus between both reviewers or with the support of a third reviewer if necessary.

Data Extraction and Quality Assessment

A data extraction sheet was designed and piloted, in which the main characteristics and results of the selected studies were extracted: country, study setting, study design, number of participants, instrument used to measure insomnia, and results. We extracted the prevalence rate in terms of the number of professionals suffering insomnia (numerator) out of the total number of study participants (denominator). If available, we extracted information about the risk factors. The methodological quality of the included studies was assessed using the set of tools developed by Evidence Partners (McMaster University) [39] specific for each type of epidemiological design used in the included studies (cross-sectional, case-control or cohort studies). Both data extraction and methodological quality assessment were carried out by a single reviewer and reviewed by a second reviewer.

Data synthesis and analysis

We carried out a tabulated and narrative synthesis of the results, using a previously developed taxonomy[37] to classify the risk factors for insomnia as social, occupational, or sociodemographic.

To conduct the meta-analysis of the prevalence of insomnia we used Stata's "*metaprop*"[40] command, which estimates prevalence (expressed in terms of proportions) and

their respective 95% confidence intervals (95%CI). The proportions were calculated via the Freeman-Turkey transformation[41 42] and a random effects model. Heterogeneity was calculated using the I^2 statistic, and was considered high when I^2>50%.[43] We considered the presence of asymmetry with both Begg's[44] and Egger's[45] tests. Subgroup and bivariate meta-regression analyses were carried out (using the "*metareg*" command) to investigate differences by gender. Although we initially planned to perform subgroup analyses also by age, finally we were unable to do so because the data were not consistently available. All analyses were carried out with the statical software Stata, version 12.

RESULTS

Search results

After removing the duplicates, we identified a total of 3,108 unique references (Figure 1). An initial screening of these references, based on their titles and abstracts, led us to exclude 2,877 of them. After a full-text assessment of the remaining 231 articles, and manually going over studies included in previous reviews, we identified 18 studies as eligible for the present systematic review. All of the studies excluded after the full-text review are listed in Online Appendix 2.

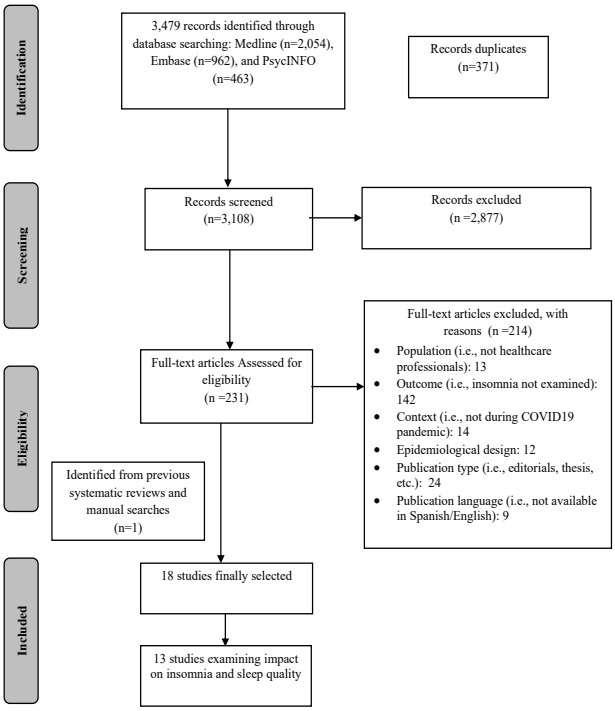


Figure 1 PRISMA flowchart (First autor: María J. Serrano-Ripoll)

Characteristics of the studies

The characteristics of the studies included are summarized in Table 1. The present systematic review included a total of 15,986 participants. 14 of the studies (78%) were carried out in China, and the remaining four in Saudi Arabia, Spain, the United States, and Serbia. The average number of participants was 888, and ranged from 100-2,285. Seven studies (39%) were conducted in a hospital setting, one (5%) in a pediatric center, and three (17%) in multiple settings; the remaining seven studies did not specify the setting where they took place. Nearly two-thirds of the studies (65%) made no distinction between the types of healthcare workers included in the study, while the remaining studies focused on either doctors (23%) or nurses (12%). All of the studies employed valid instruments for assessing insomnia and sleep quality. With the exception of one cohort study[46], all of the studies used a cross-sectional design (95%).

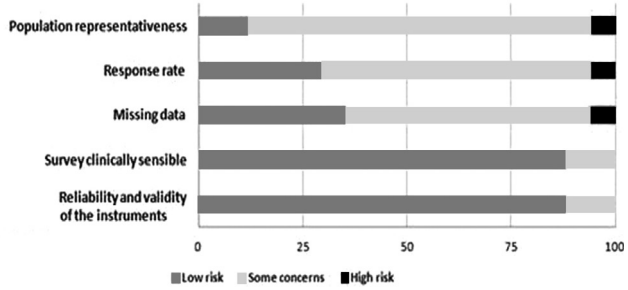
Table 1 Characteristics of the studies included

		N	% (rango)
Epidemiologic design			
	Cross-sectional	17	95
	Cohort study	1	5
Number of participants [a]		888	(100 - 2,285)
Gender (men/woman)		2,709/10,777	17/83
Instruments[b]			
	Pittsburgh Sleep Quality Index	9	50
	Insomnia Severity Index	7	39
	Athens Insomnia Scale	3	17
Country			
	China	14	80
	Saudi Arabia	1	5
	Spain	1	5
	United States of America	1	5
	Serbia	1	5
Population			
	Healthcare workers in general	12	65
	Doctors	4	23
	Nurses	2	12
Setting			
	Hospital	7	39
	Multiple healthcare facilities / medical center	3	17
	Pediatric center	1	5
	Non specified	7	39

[a]Mean and range, [b]Percentages exceeding 100% as categories are not mutually exclusive.

RISK OF BIAS

In general, the main risks of bias in the 17 cross-sectional studies were related to the selection bias (14 of these [82%] with moderate risk and one [5%] with high risk), the response rate (moderate risk in 11 studies [65%] and high risk in one study [5%]), and missing data (moderate risk in 10 studies [59%] and high risk in one study [5%]) (Figure 2). The main sources of bias in the cohort study were the possible risk that the outcome of interest (insomnia) were already present at the start of the study and a lack of adjustment for prognostic variables for insomnia (Online Appendix 3).



*The reviewer assessment of each element of risk of biasis presnted as a percentage of the total included studies

Figure 2 Risk of bias in cross-sectional studies*

(First autor: María J. Serrano-Ripoll)

The prevalence of insomnia in healthcare workers

The results of the 18 studies on the sleep quality and presence of insomnia in healthcare workers during the current COVID-19 pandemic are detailed in Table 2. The overall prevalence of self-related insomnia, estimated through meta-analysis (Figure 3) was 38% (95%CI=37% to 39%, I^2 0%; 13 studies, 14,075 participants).

A subgroup analysis by gender (Figure 4) showed a slightly higher prevalence of insomnia in women (29%, 95%CI=27% to 30%, I^2 0%; 5 studies, 3,603 participants) than in men (24%, 95%CI=21% to 27%, I^2 0%; 5 studies, 816 participants). This difference was not statistically significant according to the meta-regression performed (p=0.2). Begg's and Egger's tests suggest the absence of publication bias in all of the meta-analyses carried out.

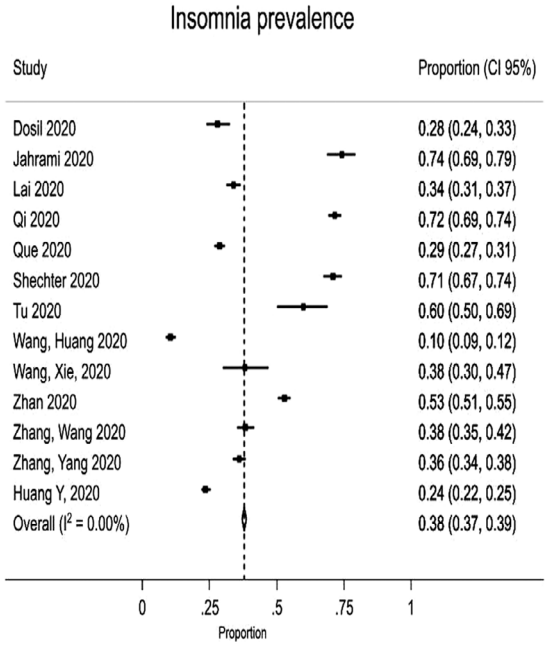


Figure 3 Forest plot - Insomnia prevalence. CI, confidence interval; I2, heterogenity level

(First autor: María J. Serrano-Ripoll)

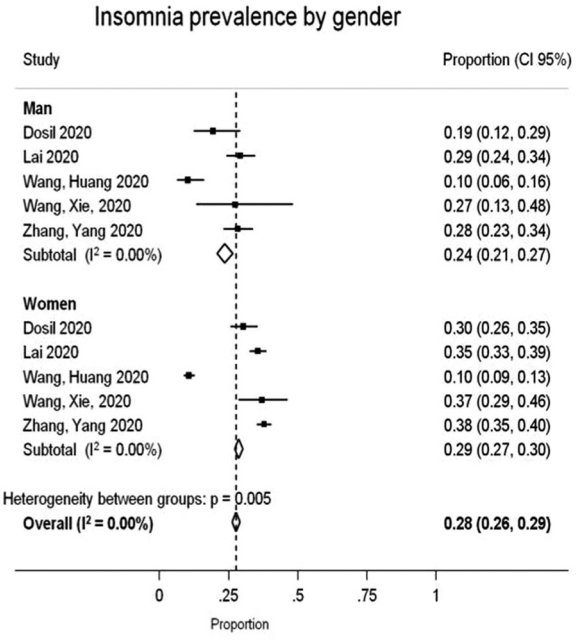


Figure 4 Forest plot - Insomnia prevalence by gender. CI, confidence interval; I2, heterogenity level

(First autor: María J. Serrano-Ripoll)

Five of the studies did not provide data on the prevalence of insomnia that were appropriate for meta-analysis[46-50]. One study[47] showed that the majority of healthcare workers surveyed had had their quality of sleep affected: slightly in 34.4% of participants, moderately in 22.4%, and severe in 6.2%. Another study[48] found that 11.3% of healthcare workers frequently experienced sleeping problems, while 6.7% had problems falling asleep and 6.2% slept for less than six hours per night. Another study[46] reported that, despite seeing a decline in healthcare workers' levels of anxiety over two weeks, this did not translate into improved quality of sleep, which remained disrupted. Another study[49] showed increased levels of self-reported insomnia (Pittsburgh Index>10) in 32% of frontline professionals and in 16% of the rest of healthcare workers. Finally, another study on frontline professionals[50] reported that quality of sleep was associated with levels of anxiety, stress, and self-efficacy, which acted as mediator variables for insomnia.

Risk factors for insomnia during the COVID-19 pandemic

12 of the 18 studies (66.7%) identified occupational, sociodemographic, and/or social factors as being associated with a probability of developing insomnia problems when providing medical care during the COVID-19 pandemic.

Occupational risk factors

13 studies considered occupational risk factors[25 47 49 51-59]. The main risk factor associated with suffering from insomnia was working in a high-risk environment (10/13 studies). Defining an environment as being high-risk generally involved having direct contact with infected patients providing frontline care[26 51 53] or in isolated environments[59], and/or experiencing negative events related to COVID-19.[57] Three studies[51 56 58] concluded that professionals in contact with infected persons had a greater risk of suffering from insomnia (2-2.5 times greater). This was supported by two additional studies[53 54] that reported a greater risk for frontline professionals (OR=2.97 and 1.90, respectively). Wang et al[55] reported a greater risk of self-reported insomnia ($p<0.05$) in frontline professionals (OR=1.60) and healthcare workers with less seniority (OR=1.88). Similarly, Zhan et al[57] showed that caring for patients with COVID-19 was a risk factor associated with insomnia, as well as the frequency of night shifts, having more work experience, and having negative experiences with COVID-19 ($p<0.05$ in all cases). Zhang et al.[59] showed that the symptoms of insomnia were significantly ($p<0.05$) associated with working in an isolation unit (OR=1.71) and having a high level of uncertainty about effectively managing the disease (OR=3.30), while being a doctor seemed to be a protective factor (OR=0.44). The study by Huang et al[52] reported that healthcare workers had a greater risk of suffering from insomnia than other professionals included in the study (OR=1.32), while the study by Jahrami et al[25] found no significant differences between healthcare professionals working on the frontlines and others who were not on the frontline. This study also found that being a doctor served to protect against a combination of poor sleep quality and moderate-severe stress (OR=0.7).

Sociodemographic risk factors

Five studies identified sociodemographic factors related to insomnia[25 55-57 59]. In two of them, females were seen to have a greater probability of suffering from insomnia during the COVID-19 pandemic. Jahrami et al[25] reported that one of the independent predictors of the combination of poor sleep quality and moderate-severe stress was the female gender (OR = 2.0). Zhan et al[57] observed an association between insomnia and female gender ($p = 0.002$) and middle-aged (46-55 years). Wang et al[55] and Zhang et al[59] associated insomnia with lower levels of education. Additionally, insomnia was associated with being an only child (OR=3.40)[56] and living in a rural area (OR=2.18).[59]

Social risk factors

Three studies considered social risk factors associated with insomnia[51 54 59]. Dosil et al[51] saw a greater risk of insomnia ($p<0.05$) in healthcare workers who lived with a chronically ill person. Que et al[54] found that healthcare workers who received negative comments from family members or friends regarding their frontline work were at greater risk (OR=3.47), and Zhang et al[59] saw an association between insomnia and a lack of psychosocial support in mass media and social networks (OR=2.10).

DISCUSSION

In this rapid systematic review, we synthesize the evidence of 18 studies that examine the impact of COVID-19 pandemic on insomnia and the sleep quality in healthcare workers dealing with the outbreak. The review highlights the prevalence of self-reported insomnia and identifies occupational, sociodemographic, and social risk factors, observing that being female, working in a high-risk environment, and having a lower educational level are important risk factors consistently identified in the available literature.

Discussion of main results

The estimation of the prevalence of self-reported insomnia obtained from our meta-analysis (38%) is similar to the rates observed in previous meta-analyses, which ranged from 29%[60 61] to 39%[62]. However, previous reviews were conducted with a lower number of primary studies (between

Table 2 Summary of main results of studies examining the impact on insomnia and sleep quality in healthcare professionals during the COVID-19 outbreak (N=18)

Author/year/ country	Setting/ Population	Study design/ Sample size / N	Insomnia / sleep disturbances (instrument)	Main results			
				Insomnia frequency/ severity	Sociodemographic risk factors	Occupational risk factors	Social risk factors
Dosil 2020 [51]/ Spain	Multiple healthcare facilities/ Healthcare workers	Cross-sectional N=421	Insomnia (AIS)	Insomnia prevalence was 28.9%.	NA	Increased risk of insomnia after having worked in contact with the virus (p= 0.029).	Living with a person with a chronic illness (p= 0.037).
Huang 2020 [52]/ China	NA/ Healthcare workers	Cross-sectional N=2,250	Sleep quality (PSQI)	Insomnia prevalence was 23.6%.	NA	Higher risk of poor sleep quality in healthcare workers than in other occupational groups (OR= 1.32; 95%CI: 1.18-1.88).	NA
Jahrami 2020 [25]/ Saudi Arabia	NA/ Healthcare workers	Cross-sectional N=257	Sleep quality (PSQI)	In frontline healthcare workers, 75% were poor sleepers and 61% had poor sleep quality. Among the non-frontline healthcare workers, 76% were poor sleepers and 62% had poor sleep quality.	Higher risk of poor sleep quality and stress in women (OR= 2.0 [95%CI: 1.1-3.5]).	Lower risk of poor sleep quality and stress in doctors than in other healthcare workers (OR= 0.7 [95% CI: 0.5-1.1]).	NA
Kang 2020 [47]/ China	NA/ Doctors and nurses	Cross-sectional N=994	Insomnia (ISI)	Minor sleep disturbances in 34.4%, moderate in 22.4% and severe in 6.2%.	Higher prevalence in young women (p<0.05).	Higher risk of insomnia in healthcare workers working in high-risk environment.	NA
Lai 2020 [53]/ China	Hospital/ Healthcare workers	Cross-sectional N=1,257	Insomnia (ISI)	Insomnia prevalence was 34.0%.	NA	Higher risk of insomnia in healthcare workers in high-risk environment (OR= 2.97; p<0.05).	NA
Qi 2020 [26]/ China	NA/ Doctors	Cross-sectional N=1,306	Insomnia (PSQI, AIS)	Higher prevalence of sleep disturbances in frontline healthcare workers according to PSQI> 6 points (78.4% vs 61.0%) and AIS> 6 points (51.7% vs 35.6%).	NA	NA	NA
Que 2020 [54]/ China	Hospital/ Healthcare workers	Cross-sectional N=2,285	Insomnia (ISI)	The prevalence of insomnia was 28.75%.	NA	Increased risk of insomnia working in frontline (OR= 1.90; 95%CI: 1.21 - 2.97). The highest prevalence was observed in nurses (33.17%) and the lower prevalence in medical residents (24.53%).	Higher risk of insomnia when receiving negative feedback from families and friends regarding their front-line work (OR= 3.47; 95%CI: 1.95 - 6.17%).
Shechter 2020 [64]/ USA	Medical center/ Healthcare workers	Cross-sectional N=657	Insomnia (ISI)	The prevalence of moderate insomnia was 45% and severe or extremely severe insomnia was 26%.	NA	Nurses and advanced practice providers, reported the worst sleep problems (p<0.001).	NA
Stojanov 2020 [49]/ Serbia	Hospital/ Healthcare workers	Cross-sectional N=201	Sleep quality (PSQI)	NA	NA	Healthcare workers who treated COVID-19 patients had worse sleep quality (PSQI=8.3 ± 4.5) than those who did not (5.2 ± 3.7) (p<0.01).	NA
Tu 2020 [65]/ China	Hospital/ Nurses	Cross-sectional/ N=100	Sleep quality (PSQI)	The prevalence of poor sleep quality was 60%.	NA	NA	NA

Table 2 Summary of main results of studies examining the impact on insomnia and sleep quality in healthcare professionals during the COVID-19 outbreak (N=18) (continuation)

Wang, Huang 2020 [55]/ China	Hospital/ Healthcare workers	Cross-sectional N=1,045	Insomnia (ISI)	The prevalence of insomnia symptoms was 49.9%. 10.4% of the participants had a clinical sleep disorder (ISI ⩾15).	Lower insomnia risk in staff with a higher education level (p=0.027).	Higher insomnia risk in staff working in high-risk environment (OR=1.60; 95% CI: 1.07-2.40) and staff with fewer years of employment (OR=1.88; 1.09- 3.26).	NA
Wang, Xie, 2020 [56]/ China	Pediatric center/ Healthcare workers	Cross-sectional/ N=123	Insomnia (PSQI)	The prevalence of insomnia was 38%.	Higher insomnia risk related with being an only child (OR=3.40; 95%CI: 1.21-9.57).	Higher risk of insomnia in healthcare workers working in high-risk environments (OR=2.97; 95%CI: 1.08–8.18).	NA
Xiao 2020 [50]/ China	Multiple healthcare facilities (respiratory medicine/ICU)/ Doctors and nurses	Cross-sectional N=180	Sleep quality (PSQI)	PSQI mean score was 8.583± 4.567.	NA	NA	NA
Yin 2020 [48]/ China	NA/ Healthcare workers	Cross-sectional/ N=377	Insomnia (PSQI)	The prevalence of frequent sleep disturbances was 11.3%, 6.7% complained having difficulty falling asleep and 6,2% had less than 6 hours sleeping time per night.	NA	NA	NA
Yuan 2020 [46]/ COVID-19 China	NA/ Healthcare workers	Cohort/ N=249	Sleep quality (PSQI)	36.43% of doctors reported severely impaired sleep quality.	NA	NA	NA
Zhan 2020 [57]/ China	Hospital/ Nurses	Cross-sectional/ N=1,794	Insomnia (AIS)	The prevalence of insomnia was 52.8%.	Higher risk in female participants (p= 0.002) and in the middle age (46-55 years old) (p= 0.010).	Higher risk of insomnia in professionals working in high-risk environment (p<0.000), frequency of night shifts (p=0.015), greater working experience (p<0.000) and negative experiences related to COVID-19 (p=0.002).	NA
Zhang, Wang 2020 [58]/ China	NA/ Healthcare workers	Cross-sectional/ N=927	Insomnia (ISI)	The prevalence of insomnia was 33.9%.	Higher risk when living in rural areas (medical health workers) (OR= 2.18; 95%CI: 1.42-3.35).	The prevalence of insomnia was 38.4% in medical health workers (doctors and nurses) and 30.5% in nonmedical health workers (p<0.01). Higher risk of insomnia in professionals working in high-risk environment (OR= 2.53; 95% CI: 1.74-3.68).	NA
Zhang, Yang 2020 [59]/ China	Hospital/ Healthcare workers	Cross-sectional/ N=1,563	Insomnia (ISI)	The prevalence of insomnia was 36.1%.	Higher risk of insomnia among medical staff with a high school or below education level (OR= 2.69; 95% CI: 1.0-7.0).	Higher risk of insomnia when currently working in an isolation unit (OR=1.71; 95%CI: 1.0-2.8) and having great uncertainty regarding the effective control of the disease (OR= 3.30; 95% CI: 1.3–8.5). Being a doctor was a protective factor. (OR= 0.44; 95% CI: 0.2-0.8).	Higher risk with the perception of lack of helpfulness in terms of psychological support from news or social media (OR= 2.10; 95%CI:1.3-3.3).

AIS= Athens Insomnia Scale; CI= Confidence Interval; COVID-19= Coronavirus disease 19; ICU= Intensive Care Unit; ISI=Insomnia Severity Index; OR= Odds Ratio; PSQI= Pittsburgh Sleep Quality Index

two and six) and participants, and they included studies resulting from healthcare crises different to the current one[6 35 60-63].

In the Spanish population, the prevalence of insomnia is 6.4%, (up to 20.8% if we consider those patients who present just one symptom of insomnia such as difficulty staying asleep at least three nights per week),[19] rates which are clearly below those observed in our review. Insomnia is more prevalent in women, and it becomes more prevalent in older people.[19] Our findings are supported by two previous reviews, which suggested that insomnia is more prevalent among female healthcare workers.[60 63] Although our subgroup analysis also suggested a higher prevalence among women, the difference was not statistically significant. This could be partially due to low statistical power (as only a small number of studies provided data that could be pooled by gender).

The healthcare crisis caused by the COVID-19 pandemic is posing a serious challenge for healthcare workers, who must deal with excessive workloads, psychologically demanding conditions, and the feeling of having limited resources and support[37]. The present systematic review shows that working in a high-risk environment is the main factor in the development of symptoms of insomnia and the worsening quality of sleep of healthcare workers[47 51 53-59]. These results are in line with the majority of recent reviews[35 60 63], which suggest that working on the frontline, in high-risk units, or in contact with infected patients was considered the main risk factor for symptoms of insomnia.

While some factors cannot be modified (e.g., exposure to high-risk environments, being female), this review has also identified some factors that can be dealt with to mitigate the risk that they entail. For example, a lack of social and emotional support[50] and paying attention to negative information[54] can be cushioned by having institutions provide sufficient information and training, adequate protective equipment, and emotional support, among other factors.

Despite the large number of recently published studies on the impact that the COVID-19 healthcare crisis has had on insomnia in healthcare workers, it is worth noting that the large majority of them are cross-sectional, and they assess symptoms using self-reported measures (17 out of 18 of the studies used online surveys). Thus, they are at risk of suffering from a selection bias. Furthermore, increasing the scientific evidence would require a greater number of methodologically robust cohort studies that include diagnostic instruments in the assessment of insomnia. It is possible that such studies are already being carried out but not yet published. Although a clinical diagnostic evaluation remains the gold standard for making a valid insomnia diagnosis, in the current circumstances of a pandemic, and given the nature of the studies included in this review, such clinical evaluation has not been possible. All of the included studies used validated self-reported questionnaires. Although these questionnaires can facilitate the initial assessment and detection of insomnia, the findings regarding the observed prevalence figures require some caution in their interpretation. These questionnaires have advantages and limitations, and brief screening tools, such as the ISI, can be helpful for epidemiologists in identifying cases of insomnia and documenting the prevalence and burden of the disease. However, accurately measuring insomnia remains a challenge for researchers.

Strengths and limitations of the review

Our study provides an exhaustive review of the literature on the impact that the current COVID-19 healthcare crisis is having on the insomnia and quality of sleep of healthcare workers. Using a robust methodology, we offer precise, up-to-date estimations of the prevalence of self-reported insomnia, identifying risk factors that should be considered when coming up with future psychological support interventions aimed at this group of workers. With regard to limitations, our review did not include a search of gray literature or studies published in languages other than English or Spanish. Thus, it is possible that some relevant studies were not included. Furthermore, 14 of the studies (78%) were carried out in China, which could limit the external validity of the results of our review. Finally, as mentioned, the assessment of insomnia is multidimensional. It should ideally include a clinical assessment and be complemented with self-report questionnaires and sleep diaries, thus the self-reported nature of the scales used to measure insomnia and sleep quality it is also one of its limitations in the studies included in this review.

CONCLUSIONS

Healthcare workers exposed to working with patients during the COVID-19 pandemic show a higher prevalence of self-reported insomnia and poorer sleep quality than the general population. Given that insomnia is associated with other, more serious health problems and work-related issues, early interventions should be applied as a strategy for preventing the onset of mental disorders. It is worthwhile to implement interventions that promote mental health in general and specifically improve quality of sleep. In the current situation, with a second wave of the pandemic afflicting many countries and with social-distancing healthcare restrictions, virtual and online psychotherapy options are alternatives worth exploring.

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Authorship

All of the authors have contributed fully to the creation of the present study, from the search for information, to analyzing data, creating drafts, critically reviewing the article, and approving the final document.

REFERENCES

1. Wang C, Horby PW, Hayden FG, et al. A novel coronavirus outbreak of global health concern. Lancet (London, England) 2020;395(10223):470-73. doi: 10.1016/s0140-6736(20)30185-9
2. World Health Organization. Coronavirus disease (COVID-19). Situation Report. Weekly Epidemiological Update. Geneva: World Health Organization, 2020. Disponible en: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports. Accessed 7/10/2020
3. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020 2020 [Director General Speeches]. Disponible en: https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020. Accessed 25/08/2020
4. Serrano-Ripoll MJ, Meneses-Echavez JF, Ricci-Cabello I, et al. Impact of viral epidemic outbreaks on mental health of healthcare workers: a rapid systematic review and meta-analysis. J Affect Dis 2020;277:347-57. doi: 10.1016/j.jad.2020.08.034
5. Kisely S, Warren N, McMahon L, et al. Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis. BMJ (Clinical research ed) 2020;369:m1642. doi: 10.1136/bmj.m1642
6. Pappa S, Ntella V, Giannakas T, et al. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. Brain Behav Immun 2020;88:901-07. doi: 10.1016/j.bbi.2020.05.026
7. Xu J, Xu QH, Wang CM, et al. Psychological status of surgical staff during the COVID-19 outbreak. Psychiat Res 2020;288:112955. doi: 10.1016/j.psychres.2020.112955
8. World Health Organization. WHO Coronavirus Disease 8COVID-19) Dashboard Geneva: World Health Organization; 2020 https://covid19.who.int/. Accessed 08/09/2020.
9. Huang C, Wang Y, Li X, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet (London, England) 2020;395(10223):497-506. doi: 10.1016/s0140-6736(20)30183-5
10. Struyf T, Deeks JJ, Dinnes J, et al. Signs and symptoms to determine if a patient presenting in primary care or hospital outpatient settings has COVID-19 disease. Cochrane DB Syst Rev 2020;7(7):Cd013665. doi: 10.1002/14651858.Cd013665
11. Hartmann S, Rubin Z, Sato H, et al. Coronavirus 2019 (COVID-19) Infections Among Healthcare Workers, Los Angeles County, February - May 2020. Clin Infec Dis 2020 doi: 10.1093/cid/ciaa1200
12. Zheng C, Hafezi-Bakhtiari N, Cooper V, et al. Characteristics and transmission dynamics of COVID-19 in healthcare workers at a London teaching hospital. J Hosp Infec 2020 doi: 10.1016/j.jhin.2020.07.025
13. Si MY, Su XY, Jiang Y, et al. Psychological impact of COVID-19 on medical care workers in China. Infec Dis Poverty 2020;9(1):113. doi: 10.1186/s40249-020-00724-0
14. Vega-Escaño J, Porcel-Gálvez AM, Barrientos-Trigo S, et al. Turnicity as a determining factor in the occurrence of insomnia in the working population: a systematic review. Rev Esp Salud Public 2020;94: e202007047. doi: 10.1002/14651858.CD011558.pub2.
15. Baker MG, Peckham TK, Seixas NS. Estimating the burden of United States workers exposed to infection or disease: A key factor in containing risk of COVID-19 infection. PloS One 2020;15(4):e0232452. doi: 10.1371/journal.pone.0232452
16. American Academy of Sleep Medicine. International classification of sleep disorders, 3rd ed. Darien, IL: American Academy of Sleep Medicine, 2014.
17. Chung KF, Yeung WF, Ho FY, et al. Cross-cultural and comparative epidemiology of insomnia: the Diagnostic and statistical manual (DSM), International classification of diseases (ICD) and International classification of sleep disorders (ICSD). Sleep Med 2015;16(4):477-82. doi: 10.1016/j.sleep.2014.10.018
18. Leger D, Guilleminault C, Dreyfus JP, et al. Prevalence of insomnia in a survey of 12,778 adults in France. J Sleep Res 2000;9(1):35-42. doi: 10.1046/j.1365-2869.2000.00178.x
19. Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. Sleep Med Rev 2002;6(2):97-111. doi: 10.1053/smrv.2002.0186
20. Léger D, Partinen M, Hirshkowitz M, et al. Daytime consequences of insomnia symptoms among outpatients in primary care practice: EQUINOX international survey. Sleep Med 2010;11(10):999-1009. doi: 10.1016/j.sleep.2010.04.018
21. Freeman D, Sheaves B, Waite F, et al. Sleep disturbance and psychiatric disorders. Lancet Psychiat 2020;7(7):628-37. doi: 10.1016/s2215-0366(20)30136-x

22. Chattu VK, Manzar MD, Kumary S, et al. The Global Problem of Insufficient Sleep and Its Serious Public Health Implications. Healthcare-Basel 2018;7(1) doi: 10.3390/healthcare7010001
23. Wickwire EM, Shaya FT, Scharf SM. Health economics of insomnia treatments: The return on investment for a good night's sleep. Sleep Med Rev 2016;30:72-82. doi: 10.1016/j.smrv.2015.11.004
24. Léger D, Pepin E, Caetano G. The Economic Burden of Sleepy Driving. Sleep Med Clin 2019;14(4):423-29. doi: 10.1016/j.jsmc.2019.07.004
25. Jahrami H, BaHammam AS, AlGahtani H, et al. The examination of sleep quality for frontline healthcare workers during the outbreak of COVID-19. Sleep Breath 2020:1-9. doi: 10.1007/s11325-020-02135-9
26. Qi J, Xu J, Li BZ, et al. The evaluation of sleep disturbances for Chinese frontline medical workers under the outbreak of COVID-19. Sleep Med 2020;72:1-4. doi: 10.1016/j.sleep.2020.05.023
27. Tricco AC LE, Straus SE, editor. Rapid Reviews To Strengthen Health Policy And Systems: A Practical Guide. Geneva: World Health Organization, 2017.
28. Deeks JJ HJ, Altman DG, on behalf of the Cochrane Statistical Methods Group. Analysing data and undertaking meta□analyses. In: Higgins JPT TJ, Chandler J, Cumpston M, Li T, Page MJ, Welch VA, ed. Cochrane Handbook for Systematic Reviews of Interventions: The Cochrane Collaboration 2019.
29. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med 2009;6(7):e1000097. doi: 10.1371/journal.pmed.1000097
30. Shaukat N, Ali DM, Razzak J. Physical and mental health impacts of COVID-19 on healthcare workers: A scoping review. Int J Emerg Med 2020;13(1) :40. doi: 10.1186/s12245-020-00299-5
31. Pappa S, Ntella V, Giannakas T, et al. Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. Brain Behav Immun 2020; 88:901-907. doi: 10.1016/j.bbi.2020.05.026.
32. Pan R, Zhang L, Pan J. The anxiety status of chinese medical workers during the epidemic of COVID-19: A meta-analysis. Psychiat Invest 2020;17(5):475-80.
33. Luo M, Guo L, Yu M, et al. The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public - A systematic review and meta-analysis. *Psychiatry research* 2020;291:113190. doi: 10.30773/pi.2020.0127
34. Kisely S, Warren N, McMahon L, et al. Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis. BMJ 2020;369:m1642. doi: 10.1136/bmj.m1642.
35. Garcia-Iglesias JJ, Gomez-Salgado J, Martin-Pereira J, et al. Impact of SARS-CoV-2 (Covid-19) on the mental health of healthcare professionals: a systematic review. Rev Esp Salud Publica 2020;94 :e202007088.
36. Carmassi C, Foghi C, Dell'Oste V, et al. PTSD symptoms in healthcare workers facing the three coronavirus outbreaks: What can we expect after the COVID-19 pandemic. Psychiat Res 2020;292 :113312. doi: 0.1016/j.psychres.2020.113312.
37. Brooks SK, Dunn R, Amlot R, et al. A Systematic, Thematic Review of Social and Occupational Factors Associated With Psychological Outcomes in Healthcare Employees During an Infectious Disease Outbreak. J Occup Environ Med 2018;60(3):248-57. doi: 10.1097/jom.0000000000001235
38. Ouzzani M, Hammady H, Fedorowicz Z, et al. Rayyan-a web and mobile app for systematic reviews. Syst Rev-London 2016;5(1):210. doi: 10.1186/s13643-016-0384-4
39. Partners E. Tool to Assess Risk of Bias. Contributed by the CLARITY Group at McMaster University: McMaster University; Disponible en: https://www.evidencepartners.com/resources/methodological-resources/. Acceso 07/10/20
40. Nyaga VN, Arbyn M, Aerts M. Metaprop: a Stata command to perform meta-analysis of binomial data. Arch Public Health 2014;72(1):39-39. doi: 10.1186/2049-3258-72-39
41. Freeman MF, Tukey JW. Transformations related to the angular and the square root. Ann Math Statist 1950:607-11.
42. Miller JJ. The inverse of the Freeman–Tukey double arcsine transformation. Am Stat 1978;32(4):138-38.
43. Deeks JJ, Higgins JP, Altman DG, et al. Analysing data and undertaking meta-analyses. Cochrane handbook for systematic reviews of interventions 2019:241-84.
44. Begg CB, Mazumdar M. Operating characteristics of a rank correlation test for publication bias. Biometrics 1994:1088-101.
45. Egger M, Smith GD, Schneider M, et al. Bias in meta-analysis detected by a simple, graphical test. BMJ 1997;315(7109):629-34.
46. Yuan S, Liao Z, Huang H, et al. Comparison of the Indicators of Psychological Stress in the Population of Hubei Province and Non-Endemic Provinces in China During Two Weeks During the Coronavirus Disease 2019 (COVID-19) Outbreak in February 2020. Med Sci Monitor 2020;26:e923767. doi: 10.12659/msm.923767
47. Kang L, Ma S, Chen M, et al. Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel coronavirus disease outbreak: A cross-sectional study. Brain Behavior Immun 2020;87:11-17. doi: 10.1016/j.bbi.2020.03.028

48. Yin Q, Sun Z, Liu T, et al. Posttraumatic stress symptoms of health care workers during the corona virus disease 2019. Clin Psychol Psychot 2020;27(3):384-95. doi: 10.1002/cpp.2477
49. Stojanov J, Malobabic M, Stanojevic G, et al. Quality of sleep and health-related quality of life among health care professionals treating patients with coronavirus disease-19. Int J Soc Psychiat2020:20764020942800. doi: 10.1177/0020764020942800
50. Xiao H, Zhang Y, Kong D, et al. The Effects of Social Support on Sleep Quality of Medical Staff Treating Patients with Coronavirus Disease 2019 (COVID-19) in January and February 2020 in China. Med Sci Monitor 2020;26:e923549. doi: 10.12659/msm.923549
51. Dosil Santamaría M, Ozamiz-Etxebarria N, Redondo Rodríguez I, et al. Psychological impact of COVID-19 on a sample of Spanish health professionals. Rev Psiquiatr Salud Ment 2020 doi: 10.1016/j.rpsm.2020.05.004
52. Huang Y, Zhao N. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 outbreak in China: a web-based cross-sectional survey. Psychiat Res 2020;288:112954. doi: 10.1016/j.psychres.2020.112954
53. Lai J, Ma S, Wang Y, et al. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. JAMA Netw Open 2020;3(3):e203976. doi: 10.1001/jamanetworkopen.2020.3976
54. Que J, Shi L, Deng J, et al. Psychological impact of the COVID-19 pandemic on healthcare workers: a cross-sectional study in China. Gen Psychiat 2020;33(3):e100259. doi: 10.1136/gpsych-2020-100259
55. Wang H, Huang D, Huang H, et al. The psychological impact of COVID-19 pandemic on medical staff in Guangdong, China: a cross-sectional study. Psychol Med 2020:1-9. doi: 10.1017/s0033291720002561
56. Wang S, Xie L, Xu Y, et al. Sleep disturbances among medical workers during the outbreak of COVID-2019. Occup Med-Oxford 2020;70(5):364-69. doi: 10.1093/occmed/kqaa074
57. Zhan Y, Liu Y, Liu H, et al. Factors associated with insomnia among Chinese front-line nurses fighting against COVID-19 in Wuhan: A cross-sectional survey. J Nurs Manag 2020:e13094. doi: 10.1111/jonm.13094
58. Zhang WR, Wang K, Yin L, et al. Mental Health and Psychosocial Problems of Medical Health Workers during the COVID-19 Epidemic in China. Psychother Psychosom 2020;89(4):242-50. doi: 10.1159/000507639
59. Zhang C, Yang L, Liu S, et al. Survey of Insomnia and Related Social Psychological Factors Among Medical Staff Involved in the 2019 Novel Coronavirus Disease Outbreak. Front Psychiatry 2020;11:306. doi: 10.3389/fpsyt.2020.00306
60. Talevi D, Socci V, Carai M, et al. Mental health outcomes of the CoViD-19 pandemic. Riv Psichiatr 2020;55(3):137-44. doi: 10.1708/3382.33569
61. Sheraton M, Deo N, Dutt T, et al. Psychological effects of the COVID 19 pandemic on healthcare workers globally: A systematic review. Psychiatr Res 2020;292:113360. doi: 10.1016/j.psychres.2020.113360
62. Stuijfzand S, Deforges C, Sandoz V, et al. Psychological impact of an epidemic/pandemic on the mental health of healthcare professionals: a rapid review. BMC Public Health 2020;20(1):1230. doi: 10.1186/s12889-020-09322-z
63. Preti E, Di Mattei V, Perego G, et al. The Psychological Impact of Epidemic and Pandemic Outbreaks on Healthcare Workers: Rapid Review of the Evidence. Current Psychiat Rep 2020;22(8):43. doi: 10.1007/s11920-020-01166-z
64. Shechter A, Diaz F, Moise N, et al. Psychological distress, coping behaviors, and preferences for support among New York healthcare workers during the COVID-19 pandemic. Gen Hosp Psychiat 2020;66:1-8. doi: 10.1016/j.genhosppsych.2020.06.007
65. Tu ZH, He JW, Zhou N. Sleep quality and mood symptoms in conscripted frontline nurse in Wuhan, China during COVID-19 outbreak: A cross-sectional study. Medicine 2020;99(26):e20769. doi: 10.1097/md.000000000002076

ONLINE APPENDIX 1. SEARCH STRATEGY

Medline (Ovid): 3 August 2020

	Searches	Hits
1	exp Health Personnel/ or ((health or health care or healthcare) adj2 (personnel or worker* or provider* or employee* or staff or professional*)).tw. or ((medical or hospital) adj2 (staff or employee* or personnel or worker*)).tw. or (doctor* or physician* or clinician*).tw. or (allied health adj2 (staff or personnel or worker*)).tw. or paramedic*.tw. or nurse*.tw. or (nursing adj2 (staff or personnel or auxiliar*)).tw.	1411837
2	mental disorders/ or exp adjustment disorders/ or exp anxiety disorders/ or exp mood disorders/ or neurotic disorders/ or mental health.mp.	476636
3	(anxi* or depress* or melancholi* or neuros* or neurotic or psychoneuro* or stress* or distress* or emotion*).tw.	1656645
4	affective symptom*.mp.	14810
5	2 or 3 or 4	1929078
6	Disease Outbreaks.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	83087
7	exp *Disease Outbreaks/	67862
8	pandemic*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	48311
9	epidemic.mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]	93423
10	exp *Coronaviridae Infections/ or exp *Coronaviridae/	27523
11	exp *Coronavirus/	16445
12	covid 19.mp.	34192
13	covid-19.mp.	34192
14	exp *SARS Virus/	2665
15	exp *Hemorrhagic Fever, Ebola/	4776
16	exp *Influenza, Human/ or exp *Influenza A Virus, H1N1 Subtype/ or exp *Influenza A virus/	60695
17	health crisis.mp.	2483
18	emergency crisis.mp.	46
19	6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18	267468
20	1 and 5 and 19	2054

Embase (Elsevier): 3 August 2020

	Searches	Hits
1	'health care personnel'/exp OR 'health care personnel'	1,584,942
2	health NEXT/2 (personnel OR worker* OR provider* OR employee* OR staff OR professional*)	411,852
3	'health care' NEXT/2 (personnel OR worker* OR provider* OR employee* OR staff OR professional*)	225,881
4	healthcare NEXT/2 (personnel OR worker* OR provider* OR employee* OR staff OR professional*)	90,924
5	medical NEAR/2 (staff OR employee* OR personnel OR worker*)	69,674
6	hospital NEAR/2 (staff OR employee* OR personnel OR worker*)	38,053
7	doctor* OR physician* OR clinician*	1,467,423
8	'allied health' NEAR/2 (staff OR personnel OR worker*)	1,013
9	paramedic* OR nurse*	552,833

10	nursing NEAR/2 (staff OR personnel OR auxiliar*)	83,622
11	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10	2,921,448
12	'mental health'/exp OR 'mental health'	478,12
13	'mental disease'/exp OR 'mental disease'	2,334,133
14	anxi* OR depress* OR melancholi* OR neuros* OR neurotic OR psychoneuro* OR stress* OR distress* OR emotion*	3,761,584
15	'affective symptom*'	3,182
16	#12 OR #13 OR #14 OR #15	5,208,293
17	'epidemic'/exp OR 'epidemic'	184,691
18	'pandemic'/exp OR 'pandemic'	51,454
19	'coronavirus infection'/exp OR 'coronavirus infection'	45,375
20	covid AND 19 OR covid19 OR 'covid 19'	34,225
21	'sars-related coronavirus'/exp OR 'sars-related coronavirus'	14,557
22	'ebolavirus'/exp OR 'ebolavirus'	6,046
23	'influenza'/exp OR 'influenza'	159,788
24	'health crisis' OR 'emergency crisis'	3,643
25	#17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24	385,121
26	#11 AND #16 AND #25	8,253
27	#26 AND [embase]/lim NOT ([embase]/lim AND [medline]/lim) AND 'human'/de AND ('article'/it OR 'article in press'/it OR 'review'/it)	962

PsycINFO (EBSCO): 3 August 2020

	Searches	Hits
1	TI (healthcare professionals or healthcare workers or healthcare providers or physician or nurse or doctor) OR AB (healthcare professionals or healthcare workers or healthcare providers or physician or nurse or doctor)	166,451
2	DE mental health	72,726
3	TI (mental health or mental illness or mental disorder or psychiatric illness) OR AB (mental health or mental illness or mental disorder or psychiatric illness)	257,351
4	DE depression	45,922
5	DE anxiety	80,437
6	TI (depression or depressive disorder or depressive symptoms or major depressive disorder) OR AB (depression or depressive disorder or depressive symptoms or major depressive disorder)	272,066
7	TI (anxiety disorders or anxiety or generalized anxiety disorder) OR AB (anxiety disorders or anxiety or generalized anxiety disorder)	195,472
8	S2 OR S3 OR S4 OR S5 OR S6 OR S7	620,287
9	DE disease outbreaks	1,018
10	TI (disease outbreaks or pandemic or epidemic or health emergency) OR AB (disease outbreaks or pandemic or epidemic or health emergency)	17,177
11	DE coronavirus	381
12	TI (coronavirus or covid-19 or sars or mers or pandamic or outbreak) OR AB (coronavirus or covid-19 or sars or mers or pandamic or outbreak)	4,196
13	S9 OR S10 OR S11 OR S12	19,839
14	S1 AND S8 AND S13	463

ONLINE APPENDIX 2. LIST OF STUDIES EXCLUDED AFTER FULL TEXT EVALUATION

A. Target population (non-healthcare professionals)

1. Aiello, A., Khayeri, M. Y.-E., Raja, S., Peladeau, N., Romano, D., Leszcz, M., . . . Schulman, R. B. (2011). Resilience training for hospital workers in anticipation of an influenza pandemic. The Journal of continuing education in the health professions, 31(1), 15-20.
2. Chen, R., Chou, K.-R., Huang, Y.-J., Wang, T.-S., Liu, S.-Y., & Ho, L.-Y. (2006). Effects of a SARS prevention programme in Taiwan on nursing staff's anxiety, depression and sleep quality: a longitudinal survey. International journal of nursing studies, 43(2), 215-225.
3. Fang, X., Zhang, J., Teng, C., Zhao, K., Su, K. P., Wang, Z., . . . Zhang, C. (2020). Depressive symptoms in the front-line non-medical workers during the COVID-19 outbreak in Wuhan. Journal of Affective Disorders, 276, 441-445.
4. Gardner, P. J., & Moallef, P. (2015). Psychological impact on SARS survivors: Critical review of the English language literature. Canadian Psychology/Psychologie canadienne, 56(1), 123-135.
5. Li, Y., Wang, Y., Jiang, J., Valdimarsdottir, U. A., Fall, K., Fang, F., . . . Zhang, W. (2020). Psychological distress among health professional students during the COVID-19 outbreak. Psychological medicine, 1-3.
6. Liu, J., Zhu, Q., Fan, W., Makamure, J., Zheng, C., & Wang, J. (2020). Online Mental Health Survey in a Medical College in China During the COVID-19 Outbreak. Frontiers in Psychiatry, 11.
7. Luo, L.-S., Jin, Y.-H., Cai, L., Pan, Z.-Y., Zeng, X.-T., & Wang, X.-H. (2020). COVID-19: Presumed Infection Routes and Psychological Impact on Staff in Administrative and Logistics Departments in a Designated Hospital in Wuhan, China. Frontiers in psychology, 11, 1501.
8. Ma, Y., Rosenheck, R., & He, H. (2020). Psychological stress among health care professionals during the 2019 novel coronavirus disease Outbreak: Cases from online consulting customers. Intensive & critical care nursing, 102905.
9. Maunder, R. G., Lancee, W. J., Mae, R., Vincent, L., Peladeau, N., Beduz, M. A., . . . Leszcz, M. (2010). Computer-assisted resilience training to prepare healthcare workers for pandemic influenza: a randomized trial of the optimal dose of training. BMC health services research, 10(101088677), 72.
10. Rajkumar, R. P. (2020). COVID-19 and mental health: A review of the existing literature. Asian J Psychiatr, 52, 102066.
11. Sipos, M. L., Kim, P. Y., Thomas, S. J., & Adler, A. B. (2018). U.S. Service Member Deployment in Response to the Ebola Crisis: The Psychological Perspective. Military medicine, 183(3), e171-e178.
12. T.W., W., Y., G., & W.W.S., T. (2007). Anxiety among university students during the SARS epidemic in Hong Kong. Stress Health, 23(1), 31-35.
13. Temsah, M. H., Al-Sohime, F., Alamro, N., Al-Eyadhy, A., Al-Hasan, K., Jamal, A., . . . Somily, A. M. (2020). The psychological impact of COVID-19 pandemic on health care workers in a MERS-CoV endemic country. Journal of infection and public health.

B. Outcome measure (insomnia not studied)

1. Abdessater, M., Roupret, M., Misrai, V., Matillon, X., Gondran-Tellier, B., Freton, L., . . . Association Francaise des Urologues en, F. (2020). COVID19 pandemic impacts on anxiety of French urologist in training: Outcomes from a national survey. *Prog Urol, 30*(8), 448-455.
2. Ahmed, M. A., Jouhar, R., Ahmed, N., Adnan, S., Aftab, M., Zafar, M. S., & Khurshid, Z. (2020). Fear and Practice Modifications among Dentists to Combat Novel Coronavirus Disease (COVID-19) Outbreak. *Int J Environ Res Public Health, 17*(8).
3. Al Sulais, E., Mosli, M., & AlAmeel, T. (2020). The psychological impact of COVID-19 pandemic on physicians in Saudi Arabia: A cross-sectional study. *Saudi journal of gastroenterology : official journal of the Saudi Gastroenterology Association*.
4. Alsahafi, A. J., & Cheng, A. C. (2016). Knowledge, Attitudes and Behaviours of Healthcare Workers in the Kingdom of Saudi Arabia to MERS Coronavirus and Other Emerging Infectious Diseases. *International journal of environmental research and public health, 13*(12).
5. Alsubaie, S., Hani Temsah, M., Al-Eyadhy, A. A., Gossady, I., Hasan, G. M., Al-Rabiaah, A., . . . Somily, A. M. (2019). Middle East Respiratory Syndrome Coronavirus epidemic impact on healthcare workers' risk perceptions, work and personal lives. *Journal of infection in developing countries, 13*(10), 920-926.
6. An, Y., Yang, Y., Wang, A., Li, Y., Zhang, Q., Cheung, T., . . . Xiang, Y. T. (2020). Prevalence of depression and its impact on quality of life among frontline nurses in emergency departments during the COVID-19 outbreak. *Journal of Affective Disorders, 276*, 312-315.
7. Arpacioglu, S., Gurler, M., & Cakiroglu, S. (2020). Secondary Traumatization Outcomes and Associated Factors Among the Health Care Workers Exposed to the COVID-19. *The International journal of social psychiatry*, 20764020940742.
8. Austria-Corrales, F., Cruz-Valdes, B., Herrera-Kiengelher, L., Vazquez-Garcia, J. C., & Salas-Hernandez, J. (2011). [Burnout syndrome among medical residents during the influenza A H1N1 sanitary contigency in Mexico]. *Sindrome de burnout en medicos mexicanos en entrenamiento durante una contingencia sanitaria por virus de influenza A H1N1., 147*(2), 97-103.

9. Badahdah, A., Khamis, F., Al Mahyijari, N., Al Balushi, M., Al Hatmi, H., Al Salmi, I., . . . Al Noomani, J. (2020). The mental health of health care workers in Oman during the COVID-19 pandemic. *The International journal of social psychiatry*, 20764020939596.
10. Bai, Y., Lin, C.-C., Lin, C.-Y., Chen, J.-Y., Chue, C.-M., & Chou, P. (2004). Survey of stress reactions among health care workers involved with the SARS outbreak. *Psychiatric services (Washington, D.C.), 55*(9), 1055-1057.
11. Bar-Dayan, Y., Boldor, N., Kremer, I., London, M., Levy, R., Barak, M. I., & Bar-Dayan, Y. (2011). Who is willing to risk his life for a patient with a potentially fatal, communicable disease during the peak of A/H1N1 pandemic in Israel? *Journal of emergencies, trauma, and shock, 4*(2), 184-187.
12. Barello, S., Palamenghi, L., & Graffigna, G. (2020). Burnout and somatic symptoms among frontline healthcare professionals at the peak of the Italian COVID-19 pandemic. *Psychiatry research, 290*, 113129.
13. Blake, H., Bermingham, F., Johnson, G., & Tabner, A. (2020). Mitigating the Psychological Impact of COVID-19 on Healthcare Workers: A Digital Learning Package. *International journal of environmental research and public health, 17*(9).
14. Bostan, S., Akbolat, M., Kaya, A., Ozata, M., & Gunes, D. (2020). Assessments of anxiety levels and working conditions of health employees working in COV□D-19 pandemic hospitals. *Electronic Journal of General Medicine, 17*(5).
15. Bukhari, E. E., Temsah, M. H., Aleyadhy, A. A., Alrabiaa, A. A., Alhboob, A. A., Jamal, A. A., & Binsaeed, A. A. (2016). Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak perceptions of risk and stress evaluation in nurses. *Journal of infection in developing countries, 10*(8), 845-850.
16. Cai, H., Tu, B., Ma, J., Chen, L., Fu, L., Jiang, Y., & Zhuang, Q. (2020). Psychological Impact and Coping Strategies of Frontline Medical Staff in Hunan Between January and March 2020 During the Outbreak of Coronavirus Disease 2019 (COVID-19) in Hubei, China. *Medical science monitor : international medical journal of experimental and clinical research, 26*, e924171.
17. Cai, W., Lian, B., Song, X., Hou, T., Deng, G., & Li, H. (2020). A cross-sectional study on mental health among health care workers during the outbreak of Corona Virus Disease 2019. *Asian Journal of Psychiatry, 51*.
18. Çali□kan, F., & Dost, B. (2020). The evaluation of knowledge, attitudes, depression and anxiety levels among emergency physicians during the COVID-19 pandemic. *Signa Vitae, 16*(1), 163-171.
19. Chan, A. O. M., & Huak, C. Y. (2004). Psychological impact of the 2003 severe acute respiratory syndrome outbreak on health care workers in a medium size regional general hospital in Singapore. *Occupational medicine (Oxford, England), 54*(3), 190-196.
20. Chan, S. S., Leung, G. M., Tiwari, A. F., Salili, F., Leung, S. S., Wong, D. C., . . . Lam, T. H. (2005). The impact of work-related risk on nurses during the SARS outbreak in Hong Kong. *Fam Community Health, 28*(3), 274-287. doi:10.1097/00003727-200507000-00008
21. Chang, C.-S., Du, P.-L., & Huang, I.-C. (2006). Nurses' perceptions of severe acute respiratory syndrome: relationship between commitment and intention to leave nursing. *Journal of advanced nursing, 54*(2), 171-179.
22. Chatterjee, S. S., Bhattacharyya, R., Bhattacharyya, S., Gupta, S., Das, S., & Banerjee, B. B. (2020). Attitude, practice, behavior, and mental health impact of COVID-19 on doctors. *Indian Journal of Psychiatry, 62*(3), 257-265.
23. Chen, C.-S., Wu, H.-Y., Yang, P., & Yen, C.-F. (2005). Psychological Distress of Nurses in Taiwan Who Worked During the Outbreak of SARS. *Psychiatric Services, 56*(1), 76-79.
24. Chen, N.-H., Wang, P.-C., Hsieh, M.-J., Huang, C.-C., Kao, K.-C., Chen, Y.-H., & Tsai, Y.-H. (2007). Impact of severe acute respiratory syndrome care on the general health status of healthcare workers in taiwan. *Infection control and hospital epidemiology, 28*(1), 75-79.
25. Chew, N. W. S., Lee, G. K. H., Tan, B. Y. Q., Jing, M., Goh, Y., Ngiam, N. J. H., . . . Sharma, V. K. (2020). A multinational, multicentre study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak. *Brain, behavior, and immunity*.
26. Chong, M.-Y., Wang, W.-C., Hsieh, W.-C., Lee, C.-Y., Chiu, N.-M., Yeh, W.-C., . . . Chen, C.-L. (2004). Psychological impact of severe acute respiratory syndrome on health workers in a tertiary hospital. *The British journal of psychiatry : the journal of mental science, 185*(342367), 127-133.
27. Chua, S. E., Cheung, V., Cheung, C., McAlonan, G. M., Wong, J. W. S., Cheung, E. P. T., . . . Tsang, K. W. T. (2004). Psychological effects of the SARS outbreak in Hong Kong on high-risk health care workers. *Canadian journal of psychiatry. Revue canadienne de psychiatrie, 49*(6), 391-393.
28. Cipolotti, L., Chan, E., Murphy, P., Harskamp, N., & Foley, J. A. (2020). Factors contributing to the distress, concerns, and needs of uk neuroscience health care workers during the covid□19 pandemic. *Psychology and Psychotherapy: Theory, Research and Practice*.
29. Cohen, M. A., & Cohen, S. C. (1991). AIDS education and a volunteer training program for medical students. *Psychosomatics: Journal of Consultation and Liaison Psychiatry, 32*(2), 187-190.
30. Cole, C. L., Waterman, S., Stott, J., Saunders, R., Buckman, J. E. J., Pilling, S., & Wheatley, J. (2020). Adapting IAPT services to support frontline NHS staff during the

Covid-19 pandemic: The Homerton Covid Psychological Support (HCPS) pathway. *the Cognitive Behaviour Therapist, 13*.

31. Considine, J., Shaban, R. Z., Patrick, J., Holzhauser, K., Aitken, P., Clark, M., . . . FitzGerald, G. (2011). Pandemic (H1N1) 2009 Influenza in Australia: Absenteeism and redeployment of emergency medicine and nursing staff. *Emergency medicine Australasia : EMA, 23*(5), 615-623.
32. Corbett, G. A., Milne, S. J., Mohan, S., Reagu, S., Farrell, T., Lindow, S. W., . . . O'Connell, M. P. (2020). Anxiety and Depression Scores in Maternity Healthcare Workers during the Covid-19 Pandemic. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics*.
33. Di Tella, M., Romeo, A., Benfante, A., & Castelli, L. (2020). Mental health of healthcare workers during the COVID-19 pandemic in Italy. *Journal of evaluation in clinical practice*.
34. Dong, Z.-Q., Ma, J., Hao, Y.-N., Shen, X.-L., Liu, F., Gao, Y., & Zhang, L. (2020). The social psychological impact of the COVID-19 pandemic on medical staff in China: A cross-sectional study. *European psychiatry : the journal of the Association of European Psychiatrists, 63*(1), e65.
35. El Gaafary, M. M., Abd Elaziz, K. M., Abdel-Rahman, A. G., & Allam, M. F. (2010). Concerns, perceived impacts and preparedness of health care workers in a referral hospital in Egypt in facing influenza (H1N1) epidemic. *Journal of preventive medicine and hygiene, 51*(3), 105-109.
36. Elbay, R. Y., Kurtulmus, A., Arpacioglu, S., & Karadere, E. (2020). Depression, anxiety, stress levels of physicians and associated factors in Covid-19 pandemics. *Psychiatry research, 290*, 113130.
37. Garcia-Fernandez, L., Romero-Ferreiro, V., Lopez-Roldan, P. D., Padilla, S., Calero-Sierra, I., Monzo-Garcia, M., . . . Rodriguez-Jimenez, R. (2020). Mental health impact of COVID-19 pandemic on Spanish healthcare workers. *Psychological medicine*, 1-3.
38. Geoffroy, P. A., Le Goanvic, V., Sabbagh, O., Richoux, C., Weinstein, A., Dufayet, G., & Lejoyeux, M. (2020). Psychological Support System for Hospital Workers During the Covid-19 Outbreak: Rapid Design and Implementation of the Covid-Psy Hotline. *Frontiers in Psychiatry, 11*.
39. Giordano, F., Scarlata, E., Baroni, M., Gentile, E., Puntillo, F., Brienza, N., & Gesualdo, L. (2020). Receptive music therapy to reduce stress and improve wellbeing in Italian clinical staff involved in COVID-19 pandemic: A preliminary study. *Arts in Psychotherapy, 70*.
40. Goulia, P., Mantas, C., Dimitroula, D., Mantis, D., & Hyphantis, T. (2010). General hospital staff worries, perceived sufficiency of information and associated psychological distress during the A/H1N1 influenza pandemic. *BMC infectious diseases, 10*(100968551), 322.
41. Grace, S. L., Hershenfield, K., Robertson, E., & Stewart, D. E. (2005). The occupational and psychosocial impact of SARS on academic physicians in three affected hospitals. *Psychosomatics, 46*(5), 385-391.
42. H., S., & X., R. (2004). Psychological analysis for the medical staff suffering from severe acute respiratory syndrome. *Chin. J. Clin. Rehab., 8*(33), 7609-7611.
43. Han, L., Wong, F. K. Y., She, D. L. M., Li, S. Y., Yang, Y. F., Jiang, M. Y., . . . Chung, L. Y. F. (2020). Anxiety and Depression of Nurses in a North West Province in China During the Period of Novel Coronavirus Pneumonia Outbreak. *Journal of nursing scholarship : an official publication of Sigma Theta Tau International Honor Society of Nursing*.
44. Ho, S. M. Y., Kwong-Lo, R. S. Y., Mak, C. W. Y., & Wong, J. S. (2005). Fear of severe acute respiratory syndrome (SARS) among health care workers. *Journal of consulting and clinical psychology, 73*(2), 344-349.
45. Honey, M., & Wang, W. Y. Q. (2013). New Zealand nurses perceptions of caring for patients with influenza A (H1N1). *Nursing in critical care, 18*(2), 63-69.
46. Hong, X., Cao, J., Wei, J., Duan, Y., Zhao, X., Jing, J., . . . Zhu, H. (2020). The Stress and Psychological Impact of the COVID-19 Outbreak on Medical Workers at the Fever Clinic of a Tertiary General Hospital in Beijing: A Cross-Sectional Study. *SSRN Electronic Journal*.
47. Hope, K., Merritt, T., Eastwood, K., Main, K., Durrheim, D. N., Muscatello, D., . . . Zheng, W. (2008). The public health value of emergency department syndromic surveillance following a natural disaster. *Communicable diseases intelligence quarterly report, 32*(1), 92-94.
48. Hosseinzadeh-Shanjani, Z., Hajimiri, K., Rostami, B., Ramazani, S., & Dadashi, M. (2020). Stress, anxiety, and depression levels among healthcare staff during the COVID-19 epidemic. *Basic and Clinical Neuroscience, 11*(2), 163-170.
49. Hou, T., Zhang, T., Cai, W., Song, X., Chen, A., Deng, G., & Ni, C. (2020). Social support and mental health among health care workers during Coronavirus Disease 2019 outbreak: A moderated mediation model. *PloS one, 15*(5), e0233831.
50. Hu, D., Kong, Y., Li, W., Han, Q., Zhang, X., Zhu, L. X., . . . Zhu, J. (2020). Frontline nurses' burnout, anxiety, depression, and fear statuses and their associated factors during the COVID-19 outbreak in Wuhan, China: A large-scale cross-sectional study. *EClinicalMedicine*.
51. Hu, L., Li, H., Wang, T., Xue, H., Liu, J., Panayi, A. C., . . . Xiong, Y. (2020). Assessment of the Mental Health of Front Line Healthcare Workers in a COVID-19 Epidemic Epicenter of China.
52. Huang, L., Wang, Y., Liu, J., Ye, P., Chen, X., Xu, H., . . . Ning, G. (2020). Factors Influencing Anxiety of Health Care Workers in the Radiology Department with High

Exposure Risk to COVID-19. *Medical science monitor : international medical journal of experimental and clinical research, 26*, e926008.

53. Huang, L., Wang, Y., Liu, J., Ye, P., Cheng, B., Xu, H., . . . Ning, G. (2020). Factors Associated with Resilience Among Medical Staff in Radiology Departments During The Outbreak of 2019 Novel Coronavirus Disease (COVID-19): A Cross-Sectional Study. *Medical science monitor : international medical journal of experimental and clinical research, 26*, e925669.
54. Hurley, P. M. (1989). Human immunodeficiency virus and mental health: meeting the needs of health professionals. *Archives of psychiatric nursing, 3*(5), 277-280.
55. Imai, H., Matsuishi, K., Ito, A., Mouri, K., Kitamura, N., Akimoto, K., . . . Mita, T. (2010). Factors associated with motivation and hesitation to work among health professionals during a public crisis: a cross sectional study of hospital workers in Japan during the pandemic (H1N1) 2009. *BMC public health, 10*(100968562), 672.
56. Ji, D., Ji, Y.-J., Duan, X.-Z., Li, W.-G., Sun, Z.-Q., Song, X.-A., . . . Duan, H.-J. (2017). Prevalence of psychological symptoms among Ebola survivors and healthcare workers during the 2014-2015 Ebola outbreak in Sierra Leone: a cross-sectional study. *Oncotarget, 8*(8), 12784-12791.
57. Jiang, X., Deng, L., Zhu, Y., Ji, H., Tao, L., Liu, L., . . . Ji, W. (2020). Psychological crisis intervention during the outbreak period of new coronavirus pneumonia from experience in Shanghai. *Psychiatry Res, 286*, 112903.
58. K.Y., T., Y.H., T., O.H., L., W.L., T., M.K., O., & H.K., T. (2005). Psychological morbidity among emergency department doctors and nurses after the SARS outbreak. *Hong Kong J. Emerg. Med., 12*(4), 215-223.
59. Khaled Al-Hanawi, M., Mwale, M. L., Alshareef, N., Qattan, A. M. N., Angawi, K., Almubark, R., & Alsharqi, O. (2020). Psychological distress amongst health workers and the general public during the COVID-19 pandemic in Saudi Arabia. *Risk Management and Healthcare Policy, 13*, 733-742.
60. Khalid, I., Khalid, T. J., Qabajah, M. R., Barnard, A. G., & Qushmaq, I. A. (2016). Healthcare Workers Emotions, Perceived Stressors and Coping Strategies During a MERS-CoV Outbreak. *Clinical medicine & research, 14*(1), 7-14.
61. Khanna, R. C., Honavar, S. G., Metla, A. L., Bhattacharya, A., & Maulik, P. K. (2020). Psychological impact of COVID-19 on ophthalmologists-in-training and practising ophthalmologists in India. *Indian journal of ophthalmology, 68*(6), 994-998.
62. Khattab, M. F., Kannan, T. M. A., Morsi, A., Al-Sabbagh, Q., Hadidi, F., Al-Sabbagh, M. Q., . . . Obeid, I. (2020). The short-term impact of COVID-19 pandemic on spine surgeons: a cross-sectional global study. *European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society.*
63. Kim, C.-J., Yoo, H.-R., Yoo, M. S., Kwon, B. E., & Hwang, K. J. (2006). Attitude, beliefs, and intentions to care for SARS patients among Korean clinical nurses: an application of theory of planned behavior. *Taehan Kanho Hakhoe chi, 36*(4), 596-603.
64. Kim, J. S., & Choi, J. S. (2016). Factors Influencing Emergency Nurses' Burnout During an Outbreak of Middle East Respiratory Syndrome Coronavirus in Korea. *Asian nursing research, 10*(4), 295-299.
65. Koh, D., Lim, M. K., Chia, S. E., Ko, S. M., Qian, F., Ng, V., . . . Fones, C. (2005). Risk Perception and Impact of Severe Acute Respiratory Syndrome (SARS) on Work and Personal Lives of Healthcare Workers in Singapore: What Can We Learn? *Medical Care, 43*(7), 676-682.
66. Kurt, O., Deveci, S. E., & Oguzoncul, A. F. (2020). Levels of anxiety and depression related to covid-19 among physicians: An online cross-sectional study from turkey. *Annals of Clinical and Analytical Medicine, 11*, S288-S293.
67. L., d. S. Z., M.L., Z., & K.G., B. (2006). Caring for home-based care workers. Understanding the needs, fears and motivations of front-line care workers in South Africa. *South. Afr. J. HIV Med.*(24), 38-43.
68. L., F., Z., M., E.R., G., & S., C. (2006). Emotional exhaustion and state anger in nurses who worked during the sars outbreak: The role of perceived threat and organizational support. *Can. J. Community Ment. Health, 25*(2), 89-103.
69. Lai, J., Ma, S., Wang, Y., Cai, Z., Hu, J., Wei, N., . . . Hu, S. (2020). Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. *JAMA Network Open, 3*(3), e203976.
70. Lancee, W. J., Maunder, R. G., & Goldbloom, D. S. (2008). Prevalence of psychiatric disorders among Toronto hospital workers one to two years after the SARS outbreak. *Psychiatric Services, 59*(1), 91-95.
71. Lateef, F., Lim, S. H., & Tan, E. H. (2004). New paradigm for protection: the emergency ambulance services in the time of severe acute respiratory syndrome. *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors, 8*(3), 304-307.
72. Lee, A. M., Wong, J. G. W. S., McAlonan, G. M., Cheung, V., Cheung, C., Sham, P. C., . . . Chua, S. E. (2007). Stress and psychological distress among SARS survivors 1 year after the outbreak. *Canadian journal of psychiatry. Revue canadienne de psychiatrie, 52*(4), 233-240.
73. Lee, S.-H., Juang, Y.-Y., Su, Y.-J., Lee, H.-L., Lin, Y.-H., & Chao, C.-C. (2005). Facing SARS: psychological impacts on SARS team nurses and psychiatric services in a Taiwan general hospital. *General Hospital Psychiatry, 27*(5), 352-358.

74. Lee, S. M., Kang, W. S., Cho, A.-R., Kim, T., & Park, J. K. (2018). Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients. *Comprehensive psychiatry, 87*, 123-127.
75. Lehmann, M., Bruenahl, C. A., Addo, M. M., Becker, S., Schmiedel, S., Lohse, A. W., . . . Lowe, B. (2016). Acute Ebola virus disease patient treatment and health-related quality of life in health care professionals: A controlled study. *Journal of psychosomatic research, 83*(376333), 69-74.
76. Li, L., Wan, C., Ding, R., Liu, Y., Chen, J., Wu, Z., . . . Li, C. (2015). Mental distress among Liberian medical staff working at the China Ebola Treatment Unit: a cross sectional study. *Health and quality of life outcomes, 13*(101153626), 156.
77. Li, Z., Ge, J., Yang, M., Feng, J., Qiao, M., Jiang, R., . . . Yang, C. (2020). Vicarious traumatization in the general public, members, and non-members of medical teams aiding in COVID-19 control. *Brain, behavior, and immunity*.
78. Liao, L., Wang, B., Li, X., Guo, J., Tong, Z., Guan, Q., . . . Gu, Y. (2020). Psychological Effects of COVID-19 on Hospital Staff: A National Cross-Sectional Survey of China Mainland. *SSRN Electronic Journal*.
79. Lin, C.-Y., Peng, Y.-C., Wu, Y.-H., Chang, J., Chan, C.-H., & Yang, D.-Y. (2007). The psychological effect of severe acute respiratory syndrome on emergency department staff. *Emergency medicine journal : EMJ, 24*(1), 12-17.
80. Liu, C.-Y., Yang, Y.-Z., Zhang, X.-M., Xu, X., Dou, Q.-L., Zhang, W.-W., & Cheng, A. S. K. (2020). The prevalence and influencing factors in anxiety in medical workers fighting COVID-19 in China: a cross-sectional survey. *Epidemiology and infection, 148*, e98.
81. Liu, X., Kakade, M., Fuller, C. J., Fan, B., Fang, Y., Kong, J., . . . Wu, P. (2012). Depression after exposure to stressful events: lessons learned from the severe acute respiratory syndrome epidemic. *Comprehensive psychiatry, 53*(1), 15-23.
82. Liu, X., Shao, L., Zhang, R., Wei, Y., Li, J., Wang, C., . . . Zhou, F. (2020). Perceived Social Support and Its Impact on Psychological Status and Quality of Life of Medical Staffs After Outbreak of SARS-CoV-2 Pneumonia: A Cross-Sectional Study. *SSRN Electronic Journal*.
83. Liu, Z., Han, B., Jiang, R., Huang, Y., Ma, C., Wen, J., . . . Ma, Y. (2020). Mental health status of doctors and nurses during COVID-19 epidemic in China. *Available at SSRN 3551329*.
84. Loh, L.-C., Ali, A. M., Ang, T.-H., & Chelliah, A. (2006). Impact of a spreading epidemic on medical students. *The Malaysian journal of medical sciences : MJMS, 13*(2), 30-36.
85. Louie, P. K., Harada, G. K., McCarthy, M. H., Germscheid, N., Cheung, J. P. Y., Neva, M. H., . . . Samartzis, D. (2020). The Impact of COVID-19 Pandemic on Spine Surgeons Worldwide. *Global Spine J, 10*(5), 534-552.
86. Lu, W., Wang, H., Lin, Y., & Li, L. (2020). Psychological status of medical workforce during the COVID-19 pandemic: A cross-sectional study. *Psychiatry research, 288*, 112936.
87. Lu, Y.-C., Shu, B.-C., Chang, Y.-Y., & Lung, F.-W. (2006). The mental health of hospital workers dealing with severe acute respiratory syndrome. *Psychotherapy and psychosomatics, 75*(6), 370-375.
88. Lung, F.-W., Lu, Y.-C., Chang, Y.-Y., & Shu, B.-C. (2009). Mental Symptoms in Different Health Professionals During the SARS Attack: A Follow-up Study. *The Psychiatric quarterly, 80*(2), 107-116.
89. Lv, Y., Zhang, Z., Zeng, W., Li, J., Wang, X., & Luo, G. (2020). Anxiety and depression survey of Chinese medical staff before and during COVID-19 defense. *Available at SSRN 3551350*.
90. Mahendran, K., Patel, S., & Sproat, C. (2020). Psychosocial effects of the COVID-19 pandemic on staff in a dental teaching hospital. *British dental journal, 229*(2), 127-132.
91. Marjanovic, Z., Greenglass, E. R., & Coffey, S. (2007). The relevance of psychosocial variables and working conditions in predicting nurses' coping strategies during the SARS crisis: an online questionnaire survey. *International journal of nursing studies, 44*(6), 991-998.
92. Matsuishi, K., Kawazoe, A., Imai, H., Ito, A., Mouri, K., Kitamura, N., . . . Mita, T. (2012). Psychological impact of the pandemic (H1N1) 2009 on general hospital workers in Kobe. *Psychiatry and clinical neurosciences, 66*(4), 353-360.
93. Maunder, R. G., Lancee, W. J., Balderson, K. E., Bennett, J. P., Borgundvaag, B., Evans, S., . . . Wasylenki, D. A. (2006). Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. *Emerging infectious diseases, 12*(12), 1924-1932.
94. Maunder, R. G., Lancee, W. J., Rourke, S., Hunter, J. J., Goldbloom, D., Balderson, K., . . . Fones, C. S. L. (2004). Factors associated with the psychological impact of severe acute respiratory syndrome on nurses and other hospital workers in Toronto. *Psychosomatic medicine, 66*(6), 938-942.
95. McAlonan, G. M., Lee, A. M., Cheung, V., Cheung, C., Tsang, K. W. T., Sham, P. C., . . . Wong, J. G. W. S. (2007). Immediate and sustained psychological impact of an emerging infectious disease outbreak on health care workers. *Canadian journal of psychiatry. Revue canadienne de psychiatrie, 52*(4), 241-247.
96. Mo, Y., Deng, L., Zhang, L., Lang, Q., Liao, C., Wang, N., . . . Huang, H. (2020). Work stress among Chinese nurses to support Wuhan in fighting against COVID-19 epidemic. *Journal of nursing management, 28*(5), 1002-1009.
97. Nemati, M., Ebrahimi, B., & Nemati, F. (2020). Assessment of Iranian Nurses' Knowledge and Anxiety Toward

COVID-19 During the Current Outbreak in Iran. *Archives of Clinical Infectious Diseases, 15*.

98. Ni, M. Y., Yang, L., Leung, C. M. C., Li, N., Yao, X. I., Wang, Y., . . . Liao, Q. (2020). Mental Health, Risk Factors, and Social Media Use During the COVID-19 Epidemic and Cordon Sanitaire Among the Community and Health Professionals in Wuhan, China: Cross-Sectional Survey. *JMIR Ment Health, 7*(5), e19009.
99. Nickell, L. A., Crighton, E. J., Tracy, C. S., Al-Enazy, H., Bolaji, Y., Hanjrah, S., . . . Upshur, R. E. G. (2004). Psychosocial effects of SARS on hospital staff: survey of a large tertiary care institution. *CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne, 170*(5), 793-798.
100. Oh, N., Hong, N., Ryu, D. H., Bae, S. G., Kam, S., & Kim, K.-Y. (2017). Exploring Nursing Intention, Stress, and Professionalism in Response to Infectious Disease Emergencies: The Experience of Local Public Hospital Nurses During the 2015 MERS Outbreak in South Korea. *Asian nursing research, 11*(3), 230-236.
101. Park, J.-S., Lee, E.-H., Park, N.-R., & Choi, Y. H. (2018). Mental Health of Nurses Working at a Government-designated Hospital During a MERS-CoV Outbreak: A Cross-sectional Study. *Archives of psychiatric nursing, 32*(1), 2-6.
102. Phua, D. H., Tang, H. K., & Tham, K. Y. (2005). Coping responses of emergency physicians and nurses to the 2003 severe acute respiratory syndrome outbreak. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine, 12*(4), 322-328.
103. Ping, N. P. T., Shoesmith, W. D., James, S., Nor Hadi, N. M., Yau, E. K. B., & Lin, L. J. (2020). Ultra brief psychological interventions for covid-19 pandemic: Introduction of a locally-adapted brief intervention for mental health and psychosocial support service. *Malaysian Journal of Medical Sciences, 27*(2), 51-56.
104. Poon, E., Liu, K. S., Cheong, D. L., Lee, C. K., Yam, L. Y. C., & Tang, W. N. (2004). Impact of severe respiratory syndrome on anxiety levels of front-line health care workers. *Hong Kong medical journal = Xianggang yi xue za zhi, 10*(5), 325-330.
105. Pratt, M., Kerr, M., & Wong, C. (2009). The impact of ERI, burnout, and caring for SARS patients on hospital nurses' self-reported compliance with infection control. *The Canadian journal of infection control : the official journal of the Community & Hospital Infection Control Association-Canada = Revue canadienne de prevention des infections, 24*(3), 167-174.
106. Q., Z., Z.-M., X., S.-Y., C., Y.-L., W., L.-X., M., J.-S., F., & Y.-J., L. (2005). Comparison of anxious level of medical students from different resources during severe acute respiratory syndrome epidemic period. *Chin. J. Clin. Rehab., 9*(4), 32-33.
107. Rodriguez, R. M., Medak, A. J., Baumann, B. M., Lim, S., Chinnock, B., Frazier, R., & Cooper, R. J. (2020). Academic Emergency Medicine Physicians' Anxiety Levels, Stressors, and Potential Stress Mitigation Measures During the Acceleration Phase of the COVID-19 Pandemic. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine*.
108. Savitsky, B., Findling, Y., Ereli, A., & Hendel, T. (2020). Anxiety and coping strategies among nursing students during the covid-19 pandemic. *Nurse education in practice, 46*, 102809.
109. Schulte, E. E., Bernstein, C. A., & Cabana, M. D. (2020). Addressing Faculty Emotional Responses during the Coronavirus 2019 Pandemic. *The Journal of Pediatrics, 222*, 13-14.
110. Shen, Y., Cui, Y., Li, N., Tian, C., Chen, M., Zhang, Y. W., . . . Teng, G. J. (2020). Emergency Responses to Covid-19 Outbreak: Experiences and Lessons from a General Hospital in Nanjing, China. *Cardiovasc Intervent Radiol, 43*(6), 810-819.
111. Shi, C., Yu, X., Hong, N., Chan, R. C. K., Chen, Y., & He, Y. (2011). Emotional, memory and daily function among health care worker survivors with SARS. *Chinese Mental Health Journal, 25*(9), 660-665.
112. Sim, K., Chong, P. N., Chan, Y. H., & Soon, W. S. W. (2004). Severe acute respiratory syndrome-related psychiatric and posttraumatic morbidities and coping responses in medical staff within a primary health care setting in Singapore. *The Journal of clinical psychiatry, 65*(8), 1120-1127.
113. Sin, S. S., & Huak, C. Y. (2004). Psychological impact of the SARS outbreak on a Singaporean rehabilitation department. *International Journal of Therapy and Rehabilitation, 11*(9), 417-424.
114. Sockalingam, S., Clarkin, C., Serhal, E., Pereira, C., & Crawford, A. (2020). Responding to Health Care Professionals' Mental Health Needs During COVID-19 Through the Rapid Implementation of Project ECHO. *The Journal of continuing education in the health professions*.
115. Song, X., Fu, W., Liu, X., Luo, Z., Wang, R., Zhou, N., . . . Lv, C. (2020). Mental health status of medical staff in emergency departments during the Coronavirus disease 2019 epidemic in China. *Brain, behavior, and immunity*.
116. Styra, R., Hawryluck, L., Robinson, S., Kasapinovic, S., Fones, C., & Gold, W. L. (2008). Impact on health care workers employed in high-risk areas during the Toronto SARS outbreak. *Journal of psychosomatic research, 64*(2), 177-183.
117. Su, T.-P., Lien, T.-C., Yang, C.-Y., Su, Y. L., Wang, J.-H., Tsai, S.-L., & Yin, J.-C. (2007). Prevalence of psychiatric morbidity and psychological adaptation of the nurses in a structured SARS caring unit during outbreak: a prospective and periodic assessment study in Taiwan. *Journal of psychiatric research, 41*(1), 119-130.
118. Sun, D., Yang, D., Li, Y., Zhou, J., Wang, W., Wang, Q., . .

. Zhang, Q. (2020). Psychological impact of 2019 novel coronavirus (2019-nCoV) outbreak in health workers in China. *Epidemiology and infection, 148*, e96.

119. Tam, C. W. C., Pang, E. P. F., Lam, L. C. W., & Chiu, H. F. K. (2004). Severe acute respiratory syndrome (SARS) in Hong Kong in 2003: stress and psychological impact among frontline healthcare workers. *Psychological medicine, 34*(7), 1197-1204.
120. Tang, L., Pan, L., Yuan, L., & Zha, L. (2017). Prevalence and related factors of post-traumatic stress disorder among medical staff members exposed to H7N9 patients. *International journal of nursing sciences, 4*(1), 63-67.
121. Tolomiczenko, G. S., Kahan, M., Ricci, M., Strathern, L., Jeney, C., Patterson, K., & Wilson, L. (2005). SARS: coping with the impact at a community hospital. *Journal of advanced nursing, 50*(1), 101-110.
122. Verma, S., Mythily, S., Chan, Y. H., Deslypere, J. P., Teo, E. K., & Chong, S. A. (2004). Post-SARS psychological morbidity and stigma among general practitioners and traditional Chinese medicine practitioners in Singapore. *Annals of the Academy of Medicine, Singapore, 33*(6), 743-748.
123. Vinck, L., Isken, L., Hooiveld, M., Trompenaars, M., Ijzermans, J., & Timen, A. (2011). Impact of the 2009 influenza A(H1N1) pandemic on public health workers in the Netherlands. *Euro surveillance : bulletin Europeen sur les maladies transmissibles = European communicable disease bulletin, 16*(7).
124. Viswanathan, R., Myers, M. F., & Fanous, A. H. (2020). Support groups and individual mental health care via video conferencing for frontline clinicians during the covid-19 pandemic. *Psychosomatics: Journal of Consultation and Liaison Psychiatry*.
125. von Strauss, E., Paillard-Borg, S., Holmgren, J., & Saaristo, P. (2017). Global nursing in an Ebola viral haemorrhagic fever outbreak: before, during and after deployment. *Global health action, 10*(1), 1371427.
126. Wang, H., Liu, Y., Hu, K., Zhang, M., Du, M., Huang, H., & Yue, X. (2020). Healthcare workers' stress when caring for COVID-19 patients: An altruistic perspective. *Nursing ethics*, 969733020934146.
127. Wang, Y.-X., Guo, H.-T., Du, X.-W., Song, W., Lu, C., & Hao, W.-N. (2020). Factors associated with post-traumatic stress disorder of nurses exposed to corona virus disease 2019 in China. *Medicine, 99*(26), e20965.
128. Wong, T. W., Yau, J. K. Y., Chan, C. L. W., Kwong, R. S. Y., Ho, S. M. Y., Lau, C. C., . . . Lit, C. H. (2005). The psychological impact of severe acute respiratory syndrome outbreak on healthcare workers in emergency departments and how they cope. *European journal of emergency medicine : official journal of the European Society for Emergency Medicine, 12*(1), 13-18.
129. Wong, T. Y., Koh, G. C., Cheong, S. K., Lee, H. Y., Fong, Y. T., Sundram, M., . . . Koh, D. (2008). Concerns, perceived impact and preparedness in an avian influenza pandemic--a comparative study between healthcare workers in primary and tertiary care. *Annals of the Academy of Medicine, Singapore, 37*(2), 96-102.
130. Wong, T. Y., Koh, G. C. H., Cheong, S. K., Sundram, M., Koh, K., Chia, S. E., & Koh, D. (2008). A cross-sectional study of primary-care physicians in Singapore on their concerns and preparedness for an avian influenza outbreak. *Annals of the Academy of Medicine, Singapore, 37*(6), 458-464.
131. Wong, W. C., Wong, S. Y., Lee, A., & Goggins, W. B. (2007). How to provide an effective primary health care in fighting against severe acute respiratory syndrome: the experiences of two cities. *Am J Infect Control, 35*(1), 50-55. doi:10.1016/j.ajic.2006.06.009
132. Wong, W. C. W., Lee, A., Tsang, K. K., & Wong, S. Y. S. (2004). How did general practitioners protect themselves, their family, and staff during the SARS epidemic in Hong Kong? *Journal of epidemiology and community health, 58*(3), 180-185.
133. Wu, P., Fang, Y., Guan, Z., Fan, B., Kong, J., Yao, Z., . . . Hoven, C. W. (2009). The psychological impact of the SARS epidemic on hospital employees in China: Exposure, risk perception, and altruistic acceptance of risk. *The Canadian Journal of Psychiatry / La Revue canadienne de psychiatrie, 54*(5), 302-311.
134. Wu, P., Liu, X., Fang, Y., Fan, B., Fuller, C. J., Guan, Z., . . . Litvak, I. J. (2008). Alcohol abuse/dependence symptoms among hospital employees exposed to a SARS outbreak. *Alcohol and alcoholism (Oxford, Oxfordshire), 43*(6), 706-712.
135. Wu, W., Zhang, Y., Wang, P., Zhang, L., Wang, G., Lei, G., . . . Luo, M. (2020). Psychological stress of medical staffs during outbreak of COVID-19 and adjustment strategy. *Journal of medical virology*.
136. Xing, J., Sun, N., Xu, J., Geng, S., & Li, Y. (2020). Study of the mental health status of medical personnel dealing with new coronavirus pneumonia. *PloS one, 15*(5), e0233145.
137. Yang, S., Kwak, S. G., Ko, E. J., & Chang, M. C. (2020). The Mental Health Burden of the COVID-19 Pandemic on Physical Therapists. *International journal of environmental research and public health, 17*(10).
138. Yildirim, T. T., Atas, O., Asafov, A., Yildirim, K., & Balibey, H. (2020). Psychological Status of Healthcare Workers during the Covid-19 Pandemic. *Journal of the College of Physicians and Surgeons--Pakistan : JCPSP, 30*(6), 26-31.
139. Zerbini, G., Ebigbo, A., Reicherts, P., Kunz, M., & Messman, H. (2020). Psychosocial burden of healthcare professionals in times of COVID-19 - a survey conducted at the University Hospital Augsburg. *German medical science : GMS e-journal, 18*, Doc05.

140. Zhu, J., Sun, L., Zhang, L., Wang, H., Fan, A., Yang, B., . . . Xiao, S. (2020). Prevalence and Influencing Factors of Anxiety and Depression Symptoms in the First-Line Medical Staff Fighting Against COVID-19 in Gansu. *Frontiers in Psychiatry, 11*.
141. Zhu, Z., Xu, S., Wang, H., Liu, Z., Wu, J., Li, G., . . . Wang, W. (2020). COVID-19 in Wuhan: Sociodemographic characteristics and hospital support measures associated with the immediate psychological impact on healthcare workers. *EClinicalMedicine*.
142. Zhuo, K., Gao, C., Wang, X., Zhang, C., & Wang, Z. (2020). Stress and sleep: a survey based on wearable sleep trackers among medical and nursing staff in Wuhan during the COVID-19 pandemic. *General psychiatry, 33*(3), e100260.

C. Context (study not conducted during the COVID19 pandemic)

1. Bakhamis, L., Paul, D. P. r., Smith, H., & Coustasse, A. (2019). Still an Epidemic: The Burnout Syndrome in Hospital Registered Nurses. *The health care manager, 38*(1), 3-10.
2. Carnes, B. A. (1992). Caring for the professional caregiver: the application of Caplan's model of consultation in the era of HIV. *Issues in mental health nursing, 13*(4), 357-367.
3. E., S.-L., A., S.-U., H., R.-D.-A., S., F., & R., R. (2014). Association between chronic stress and immune response to influenza vaccine in healthcare workers. *Revista Port. Saude Publica, 32*(1), 18-26.
4. Goldberg, M. J., Shea, K. G., Weiss, J. M., Carter, C. W., Talwalkar, V. R., & Schwend, R. M. (2019). The Pediatric Orthopaedic Society of North America (POSNA) Adopts a Member Health and Wellness Charter. *Journal of pediatric orthopedics, 39*(4), e241-e244.
5. Horner, G., Daddona, J., Burke, D. J., Cullinane, J., Skeer, M., & Wurcel, A. G. (2019). "You're kind of at war with yourself as a nurse": Perspectives of inpatient nurses on treating people who present with a comorbid opioid use disorder. *PloS one, 14*(10), e0224335.
6. Letourneau, L. M., Ritzo, J., Shonk, R., Eichler, M., & Sy, S. (2019). Supporting Physicians and Practice Teams in Efforts to Address the Opioid Epidemic. *Annals of family medicine, 17*, S77-S81.
7. Magidson, J. F., Joska, J. A., Regenauer, K. S., Satinsky, E., Andersen, L. S., Seitz-Brown, C. J., . . . Myers, B. (2019). "Someone who is in this thing that I am suffering from": The role of peers and other facilitators for task sharing substance use treatment in South African HIV care. *The International journal on drug policy, 70*(9014759), 61-69.
8. McKinney, B. K. (2011). Withstanding the pressure of the profession. *Journal for nurses in staff development : JNSD : official journal of the National Nursing Staff Development Organization, 27*(2), 69-73.
9. McNicholas, F., Sharma, S., Oconnor, C., & Barrett, E. (2020). Burnout in consultants in child and adolescent mental health services (CAMHS) in Ireland: a cross-sectional study. *BMJ open, 10*(1), e030354.
10. Mohangi, K., & Pretorius, C. (2017). On the periphery of HIV and AIDS: Reflections on stress as experienced by caregivers in a child residential care facility in South Africa. *SAHARA J : journal of Social Aspects of HIV/AIDS Research Alliance, 14*(1), 153-161.
11. O'Boyle, C., Robertson, C., & Secor-Turner, M. (2006). Public health emergencies: nurses' recommendations for effective actions. *AAOHN journal : official journal of the American Association of Occupational Health Nurses, 54*(8), 347-353.
12. Sexton, J. B., & Adair, K. C. (2019). Forty-five good things: a prospective pilot study of the Three Good Things well-being intervention in the USA for healthcare worker emotional exhaustion, depression, work-life balance and happiness. *BMJ open, 9*(3), e022695.
13. Watt, K., Tippett, V. C., Raven, S. G., Jamrozik, K., Coory, M., Archer, F., & Kelly, H. A. (2010). Attitudes to living and working in pandemic conditions among emergency prehospital medical care personnel. *Prehospital and disaster medicine, 25*(1), 13-19.
14. Wong, E. L. Y., Wong, S. Y. S., Kung, K., Cheung, A. W. L., Gao, T. T., & Griffiths, S. (2010). Will the community nurse continue to function during H1N1 influenza pandemic: a cross-sectional study of Hong Kong community nurses? *BMC health services research, 10*(101088677), 107.

D. Epidemiological design

1. Albott, C. S., Wozniak, J. R., McGlinch, B. P., Wall, M. H., Gold, B. S., & Vinogradov, S. (2020). Battle Buddies: Rapid Deployment of a Psychological Resilience Intervention for Health Care Workers During the COVID-19 Pandemic. Anesthesia and analgesia, 131(1), 43-54.
2. Almutairi, A. F., Adlan, A. A., Balkhy, H. H., Abbas, O. A., & Clark, A. M. (2018). "It feels like I'm the dirtiest person in the world.": Exploring the experiences of healthcare providers who survived MERS-CoV in Saudi Arabia. Journal of infection and public health, 11(2), 187-191.
3. Amaratunga, C. A., O'Sullivan, T. L., Phillips, K. P., Lemyre, L., O'Connor, E., Dow, D., & Corneil, W. (2007). Ready, aye ready? Support mechanisms for healthcare workers in emergency planning: a critical gap analysis of three hospital emergency plans. American journal of disaster medicine, 2(4), 195-210.
4. Chalk, M. (2017). The psychological effects of working at an Ebola treatment centre. British journal of nursing (Mark Allen Publishing), 26(3), 178-179.
5. Englert, E. G., Kiwanuka, R., & Neubauer, L. C. (2019).

'When I die, let me be the last.' Community health worker perspectives on past Ebola and Marburg outbreaks in Uganda. Global public health, 14(8), 1182-1192.
6. Lau, P. Y., & Chan, C. W. H. (2005). SARS (severe acute respiratory syndrome): reflective practice of a nurse manager. Journal of clinical nursing, 14(1), 28-34.
7. Li, Y., Wang, H., Jin, X.-R., Li, X., Pender, M., Song, C.-P., . . . Wang, Y.-G. (2018). Experiences and challenges in the health protection of medical teams in the Chinese Ebola treatment center, Liberia: a qualitative study. Infectious diseases of poverty, 7(1), 92.
8. McMullan, C., Brown, G. D., & O'Sullivan, D. (2016). Preparing to respond: Irish nurses' perceptions of preparedness for an influenza pandemic. International emergency nursing, 26(101472191), 3-7.
9. O'Sullivan, T. L., Amaratunga, C. A., Hardt, J., Dow, D., Phillips, K. P., & Corneil, W. (2007). Are we ready? Evidence of support mechanisms for Canadian health care workers in multi-jurisdictional emergency planning. Canadian journal of public health = Revue canadienne de sante publique, 98(5), 358-363.
10. Smith, E., Burkle, F. M., Gebbie, K., Ford, D., & Bensimon, C. (2018). Acceptable Limitations on Paramedic Duty to Treat During Disaster: A Qualitative Exploration. Prehospital and disaster medicine, 33(5), 466-470.
11. Wu, K., & Wei, X. (2020). Analysis of Psychological and Sleep Status and Exercise Rehabilitation of Front-Line Clinical Staff in the Fight Against COVID-19 in China. Medical science monitor basic research, 26, e924085.
12. Xi, Y., Chen, R., Gillespie, A. L., He, Y., Jia, C., Shi, K., . . . Chan, E. Y. Y. (2019). Mental health workers perceptions of disaster response in China. BMC public health, 19(1), 11.

E. Type of publication (editorials, thesis, etc.)

1. Belfroid, E., van Steenbergen, J., Timen, A., Ellerbroek, P., Huis, A., & Hulscher, M. (2018). Preparedness and the importance of meeting the needs of healthcare workers: a qualitative study on Ebola. *The Journal of hospital infection, 98*(2), 212-218.
2. Chen, Q., Liang, M., Li, Y., Guo, J., Fei, D., Wang, L., . . . Zhang, Z. (2020). Mental health care for medical staff in China during the COVID-19 outbreak. *The lancet. Psychiatry*(101638123).
3. Fiksenbaum, L., Marjanovic, Z., Greenglass, E. R., & Coffey, S. (2006). Emotional Exhaustion and State Anger in Nurses Who Worked During the Sars Outbreak: The Role of Perceived Threat and Organizational Support. *Canadian Journal of Community Mental Health, 25*(2), 89-103.
4. Hall, R. C. W., Hall, R. C. W., & Chapman, M. J. (2008). The 1995 Kikwit Ebola outbreak: lessons hospitals and physicians can apply to future viral epidemics. *General Hospital Psychiatry, 30*(5), 446-452.
5. Heath, C., Sommerfield, A., & von Ungern-Sternberg, B. S. (2020). Resilience strategies to manage psychological distress among healthcare workers during the COVID-19 pandemic: a narrative review. *Anaesthesia*.
6. Indicators, C. o. C. S. o. C. A. T. f., Triggers, Policy, B. o. H. S., & Medicine, I. o. (2013).
7. Kang, L., Li, Y., Hu, S., Chen, M., Yang, C., Yang, B. X., . . . Liu, Z. (2020). The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. *The lancet. Psychiatry, 7*(3), e14.
8. Kuper, H., Lyra, T. M., Moreira, M. E. L., de Albuquerque, M. d. S. V., de Araujo, T. V. B., Fernandes, S., . . . Valongueiro, S. (2018). Social and economic impacts of congenital Zika syndrome in Brazil: Study protocol and rationale for a mixed-methods study. *Wellcome open research, 3*(101696457), 127.
9. Lehmann, M., Bruenahl, C. A., Lowe, B., Addo, M. M., Schmiedel, S., Lohse, A. W., & Schramm, C. (2015). Ebola and psychological stress of health care professionals. *Emerging infectious diseases, 21*(5), 913-914.
10. Lozano-Vargas, A. (2020). Impact of the Coronavirus epidemic (COVID-19) on the mental health of health workers and general population in China. *Revista de Neuro-Psiquiatria, 83*(1), 51-56.
11. Macks, J. A., & Abrams, D. I. (1992). Burnout among HIV/AIDS health care providers. Helping the people on the frontlines. *AIDS clinical review*, 281-299.
12. Makamure, M., Makamure, M., Mendiola, W., Renteria, D., Repp, M., & Willden, A. (2013). A review of critical care nursing and disease outbreak preparedness. *Dimensions of critical care nursing : DCCN, 32*(4), 157-161.
13. Maunder, R. G. (2009). Was SARS a mental health catastrophe? *General Hospital Psychiatry, 31*(4), 316-317.
14. Maunder, R. G., Leszcz, M., Savage, D., Adam, M. A., Peladeau, N., Romano, D., . . . Schulman, B. (2008). Applying the lessons of SARS to pandemic influenza: an evidence-based approach to mitigating the stress experienced by healthcare workers. *Canadian journal of public health = Revue canadienne de sante publique, 99*(6), 486-488.
15. Neto, M. L. R., Almeida, H. G., Esmeraldo, J. D. a., Nobre, C. B., Pinheiro, W. R., de Oliveira, C. R. T., . . . da Silva, C. G. L. (2020). When health professionals look death in the eye: the mental health of professionals who deal daily with the 2019 coronavirus outbreak. *Psychiatry research, 288*, 112972.
16. Nochaiwong, S., Ruengorn, C., Awiphan, R., Ruanta, Y., Boonchieng, W., Nanta, S., . . . Mental Health Care Evaluation Survey Research, G. (2020). Mental health circumstances among health care workers and general

public under the pandemic situation of COVID-19 (HOME-COVID-19). *Medicine, 99*(26), e20751.
17. Paladino, L., Sharpe, R. P., Galwankar, S. C., Sholevar, F., Marchionni, C., Papadimos, T. J., . . . Medicine, A. C. o. A. I. (2017). Reflections on the Ebola Public Health Emergency of International Concern, Part 2: The Unseen Epidemic of Posttraumatic Stress among Health-care Personnel and Survivors of the 2014-2016 Ebola Outbreak. *Journal of global infectious diseases, 9*(2), 45-50.
18. Singh, R., Tadi, P., & Marlowe, D. (2019). Provider Burnout.
19. Spiers, J., Buszewicz, M., Chew-Graham, C., Gerada, C., Kessler, D., Leggett, N., . . . Riley, R. (2016). Who cares for the clinicians? The mental health crisis in the GP workforce. *The British journal of general practice : the journal of the Royal College of General Practitioners, 66*(648), 344-345.
20. Sprecher, A., Van Herp, M., & Rollin, P. E. (2017). Clinical Management of Ebola Virus Disease Patients in Low-Resource Settings. *Current topics in microbiology and immunology, 411*, 93-113.
21. Srivatsa, S., & Stewart, K. A. (2020). How Should Clinicians Integrate Mental Health Into Epidemic Responses? *AMA journal of ethics, 22*(1), E10-15.
22. Tosh, P. K., & Sampathkumar, P. (2014). What clinicians should know about the 2014 Ebola outbreak. *Mayo Clinic proceedings, 89*(12), 1710-1717.
23. Ulrich, C. M. (2014). Ebola is causing moral distress among African healthcare workers. *BMJ (Clinical research ed.), 349*(8900488), g6672.
24. Zhang, S. X., Liu, J., Afshar Jahanshahi, A., Nawaser, K., Yousefi, A., Li, J., & Sun, S. (2020). At the height of the storm: Healthcare staff's health conditions and job satisfaction and their associated predictors during the epidemic peak of COVID-19. *Brain, behavior, and immunity, 87*, 144-146.

F. Language of the publication (not available in Spanish or English)

1. Chiang, H.-H., Chen, M.-B., & Sue, I.-L. (2006). [Ethical dilemmas in caring for patients with SARS]. *Hu li za zhi The journal of nursing, 53*(5), 28-34.
2. Huang, J. Z., Han, M. F., Luo, T. D., Ren, A. K., & Zhou, X. P. (2020). [Mental health survey of 230 medical staff in a tertiary infectious disease hospital for COVID-19]. *Zhonghua lao dong wei sheng zhi ye bing za zhi = Zhonghua laodong weisheng zhiyebing zazhi = Chinese journal of industrial hygiene and occupational diseases, 38*, E001.
3. Huang, W., Hua, Q., Wu, H., Xu, W.-y., Tian, J.-h., Chen, H., . . . Zhang, J. (2004). [A study on the differences of emotion and depression between patients as doctor/nurse and others occupation with severe acute respiratory syndrome]. *Zhonghua liu xing bing xue za zhi = Zhonghua liuxingbingxue zazhi, 25*(1), 23-26.
4. K.-R., Z., Y., X., Z.-G., L., H., Y., L.-P., S., Y.-Z., X., . . . M., F. (2005). Controlled study of posttraumatic stress disorder among patients with severe acute respiratory syndrome and first-line hospital staffs as well as public in prevalent areas. *Chin. J. Clin. Rehab., 9*(12), 94-96.
5. Q., Z., X.-L., Y., X.-Q., H., & X.-B., H. (2005). Attitude of high-risk medical personnel towards severe acute respiratory syndrome and their psychological characteristics. *Chin. J. Clin. Rehab., 9*(4), 77-79.
6. X.-L., L., X.-L., L., & Q., Z. (2005). An investigation of response to SARS stress and mental health of nurse students during SARS prevalent period. *Chin. J. Clin. Rehab., 9*(44), 165-167.
7. Xue-hua, L. (2003). *SCL-90 Results of Medical Staffs treating SARS*.
8. Xuehua, L., Li, M., & Fangiang, M. (2003). Psychological Stress of Nurses in SARS Wards. *Chinese Mental Health Journal, 17*(8), 526-527.
9. Y., X., K.-R., Z., & H., Y. (2005). Difference of posttraumatic stress disorder between severe acute respirtory syndrome patients and the public in epidemic area. *Chin. J. Clin. Rehab., 9*(16), 214-215.

ONLINE APPENDIX 3. ASSESSMENT OF RISK OF BIAS.

A. Risk of bias in cross-sectional studies, assessed by "Risk of Bias Instrument for Cross-Sectional Surveys of Attitudes and Practices" (Evidence Partners)

	Population representativeness	Response rate	Missing data	Survey clinically sensible	Reliability and validity of the instruments
Dosil 2020	?	?	?	+	+
Jahrami 2020	?	?	?	+	+
Huang 2020	?	?	+	+	+
Kang 2020	?	?	?	+	+
Lai 2020	?	+	?	+	?
Qi 2020	?	?	+	+	+
Que 2020	?	?	+	+	+
Shechter 2020	-	-	-	?	?
Stojanov 2020	?	?	?	+	+
Tu 2020	?	+	?	+	+
Wang, Huang 2020	?	+	+	+	+
Wang, Xie, 2020	?	?	+	+	+
Xiao 2020	+	+	+	+	+
Yin 2020	?	?	?	?	+
Zhan 2020	+	+	?	+	+
Zhang, Wang 2020	?	?	?	+	+
Zhang, Yang 2020	?	?	?	+	+

+ Low risk
? Some concerns
- High risk

B. Risk of bias in cohort studies, assessed by "Tool to Assess Risk of Bias in Cohort Studies" (Evidence Partners)

	Yuan 2020
Exposed and non-exposed cohorts drawn from the same population	?
Confident in the assessment of exposure	?
Outcome of interest was not present at start of study	-
Associated or prognostic variables analyzed	-
Assessment of prognostic factors	?
Assessment of aoutcome	?
Follow-up of cohorts	?
Co-interventions similar between groups	+

+ Low risk
? Some concerns
- High risk