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Editorial Board Member of *World Journal of Meta-Analysis*, Zhi-Yong Shen, MD, Associate Professor, Chief Doctor, Department of Radiology, Nantong University Affiliated Tumor Hospital, Nantong 226361, Jiangsu Province, China. ntszy259296@126.com

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## Burnout syndrome and anxiety among healthcare workers during global pandemics: An umbrella review

Clayton Yang Teng Bey, Jin-Uu Koh, Christopher Wai Keung Lai

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**Clayton Yang Teng Bey, Jin-Uu Koh, Christopher Wai Keung Lai,** Health and Social Science Cluster, Singapore Institute of Technology, Dover Drive 138683, Singapore

**Corresponding author:** Christopher Wai Keung Lai, PhD, Associate Professor, Health and Social Science Cluster, Singapore Institute of Technology, 10 Dover Drive, Dover Drive 138683, Singapore. [chris.lai@singaporetech.edu.sg](mailto:chris.lai@singaporetech.edu.sg)

### Abstract

#### BACKGROUND

Burnout syndrome and anxiety are two mental health symptoms experienced by healthcare workers (HCWs) that can be exacerbated during pandemics due to increased job demands and the global health workforce crisis.

#### AIM

To provide a comprehensive review and summary of evidence on burnout and anxiety in HCWs during previous global pandemics.

#### METHODS

A systematic search on electronic databases such as PubMed Central and MEDLINE was conducted to identify high-quality systematic review studies that reported on the prevalence of burnout and/or anxiety in HCWs during any previous global pandemic.

#### RESULTS

Twenty-four high quality systematic review articles were found to be suitable for inclusion. Twenty articles focused merely on Coronavirus disease 2019, while four articles examined multiple pandemics. Burnout was examined in nine articles, while anxiety was examined in the remaining 21 articles. Female HCWs and nurses were identified to be at a higher risk of developing burnout and anxiety during pandemic. We also observed a variation in the prevalence of burnouts and anxiety across different studies due to different mental health instruments were used in different studies.

#### CONCLUSION

Nurses and females HCWs had a high prevalence of burnout syndrome and anxiety during pandemic. More emphasis and attention should be paid to safeguarding the psychological well-being of these at-risk populations in the future pandemics.

**Key Words:** Burnout; Anxiety; Pandemics; COVID-19

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**Core Tip:** During the pandemic, burnout syndrome and anxiety were highly prevalent among nurses and other female healthcare professionals. More emphasis and attention should be directed to protecting the psychological well-being of these at-risk populations in the event of future pandemics. This study has implications for healthcare stakeholders, advising them to prioritize safeguarding the psychological health of those who are vulnerable to pandemics in the future.

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## INTRODUCTION

Burnout is defined as a “syndrome conceptualised as resulting from chronic workplace stress that has not been successfully managed” [1]. From this definition, it is obvious how pandemics, which can last from months to years, can result in an increased prevalence of burnout among healthcare workers (HCWs) [2]. Furthermore, it is also hard to predict the exact duration of pandemics, such as in the ongoing coronavirus disease 2019 (COVID-19) pandemic that has been ongoing since December 2019. Some other examples of pandemics that occurred in the 21<sup>st</sup> century include the Middle East respiratory syndrome (MERS) pandemic caused by the MERS-coronavirus (CoV), the H1N1 influenza pandemic caused by the H1N1 influenza virus, and the severe acute respiratory syndrome (SARS) pandemic, caused by the SARS-CoV [3].

Anxiety is characterised by “excessive fear and worry and related behavioural disturbances”, producing significant distress or significant functional impairment [4]. If left unmanaged, anxiety can lead to burnout in high-risk individuals [5]. In a longitudinal study conducted in a large public hospital in Singapore to prospectively assess job-related burnout and psychological outcomes such as burnout and anxiety of HCWs during early COVID-19, 23% and 13% of 1410 participants experienced burnout and anxiety respectively [6].

Even during periods of non-pandemics, burnout and anxiety are prevalent in HCWs due to demanding job responsibilities. In addition, there is a serious shortage of HCWs across the globe, described by the World Health Organization as a global health workforce crisis, where they estimate an insufficiency of 10 million HCWs by 2030 [7]. During pandemics, HCWs play a crucial role in their management, which can further exacerbate these issues as job demands intensify. By being on the front lines, HCWs receive increased exposure to stressors such as limited resources, increased occupational hazards, longer shifts, and disrupted work-life balance, which can lead to the development of burnout and anxiety, among other mental health symptoms [8].

A plethora of interventions exist to help curb mental health issues in HCWs, be it individual-focused or organizational interventions [9]. The former include cognitive-behavioural therapy, physical relaxations such as massages, or mental relaxations such as meditation; for the latter, working conditions and schedules are altered, communication skills are improved, as well as implementation of support programmes [10].

The systematic review and meta-analysis study by West *et al* [9] concluded that both approaches result in reduced incidence of burnout, but more research is necessary to establish the most effective interventions for a specific population. On the other hand, in a Cochrane review by Ruotsalainen *et al* [10], the authors concluded that only low-quality evidence is available that shows improvements in mental health outcomes with individual-focused interventions; for organisational changes such as improving work conditions and organising support or special care models, significant reductions in stress levels were not achieved. With the little information exist, therefore, this umbrella review hypothesis that prevalence of burnout and anxiety in certain group of HCW will be high during pandemics. This umbrella review also serves to provide a broader summation of relevant data on anxiety and burnout respectively, and to explore possible risk factors and interventions for HCWs.

## MATERIALS AND METHODS

### Study design

This umbrella review was conducted according to the recommendations of PRISMA, using the PRISMA 2020 checklist. There is no similar protocol exists in the International Prospective Register of Systematic Reviews (PROSPERO). Furthermore, this review was conducted in conformance to the Joanna Briggs Institute (JBI) umbrella review protocol.

**Table 1** The search strategy of the present umbrella review study

Search terms	Results	Database(s)
Anxiety in healthcare professionals pandemic	82	Google Scholar
Burnout in healthcare professionals pandemic	50	Google Scholar
[(healthcare) OR (physician) OR (health personnel)] AND [(burnout) OR (anxiety)] AND (pandemic) NOT (intervention)	44	PubMed Central; MEDLINE
[(healthcare) OR (physician) OR (health personnel)] AND [(burnout) (health personnel)] AND [(burnout) OR (anxiety)] AND (COVID-19)	46	PubMed Central; MEDLINE
NOT (intervention) (burnout syndrome OR anxiety) AND (healthcare workers OR medical professionals) AND (global pandemics OR COVID-19 OR SARS OR MERS)	145	PubMed Central; MEDLINE

COVID-19: Coronavirus disease 2019; SARS: Severe acute respiratory syndrome; MERS: Middle East respiratory syndrome.

### Search strategy

A PICO question was first developed with the population including HCWs, the interest including burnout and anxiety, the context including pandemics and the outcome including the comparison of prevalence of both burnout and anxiety and also the exploration of interventions for both mental health problems. Starting from August 31, 2022, initial keywords were identified such as “anxiety”, “burnout”, “healthcare”, “healthcare workers OR medical professionals”, “pandemic” and “COVID-19”. Preliminary search on PROSPERO yielded no results however there were two similar ongoing systematic reviews (CRD42022259101) and (CRD42021260307). Next, the databases searched were PubMed Central, MEDLINE, and Google Scholar. Gray literature, which included internet sites and news articles, was also searched. Lastly, references from literature reviews that were done during screening were also included. [Table 1](#) shows a summary of the search strategies used in the present study.

### Eligibility criteria

Systematic review studies were only to be included if they fulfilled the eligibility criteria as follows: (1) Studies that conducted a systematic review with or without a meta-analysis; (2) Studies conducted with regard to pandemics (*e.g.*, SARS, MERS, COVID, *etc.*); (3) Studies with at least 1 mental health outcome stated in the objective (*i.e.*, burnout and/or anxiety); and (4) Studies that investigated patient-facing healthcare personnel as the population of interest (regardless of age, gender, or ethnicity).

On the other hand, studies were to be excluded if they were: (1) Non-English; and (2) Systematic reviews and review articles that did not use a systematic approach (*i.e.*, rapid and scoping reviews).

### Critical appraisal

Critical appraisal was also done independently by both researcher (Koh JU and Bey CYT). The JBI 2017 critical appraisal checklist for Systematic Reviews and Research Syntheses was used. An item would be scored “0” if it was answered “NO” or “UNCLEAR”; if it was answered “YES,” then the item score was “1.” The study quality was assessed as follows: low quality = 0–3, moderate quality = 4–7, and high quality = 8–11. Only high-quality studies were included in this umbrella review (*i.e.* scoring 9 out of 11). Of the 55 articles assessed, 16 articles were excluded for having a less than 80% for the critical appraisal (*i.e.* scoring 8 and below).

### Study selection and data extraction

Two reviewers (Bey CYT and Koh JU) independently screened the titles and abstracts of the remaining studies according to the aforementioned inclusion and exclusion criteria. Should there be insufficient information provided in the titles and/or abstracts, the full text was obtained for evaluation. Any disputes were resolved by means of a discussion to obtain consensus and if the reviewers were unable to arrive at an agreement, the principal investigator (Lai CWK) was consulted.

Information extracted include: (1) Authors; (2) Database(s) searched; (3) Study design(s); (4) Risk of bias assessment; (5) Number of studies included; (6) Study location(s); (7) Study population(s); (8) Period of study; (9) Pandemic(s) studies; and (10) Mental health outcome(s).

### Data collection

Data were retrieved from all included studies by one reviewer using a self-generated data extraction form and then double-checked by the second reviewer to minimize mistakes. The data included the author, publication year, database searched, study design, studies included, study population, study period, pandemic studied, mental health outcomes, risk of bias, burnout prevalence and anxiety prevalence. Synthesis of results was achieved by combining results of all included studies.

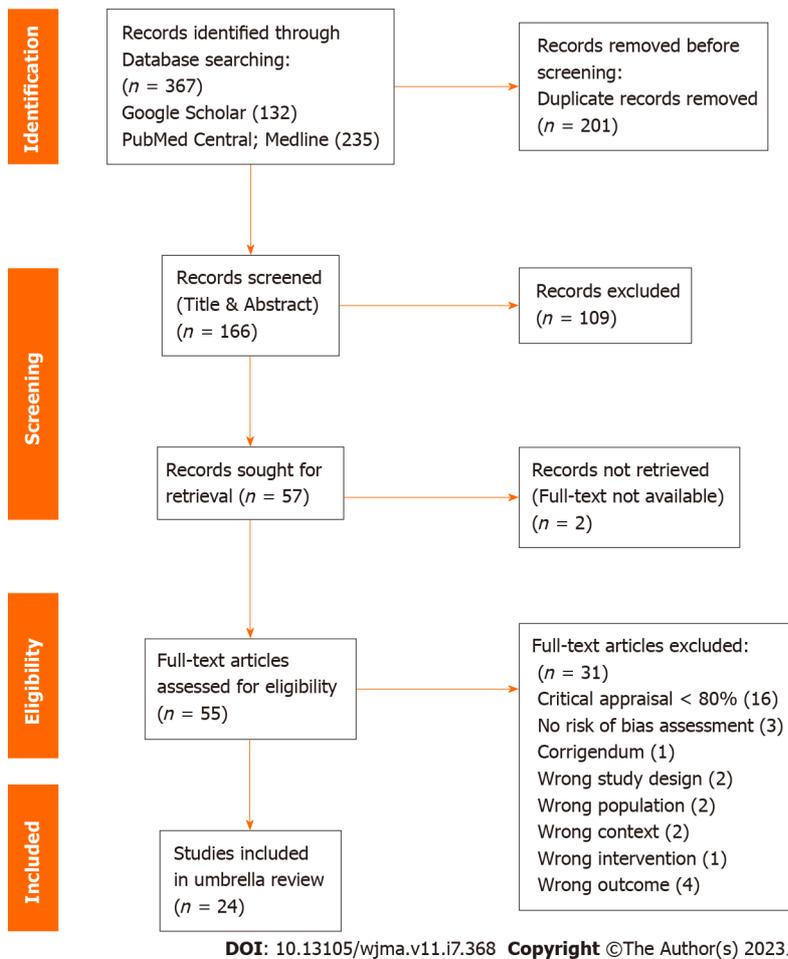


Figure 1 PRISMA flow diagram.

## RESULTS

### Study selection process

The initial database search returned 367 results, of which 201 were removed during deduplication. The titles and abstracts of the 166 remaining records were then screened, which resulted in 109 records being excluded. When retrieving the full text of the 57 included records, two were found to be unavailable, resulting in 55 articles assessed for eligibility. During the screening of the full-text articles, 31 articles were rejected due to reasons such as having a critical appraisal score of < 80%, no risk of bias assessment, being a corrigendum, as well as having the wrong study design, population, context, intervention, and outcome. [Figure 1](#) shows the PRISMA flow diagram depicting the details of the different phases of the systematic search.

### Study characteristics

[Table 2](#) shows the characteristics of the studies included in the umbrella systematic review. The majority of the included studies were systematic reviews with meta-analysis, with 16 (67%) articles, while the other 8 (33%) were solely systematic reviews. In addition, nurses were the population studied for 4 (17%) articles, while the rest studied HCWs as a whole. Twenty (83%) articles reviewed only COVID-19 while only 4 (17%) reviewed multiple pandemics including SARS, MERS, Ebola, H1N1, H7N9, and COVID-19.

### Different mental health instruments used

Anxiety was examined in the majority of the shortlisted studies, with 21 articles reporting on its prevalence. In these studies, the tools used to measure anxiety include the Beck Anxiety Inventory (BAI), Depression Anxiety Stress Scale-21 (DASS-21), Generalised Anxiety Disorder-2 (GAD-2), Generalised Anxiety Disorder-7 (GAD-7), Hamilton Anxiety Scale, Hospital Anxiety and Depression Scale, Coronavirus Anxiety Scale, Patient Health Questionnaire, State-Trait Anxiety Inventory (STAI-S), and Zung Self-Rating Anxiety Scale (SAS).

Only Four articles examined burnout in HCWs during pandemics. Mini-Z Burnout Survey (Mini-Z), Copenhagen Burnout Inventory (CBI), Maslach Burnout Inventory (MBI), Oldenburg Burnout Inventory, Stanford Professional Fulfilment Index, and Professional Fulfilment Index.

**Table 2 Summary of articles (n = 24) that included in this umbrella review**

Ref.	Database(s) searched	Study design	Studies included	Study population	Study period	Pandemic studied	Mental health outcome(s) measured	Risk of bias (quality) assessment	Burn out prevalence	Anxiety prevalence
Abdulla <i>et al</i> [39], 2021	MEDLINE (PubMed); Cochrane Library; Scopus; Web of Science; Google; Google Scholar; ResearchGate	Systematic review and meta-analysis	23	Multi-professional healthcare workers	Until Feb 2021	COVID-19	Anxiety	Downs and Black checklist	NIL	42.87%
Adibi <i>et al</i> [26], 2021	ISC; Magiran; PubMed; Scopus; Web of Science; Cochrane; ProQuest; Science Direct; Embase; Google Scholar	Systematic Review and Meta-analysis	15	Multi-professional healthcare workers	Jan 2020 to Jun 2020	COVID-19	Anxiety	STROBE checklist	NIL	30.5%
Aymerich <i>et al</i> [12], 2022	Web of Science Core Collection; BIOSIS Citation Index; KCI-Korean Journal Database; MEDLINE; Russian Science Citation Index; SciELO Citation Index; Cochrane Central Register of Reviews; Ovid/PsycINFO	Systematic Review and Meta-analysis	239	Multi-professional healthcare workers	Until Mar 2021	COVID-19	Anxiety; Burnout	NOS	37.0%	42.0%
Busch <i>et al</i> [16], 2021)	PubMed; Web of Science Core Collection; MEDLINE; PsycINFO	Systematic Review and Meta-analysis	86	Multi-professional healthcare workers	Until Oct 2020	SARS, H1N1, Ebola, MERS, COVID-19	Anxiety; Burnout	JBIC critical appraisal tool	31.81%	25.36%
Chen <i>et al</i> [30], 2022	CNKI; VIP; WanFang Data; PubMed	Systematic Review and Meta-analysis	30	Multi-professional healthcare workers	Dec 2019 to Apr 2022	COVID-19	Anxiety	Agency for Healthcare Research and Quality 11-item checklist	NIL	43.0%
Chigwedere <i>et al</i> [40], 2021	PubMed; PsycInfo; PsycArticles	Systematic Review	76	Multi-professional healthcare workers	Until June 2020	SARS, MERS, Ebola, H1N1, H7N9, COVID-19	Anxiety; Burnout	JBIC checklist for cross-sectional studies and cohort studies	NIL	NIL
Ching <i>et al</i> [13], 2021	Medline; Cinahl; PubMed; Scopus databases	Systematic Review and Meta-analysis	148	Multi-professional healthcare workers	Until Mar 2021	COVID-19	Anxiety; Burnout	STROBE checklist	68.3%	39.7%
Dong <i>et al</i> [24], 2021	PubMed; Embase; PsycINFO; Wanfang Data; Chongqing VIP; Sinomed; Chinese National Knowledge Infrastructure databases	Systematic Review and Meta-analysis	22	Multi-professional healthcare workers	Jan 2020 to Oct 2020	COVID-19	Anxiety	Agency for Healthcare Research and Quality 11-item checklist	NIL	34.4%
Dutta <i>et al</i> [27], 2021	PubMed/MEDLINE; Cochrane Library; Scopus; PsycINFO	Systematic Review and Meta-analysis	33	Multi-professional healthcare workers	Dec 2019 to Aug 2020	COVID-19	Anxiety	NOS	NIL	32.5%
Galanis <i>et al</i>	PubMed; Scopus; ProQuest; Cochrane COVID-19	Systematic	6	Nurses	Jan 2020	COVID-19	Burnout	JBIC critical appraisal	Emotional exhaustion:	NIL

[14], 2021	registry; CINAHL; pre-print services (medRxiv and PsyArXiv)	Review and Meta-analysis			to Nov 2020			tool	34.1%; Depersonalisation: 12.6%; Lack of personal accomplishment: 15.2%	
Ghahramani <i>et al</i> [15], 2021	PubMed; Scopus; EMBASE; ScienceDirect Web of Science; Cochrane Library; ProQuest	Systematic Review and Meta-analysis	27	Multi-professional healthcare workers	Until Jan 2021	COVID-19	Burnout	STROBE checklist	52.0%	NIL
Gualano <i>et al</i> [11], 2021	PubMed; Embase; SCOPUS; PsycINFO	Systematic Review	11	Multi-professional healthcare workers	Jan 2020 to Nov 2020	COVID-19	Burnout	AXIS tool	49.3% to 58.0%	NIL
Hao <i>et al</i> [29], 2021	PubMed; EMBASE; Scopus; PsycINFO; Chinese Biomedical Literature Database; China National Knowledge Infrastructure; China Science and Technology Journal Database; Wanfang database	Systematic Review and Meta-analysis	20	Multi-professional healthcare workers	Jan 2020 to Apr 2020	COVID-19	Anxiety	Agency for Healthcare Research and Quality 11-item checklist	NIL	28.6%
Hill <i>et al</i> [28], 2022	MEDLINE; Embase; The Cochrane Library (Cochrane Database of Systematic Reviews); PsycINFO	Systematic Review and Meta-analysis	43	Multi-professional healthcare workers	Until Mar 2020	SARS, MERS, COVID-19	Anxiety	Hoy quality assessment checklist	NIL	COVID: 16.1%; SARS: 14.8%; MERS: 5.8%
Koontalay <i>et al</i> [41], 2021	MEDLINE <i>via</i> PubMed; CINAHL Complete; Embase through Ovid; Scopus; Web of Science	Systematic Review	10	Multi-professional healthcare workers	Nov 2020 to Feb 2021	COVID-19	Anxiety; Burnout	CASP Qualitative Research Checklist	NIL	NIL
Marvaldi <i>et al</i> [19], 2021	PubMed; PsycINFO	Systematic Review and Meta-analysis	70	Multi-professional healthcare workers	Until Oct 2020	COVID-19	Anxiety	NIH's quality assessment tool and Crombie's items	NIL	30.0%
Pappa <i>et al</i> [18], 2020	MEDLINE; PubMed; Google Scholar databases; Medrxiv; SSRN server	Systematic Review and Meta-analysis	13	Multi-professional healthcare workers	Until Apr 2020	COVID-19	Anxiety	NOS	NIL	23.2%
Salari <i>et al</i> [42], 2020	SID; MagIran; IranMedex; IranDoc; Science-Direct; Embase; Scopus; PubMed; Web of Science (ISI); Google Scholar	Systematic Review and Meta-analysis	29	Multi-professional healthcare workers	Dec 2019 to Jun 2020	COVID-19	Anxiety	STROBE checklist	NIL	25.8%
Salazar de Pablo <i>et al</i> [17], 2020	Web of Science; grey literature	Systematic Review and Meta-analysis	115	Multi-professional healthcare workers	Jan 2020 to Apr 2020	SARS,MERS,COVID-19	Anxiety; Burnout	Mixed Methods Appraisal Tool(MMAT)	COVID: 25.0%; SARS: 22.2%; Any coronavirus:34.4%	COVID: 22.2%; SARS: 45.7%; Any coronavirus: 29.0%
Saragih <i>et al</i> [20], 2021	PubMed; Academic Search Complete; CINAHL; Web of Science; MEDLINE Complete; SocINDEX	Systematic Review and Meta-analysis	38	Multi-professional healthcare workers	Dec 2019 to Nov 2020	COVID-19	Anxiety	JBİ tool for cross-sectional studies and the 10-questions of JBİ tool for	NIL	40.0%

										case-control studies
Ślusarska <i>et al</i> , 2022[25]	PubMed; Web of Science; SCOPUS	Systematic Review and Meta-analysis	23	Nurses	Mar 2020 to Feb 2021	COVID-19	Anxiety	Agency for Healthcare Research and Quality 11-item checklist	NIL	29.0%
Sun <i>et al</i> [22], 2021	PUBMED; EMBASE; WEOF SCIENCE	Systematic Review and Meta-analysis	47	Multi-professional healthcare workers	Nov 2019 to Sep 2020	COVID-19	Anxiety	Modified NOS	NIL	38.0%
Xiong <i>et al</i> [21], 2022	Medline; PsycINFO; EMBASE; the Cochrane Library (including Cochrane Database of Systematic Reviews); Sinomed; CNKI, WanFang data; Medrxiv; SSRN servers; Google Scholar; daily updated WHO COVID-19database	Systematic Review and Meta-analysis	44	Multi-professional healthcare workers	Until Jun 2020	COVID-19	Anxiety	Modified NOS	NIL	17.0%
Zhang <i>et al</i> [23], 2021	PubMed; Embase; the Cochrane Library; E. B. Stephens Company data- base; Web of Science; ALOIS; PsycINFO; Cumulative Index to Nursing and Allied Health Literature database (CINAHL); ClinicalTrials.gov; Chinese National Knowledge Infrastructure (CNKI); Sinomed; Wanfang Data; Chongqing VIP database	Systematic Review and Meta-analysis	26	Multi-professional healthcare workers	Jan 2020 to May 2020	COVID-19	Anxiety	Quality	NIL	27.0%

COVID-19: Coronavirus disease 2019; SARS: Severe acute respiratory syndrome; MERS: Middle East respiratory syndrome; NOS: Newcastle-Ottawa Scale.

### Mental health findings

**Prevalence of burnout during COVID-19:** Five articles reported on the pooled prevalence of burnout in HCWs during COVID-19, which ranged from 25.0% to 68.3%.

The systematic review by Gualano *et al* examined burnout in HCWs working in Intensive Care Units and Emergency Departments during the COVID-19 pandemic and found that the prevalence of overall burnout ranged from 49.3% to 58.0% [11]. Another systematic review and meta-analysis by Aymerich *et al*[12] reported a pooled prevalence of 37.0% for burnout symptoms. However, when looking at the individual instruments, the prevalence varied from 22.0% when using Mini-Z to 53.0% when using CBI. In the systematic review and meta-analysis by Ching *et al*[13], the pooled prevalence of moderate to severe burnout among HCWs was 68.3%, with Korea having the highest prevalence at 90.4%, and China having the lowest at 58.0%.

Two studies reported the prevalence of the three individual dimensions of burnout: emotional exhaustion, depersonalisation, and lack of personal accomplishment. In the systematic review and meta-analysis by Galanis *et al*[14], they were 34.1%, 12.6%, and 15.2,% respectively. Ghahramani *et al*[15] on the other hand, reported these to be 51.0%, 52.0%, and 28.0%, respectively.

**Prevalence of burnout across multiple pandemics:** Two articles reported on the pooled prevalence of burnout across multiple pandemics, which ranged from 31.81% to 34.4%.

The systematic review and meta-analysis by Busch *et al*[16] reported the prevalence of burnout in HCWs to be 31.81%. Salazar de Pablo *et al*'s[17] systematic review and meta-analysis reported pooled prevalence of SARS, COVID-19, and any

pandemic to be 38.2%, 25.0%, and 34.4% respectively. For SARS, 2 studies were analysed with a total of 1305 participants. For COVID-19, only one study with 32 participants was analysed. For any pandemic, three studies were analysed with a total of 1,337 participants.

**Prevalence of anxiety during COVID-19:** Sixteen articles reported on the pooled prevalence of anxiety in HCWs during COVID-19, which ranged from 16.1% to 43.0%.

The systematic review and meta-analysis by Pappa *et al*[18] examined anxiety in 12 studies and reported a pooled prevalence of 23.21%. However, when considering only studies that had a low risk of bias, the prevalence was 24.06%. Marvaldi *et al*[19] and Saragih *et al*[20] studies reported anxiety prevalence of 30% and 40%, respectively, but both studies noted the presence of substantial heterogeneity. Ching *et al*[13] found that the pooled prevalence of mild to severe anxiety in Asia was 39.7%.

Xiong *et al*'s[21] review of 18 studies with 34793 participants estimated a 17.0% prevalence of moderate to severe anxiety. Another study that specified the level of anxiety was a systematic review and meta-analysis by Sun *et al*[22], which reported the prevalence of moderate to severe anxiety to be 21.0%, while the prevalence of mild anxiety was 26.0%.

Two studies compared the prevalence of anxiety in HCWs during COVID-19 over time. The systematic review and meta-analysis by Zhang *et al*[23] investigated a total sample size of 21447 HCWs from 23 studies reporting a decrease in anxiety rates over time, from 37.7% to 56.3% in the first week of February to 27.0% to 30.8% in the final week of February. Similarly, Dong *et al*[24] divided the survey time of 22 studies into three stages and found that the pooled prevalence of anxiety was the highest in the earliest stage, and decreased in later stages.

Several reviews that included studies which emphasize different mental health instruments found that prevalence can vary depending on the tool used. Ślusarska *et al*[25] reported that in the 12 studies that used the GAD-7 scale, the prevalence was 22%, but in the four studies that used the SAS scale, the prevalence was 7.0%; for studies that used other scales, the prevalence was 57.0%. Adibi *et al*[26] performed a meta-analysis on 19 studies which used either GAD-2 or GAD-7 to measure anxiety, reporting a prevalence of 22.62% when using the former, and 32.04% for the latter. A systematic review and meta-analysis by Aymerich *et al*[12] reported anxiety prevalence in 179 studies, with a total sample size of 206513. Overall prevalence was 42.0% but was noted to vary substantially depending on the scales used. For instance, for studies using the BAI, the prevalence was 34.0%, but studies using STAI-S reported a prevalence of 68.0%. Lastly, Dutta *et al*'s[27] systematic review and meta-analysis consisted of 31 articles that used different tools for the measurement of anxiety – GAD-7 was used in nine studies and pooled prevalence was 45.1%; DASS-21 was used in eight studies and pooled prevalence was 39.0%; SAS was used in six studies and pooled prevalence was 14.0%.

**Prevalence of anxiety across multiple pandemics:** Three articles examined the pooled prevalence of anxiety across different pandemics, which ranged from 25.4% to 29.0%.

Salazar de Pablo *et al*[17] reviewed two studies on SARS which consisted of a total of 1475 participants, four studies on COVID-19 which consisted of 7716 participants, and any pandemic, which consisted of 9191 participants. Prevalence was 45.7%, 22.2%, and 29.0%, respectively.

Hill *et al*[28] reported the prevalence of anxiety in HCWs during SARS, COVID-19, and MERS to be 14.8%, 18%, and 5.8%, respectively. The authors also noted that the overall prevalence of anxiety symptoms was higher than that of anxiety disorders, at 45.9% compared to 16.1%. A systematic review and meta-analysis by Busch *et al*[16] reported the overall prevalence of anxiety to be 25.36%.

**The at-risk group 1 (Nurses):** Multiple studies also reported that nurses were found to have a higher prevalence of mental health symptoms compared to other HCWs. In a review of HCWs in intensive care units and emergency departments, Gualano *et al*[11] reported that nurses had the highest prevalence of burnout at 64%, compared to advanced practice providers (56%), respiratory therapists (55%), physicians (49%), and physicians-in-training (48%). Emotional exhaustion and depersonalisation were also higher in nurses in critical care units, at 24.7%. Ghahramani *et al*'s[15] subgroup analysis reported overall burnout among the group which consisted of physicians and/or nurses to be the highest at 66%, compared to that of a group that mixed HCWs which were 40%. However, the mixed HCWs group had a higher prevalence for the individual components. Ching *et al*'s[13] data on burnout showed that the nurse population had an 80.2% prevalence of experiencing burnout, followed by doctors at 74.9% and lastly by allied healthcare personnel at 64.9%. Hao *et al*[29] reported that in seven out of 16 studies in their subgroup analysis that the prevalence of anxiety in nurses was 36.8% as compared to when mixed staff groups were analysed, where the prevalence was 26.8%. Similarly, Dong *et al*'s[24] meta-analysis also reported higher anxiety prevalence among nurses, 44.0% compared to 29.0% among overall HCWs. Ching *et al*[13] also found anxiety to be most prevalent in nurses at 43.1%, which surpasses that of doctors, dentists, allied healthcare professionals, and pharmacists, which had an anxiety prevalence of 38.6% to 39.6%. When compared to medical doctors, Chen *et al*[30] also reported a higher prevalence of anxiety in nurses, 45.0% compared to 25.0%.

**The at-risk group 2 (Females HCWs):** Other than nurses, HCWs of the female gender were also found to be more susceptible to anxiety. In 11 studies that reported on anxiety prevalence by gender, the pooled prevalence was 50.0% in females compared to 36.0% in males[22]. The prevalence of anxiety in females reported by Ching *et al*[13] was 50.6% compared to 40.4% in males. Chen *et al*[30] reported the prevalence of anxiety in females to be 38.0% compared to 26% in males. Salazar de Pablo *et al*[17] review found that studies which included nurses were associated with higher psychological distress compared to studies which included multiple professions or were physician-only.

## DISCUSSION

This umbrella review provides a comprehensive summary of the prevalence of burnout and anxiety in HCWs during periods of pandemics, and showcases the high prevalence of burnout and anxiety during the period of pandemics. The findings of this review also highlight the utmost importance for interventions to support the mental health of HCWs during pandemics.

From this umbrella review, female HCWs, nurses and frontline HCWs are the main highlight of burnout and anxiety during pandemics. This was the result of increased workload, longer working hours, physical exhaustion and increases the need to make ethical decisions for treatment priority during pandemic[31]. The main concern for HCWs is the risk of infections to colleagues and family members and patient violence attributed to long waiting times and feeling of impatience and frustration. Poor mental health may affect their work performance, leading to lower quality care, higher medical errors and increased mortality[26].

In the systematic reviews articles that reported on the burnout syndrome prevalence in HCWs, a variety of burnout measurement tools were used. While the 22-item MBI can be considered the “gold standard” for measuring occupational burnout due to its alignment with the WHO’s definition of burnout, all of the other tools are still validated instruments to assess the work-related well-being of respondents[32]. The issue that arises when multiple tools are used to assess a complex and multifaceted syndrome such as burnout is the heterogeneity of results[33]. In the review by Aymerich *et al* [12], burnout prevalence was 22.0% for studies using Mini-Z, but 53.0% for studies using CBI. This is likely due to the differences in focus and question content between the two instruments. Mini-Z measures emotional exhaustion, depersonalisation, and reduced personal accomplishment using 3 items for each dimension, for a total of 9 items. However, the CBI assesses personal burnout, work-related burnout, and client-related burnout using 5, 7, and 7 items for each type for a total of 19 items.

The high prevalence of burnout syndrome in HCWs has been highlighted in this umbrella systematic review, ranging from 31.81% to 34.4%, depending on the instruments used. During the COVID-19 pandemic, the prevalence of burnout was reported as high as 68.3% in the systematic review by Ching *et al*[13], whose focus was on HCWs in Asia. This information may be useful in Singapore’s context as it demonstrates how the demographic may be more susceptible to mental health symptoms during periods of a pandemic.

Organisations may also consider putting more emphasis on the psychological well-being of HCWs. Policies were introduced to elevate HCWs’ situations such as elderly care, addition of staff and makeshift hospitals. In China, specialized psychiatrists, social media and telephone services were added for support[34]. In France, some hospitals developed specific programmes with its purpose to distress and provide support amongst one another[35]. However, some obstacles faced are refusal and denial to psychological help[21]. Mental health problems are at its highest in the acute stages of the pandemic, suggesting interventions to be provided as soon as feasible. Thus, interventions should also target throughout the entire width of the pandemic and further[23].

Further research can also be conducted in the hospital setting to determine factors which may be diminishing the interventions’ effectiveness when compared to the rest of the world. The results of these studies can then be used to aid modifications in either the nature or implementation of mental health interventions. Furthermore, it is essential to distinguish between anxiety, depression, and burnout, particularly for those working in the healthcare system, as anxiety can be a significant risk factor for burnout depending on the situation[36]. Additionally, many other fundamental resilience factors, such as self-compassion and sense of coherence, are believed to impact burnout in HCWs, particularly during pandemics[37].

The review by Salazar de Pablo *et al*[17] also provided insight into the prevalence of burnout and anxiety over multiple pandemics, namely the 2003 SARS pandemic and the ongoing COVID-19 pandemic, where the incidence of burnout decreased from 38.2% to 25% while incidence of anxiety decreased from 45.7% to 22.2%. This reduction in the incidence of burnout and anxiety may be due to the HCWs being better prepared for pandemics after having experienced SARS. Additionally, considering the two pandemics were more than 15 years apart, it is also likely that psychological interventions that were devised and implemented post-SARS were effective in the management of the HCWs’ mental well-being, such that newer HCWs who did not experience the 2003 SARS pandemic did not bring up the overall prevalence.

In the present review, HCWs who were in the nursing profession were found to be at higher risk of developing burnout syndrome. Studies by Gualano *et al*[11], Ghahramani *et al*[15], and Ching *et al*[13] found that nurses were more likely to develop burnout during pandemics as compared to other healthcare professions such as advanced practice providers, respiratory therapists, physicians, and allied health professionals. This is likely due to the nature of the nurses’ job scope, where they have to provide direct care and treatment to patients daily. During COVID-19, this frequent contact with patients puts the nurses at an increased risk of infection. Coupled with the longer than usual working hours due to a lack of manpower, this can result in the development of burnout[29]. Other than the increase in burnout prevalence, the risk of turnover intention among nurses also rose. However, this can be alleviated with better organisational support, thus emphasising its importance to avoid the vicious cycle of burnout and turnover[31]. With this information, more research can be conducted with nurses as the target population to fine-tune interventions to better suit their needs. Organisations may also look to explore areas of nurses’ responsibilities during pandemics that can be delegated to volunteers or even robots with the help of artificial intelligence. Not only can this reduce the nurses’ workload, but more time can also be spent on tasks that require specific nursing expertise, tackling the burnout dimension of reduced personal accomplishment.

**Limitations of the present study**

There are several limitations in this umbrella review. First, multiple mental health instruments being used in different studies. While this is unavoidable as certain tools may work better for different professions, future reviews can be done such that the population of interests have a common instrument used. Inclusion and exclusion criteria in the future study can also be altered to only include only studies which use specific instruments, in order to reduce heterogeneity. Second, for studies that reviewed multiple pandemics, it is unlikely that the population surveyed were similar in demographic, which results in a suboptimal comparison of prevalence. For better quality comparisons, longitudinal studies can be conducted in the future. At last, the incidence of mental health outcomes may not be solely attributed to pandemics, likewise, reviews should include longitudinal studies to allow the analysis of the prevalence of mental health symptoms pre- and post-pandemic[38].

**CONCLUSION**

In conclusion, this umbrella review has collected relevant data from high-quality systematic reviews on the prevalence of burnout syndrome and anxiety during the past pandemics, including COVID-19 pandemic, demonstrating its high prevalence among HCWs. Nursing profession and females HCWs were identified to be more likely to develop these symptoms. Thus, more emphasis and attention should be put on their psychological well-being.

**ARTICLE HIGHLIGHTS****Research background**

Burnout and anxiety are common among Healthcare workers (HCWs) during pandemics.

**Research motivation**

Relevant data on anxiety and burnout during pandemic is limited.

**Research objectives**

The objectives of this umbrella review are (1) to provide a more comprehensive summary of pertinent evidence on anxiety and burnout; and (2) to investigate potential risk factors and solutions for HCWs.

**Research methods**

Using the PRISMA 2020 checklist, this umbrella review was carried out in accordance with the criteria of PRISMA.

**Research results**

Female HCWs and nurses were shown to be more prone to experiencing these symptoms. As a result, their psychological well-being should receive more importance and care.

**Research conclusions**

This umbrella review gathered relevant data from high-quality systematic reviews on the prevalence of burnout syndrome and anxiety during previous pandemics, including the Coronavirus disease 2019 pandemic, demonstrating its high prevalence among HCWs.

**Research perspectives**

The occurrence of mental health outcomes should not be attributed only to pandemics; similarly, evaluations should include longitudinal research to allow for the investigation of the prevalence of mental health symptoms before and after the pandemic.

**FOOTNOTES**

**Co-first authors:** Clayton Yang Teng Bey and Jin-Uu Koh.

**Author contributions:** Lai CWK, Bey CYT and Koh JU conceived, designed and refined the study protocol; Bey CYT and Koh JU were involved in the data collection; Lai CWK, Bey CYT and Koh JU analysed the data; Lai CWK, Bey CYT and Koh JU drafted the manuscript; all authors were involved in the critical review of the results and have contributed to, read, and approved the final manuscript. Bey CYT and Koh JU contributed equally to this work as co-first authors. The reason for designating Bey CYT and Koh JU as co-first authors is because Bey CYT and Koh JU contributed efforts of equal substance throughout the research process. The choice of these researchers as co-first authors acknowledges and respects this equal contribution, while recognizing the spirit of teamwork and collaboration of this study. In summary, we believe that designating Bey CYT and Koh JU as co-first authors is fitting for our manuscript as it accurately reflects our team's collaborative spirit, equal contributions, and diversity.

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**Country/Territory of origin:** Singapore

**ORCID number:** Christopher Wai Keung Lai [0000-0002-8010-7232](https://orcid.org/0000-0002-8010-7232).

**Corresponding Author's Membership in Professional Societies:** Singapore Institute of Technology.

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## REFERENCES

- 1 **World Health Organization.** Burn-out an ‘occupational phenomenon’: International Classification of Diseases. May 28, 2019. [Assessed on 15 November 2023]. Available from: <https://www.who.int/news/item/28-05-2019-burn-out-an-occupational-phenomenon-international-classification-of-diseases>
- 2 **Piret J, Boivin G.** Pandemics Throughout History. *Front Microbiol* 2020; **11**: 631736 [PMID: [33584597](https://pubmed.ncbi.nlm.nih.gov/33584597/) DOI: [10.3389/fmicb.2020.631736](https://doi.org/10.3389/fmicb.2020.631736)]
- 3 **Roychoudhury S, Das A, Sengupta P, Dutta S, Roychoudhury S, Choudhury AP, Ahmed ABF, Bhattacharjee S, Slama P.** Viral Pandemics of the Last Four Decades: Pathophysiology, Health Impacts and Perspectives. *Int J Environ Res Public Health* 2020; **17** [PMID: [33333995](https://pubmed.ncbi.nlm.nih.gov/33333995/) DOI: [10.3390/ijerph17249411](https://doi.org/10.3390/ijerph17249411)]
- 4 **World Health Organization.** Mental disorders. June 8, 2022. [Assessed on 15 November 2023]. Available from: <https://www.who.int/news-room/fact-sheets/detail/mental-disorders>
- 5 **Koutsimani P, Montgomery A, Georganta K.** The Relationship Between Burnout, Depression, and Anxiety: A Systematic Review and Meta-Analysis. *Front Psychol* 2019; **10**: 284 [PMID: [30918490](https://pubmed.ncbi.nlm.nih.gov/30918490/) DOI: [10.3389/fpsyg.2019.00284](https://doi.org/10.3389/fpsyg.2019.00284)]
- 6 **Teo I, Sung SC, Cheung YB, Wong WHM, Abu Bakar Aloweni F, Ang HG, Ayre TC, Chai-Lim C, Chen R, Heng AL, Nadarajan GD, Ong MEH, Soh CR, Tan BH, Tan KBK, Tan BS, Tan MH, Tan PH, Tay KXX, Wijaya L, Tan HK.** Burnout, anxiety and depression in healthcare workers during the early COVID-19 period in Singapore. *Singapore Med J* 2021 [PMID: [34617698](https://pubmed.ncbi.nlm.nih.gov/34617698/) DOI: [10.11622/smedj.2021156](https://doi.org/10.11622/smedj.2021156)]
- 7 **World Health Organization.** Global strategy on human resources for health: workforce 2030. July 7, 2020. [Assessed on 15 November 2023]. Available from: <https://www.who.int/publications/i/item/9789241511131>
- 8 **Søvdal LE, Naslund JA, Kousoulis AA, Saxena S, Qoronfle MW, Grobler C, Münter L.** Prioritizing the Mental Health and Well-Being of Healthcare Workers: An Urgent Global Public Health Priority. *Front Public Health* 2021; **9**: 679397 [PMID: [34026720](https://pubmed.ncbi.nlm.nih.gov/34026720/) DOI: [10.3389/fpubh.2021.679397](https://doi.org/10.3389/fpubh.2021.679397)]
- 9 **West CP, Dyrbye LN, Erwin PJ, Shanafelt TD.** Interventions to prevent and reduce physician burnout: a systematic review and meta-analysis. *Lancet* 2016; **388**: 2272-2281 [PMID: [27692469](https://pubmed.ncbi.nlm.nih.gov/27692469/) DOI: [10.1016/S0140-6736\(16\)31279-X](https://doi.org/10.1016/S0140-6736(16)31279-X)]
- 10 **Ruotsalainen JH, Verbeek JH, Mariné A, Serra C.** Preventing occupational stress in healthcare workers. *Cochrane Database Syst Rev* 2015; **2015**: CD002892 [PMID: [25847433](https://pubmed.ncbi.nlm.nih.gov/25847433/) DOI: [10.1002/14651858.CD002892.pub5](https://doi.org/10.1002/14651858.CD002892.pub5)]
- 11 **Gualano MR, Sinigaglia T, Lo Moro G, Rousset S, Cremona A, Bert F, Siliquini R.** The Burden of Burnout among Healthcare Professionals of Intensive Care Units and Emergency Departments during the COVID-19 Pandemic: A Systematic Review. *Int J Environ Res Public Health* 2021; **18** [PMID: [34360465](https://pubmed.ncbi.nlm.nih.gov/34360465/) DOI: [10.3390/ijerph18158172](https://doi.org/10.3390/ijerph18158172)]
- 12 **Aymerich C, Pedruzo B, Pérez JL, Laborda M, Herrero J, Blanco J, Mancebo G, Andrés L, Estévez O, Fernandez M, Salazar de Pablo G, Catalan A, González-Torres MÁ.** COVID-19 pandemic effects on health worker's mental health: Systematic review and meta-analysis. *Eur Psychiatry* 2022; **65**: e10 [PMID: [35060458](https://pubmed.ncbi.nlm.nih.gov/35060458/) DOI: [10.1192/j.eurpsy.2022.1](https://doi.org/10.1192/j.eurpsy.2022.1)]
- 13 **Ching SM, Ng KY, Lee KW, Yee A, Lim PY, Ranita H, Devaraj NK, Ooi PB, Cheong AT.** Psychological distress among healthcare providers during COVID-19 in Asia: Systematic review and meta-analysis. *PLoS One* 2021; **16**: e0257983 [PMID: [34648526](https://pubmed.ncbi.nlm.nih.gov/34648526/) DOI: [10.1371/journal.pone.0257983](https://doi.org/10.1371/journal.pone.0257983)]
- 14 **Galanis P, Vraika I, Fragkou D, Bilali A, Kaitelidou D.** Nurses' burnout and associated risk factors during the COVID-19 pandemic: A systematic review and meta-analysis. *J Adv Nurs* 2021; **77**: 3286-3302 [PMID: [33764561](https://pubmed.ncbi.nlm.nih.gov/33764561/) DOI: [10.1111/jan.14839](https://doi.org/10.1111/jan.14839)]
- 15 **Ghahramani S, Lankarani KB, Yousefi M, Heydari K, Shahabi S, Azmand S.** A Systematic Review and Meta-Analysis of Burnout Among Healthcare Workers During COVID-19. *Front Psychiatry* 2021; **12**: 758849 [PMID: [34858231](https://pubmed.ncbi.nlm.nih.gov/34858231/) DOI: [10.3389/fpsyg.2021.758849](https://doi.org/10.3389/fpsyg.2021.758849)]
- 16 **Busch IM, Moretti F, Mazzi M, Wu AW, Rimondini M.** What We Have Learned from Two Decades of Epidemics and Pandemics: A Systematic Review and Meta-Analysis of the Psychological Burden of Frontline Healthcare Workers. *Psychother Psychosom* 2021; **90**: 178-190 [PMID: [33524983](https://pubmed.ncbi.nlm.nih.gov/33524983/) DOI: [10.1159/000513733](https://doi.org/10.1159/000513733)]
- 17 **Salazar de Pablo G, Vaquerizo-Serrano J, Catalan A, Arango C, Moreno C, Ferre F, Shin JI, Sullivan S, Brondino N, Solmi M, Fusar-Poli P.** Impact of coronavirus syndromes on physical and mental health of health care workers: Systematic review and meta-analysis. *J Affect Disord* 2020; **275**: 48-57 [PMID: [32658823](https://pubmed.ncbi.nlm.nih.gov/32658823/) DOI: [10.1016/j.jad.2020.06.022](https://doi.org/10.1016/j.jad.2020.06.022)]
- 18 **Pappa S, Ntella V, Giannakas T, Giannakoulis VG, Papoutsis E, Katsaounou P.** 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 [PMID: 32437915 DOI: 10.1016/j.bbi.2020.05.026]
- 19 **Marvaldi M**, Mallet J, Dubertret C, Moro MR, Guessoum SB. Anxiety, depression, trauma-related, and sleep disorders among healthcare workers during the COVID-19 pandemic: A systematic review and meta-analysis. *Neurosci Biobehav Rev* 2021; **126**: 252-264 [PMID: 33774085 DOI: 10.1016/j.neubiorev.2021.03.024]
- 20 **Saragih ID**, Tonapa SI, Saragih IS, Advani S, Batubara SO, Suarilah I, Lin CJ. Global prevalence of mental health problems among healthcare workers during the Covid-19 pandemic: A systematic review and meta-analysis. *Int J Nurs Stud* 2021; **121**: 104002 [PMID: 34271460 DOI: 10.1016/j.ijnurstu.2021.104002]
- 21 **Xiong N**, Fritzsche K, Pan Y, Löhlein J, Leonhart R. The psychological impact of COVID-19 on Chinese healthcare workers: a systematic review and meta-analysis. *Soc Psychiatry Psychiatr Epidemiol* 2022; **57**: 1515-1529 [PMID: 35325261 DOI: 10.1007/s00127-022-02264-4]
- 22 **Sun P**, Wang M, Song T, Wu Y, Luo J, Chen L, Yan L. The Psychological Impact of COVID-19 Pandemic on Health Care Workers: A Systematic Review and Meta-Analysis. *Front Psychol* 2021; **12**: 626547 [PMID: 34305703 DOI: 10.3389/fpsyg.2021.626547]
- 23 **Zhang H**, Li W, Li H, Zhang C, Luo J, Zhu Y, Wu H, Zhu Z, Xu Y, Wang J, Li C. Prevalence and dynamic features of psychological issues among Chinese healthcare workers during the COVID-19 pandemic: a systematic review and cumulative meta-analysis. *Gen Psychiatr* 2021; **34**: e100344 [PMID: 34192242 DOI: 10.1136/gpsych-2020-100344]
- 24 **Dong F**, Liu HL, Yang M, Lu CL, Dai N, Zhang Y, Robinson N, Liu JP. Immediate Psychosocial Impact on Healthcare Workers During COVID-19 Pandemic in China: A Systematic Review and Meta-Analysis. *Front Psychol* 2021; **12**: 645460 [PMID: 34122233 DOI: 10.3389/fpsyg.2021.645460]
- 25 **Ślusarska B**, Nowicki GJ, Niedorys-Karczmarczyk B, Chrzan-Rodak A. Prevalence of Depression and Anxiety in Nurses during the First Eleven Months of the COVID-19 Pandemic: A Systematic Review and Meta-Analysis. *Int J Environ Res Public Health* 2022; **19** [PMID: 35162183 DOI: 10.3390/ijerph19031154]
- 26 **Adibi A**, Goltaleb M, Farrahi-Ashtiani I, Pirani D, Yousefi K, Jamshidbeigi Y, Sahebi A. The Prevalence of Generalized Anxiety Disorder Among Health Care Workers During the COVID-19 Pandemic: A Systematic Review and Meta-Analysis. *Front Psychiatry* 2021; **12**: 658846 [PMID: 34135784 DOI: 10.3389/fpsyg.2021.658846]
- 27 **Dutta A**, Sharma A, Torres-Castro R, Pachori H, Mishra S. Mental health outcomes among health-care workers dealing with COVID-19/severe acute respiratory syndrome coronavirus 2 pandemic: A systematic review and meta-analysis. *Indian J Psychiatry* 2021; **63**: 335-347 [PMID: 34456346 DOI: 10.4103/psychiatry.IndianJPsychiatry\_1029\_20]
- 28 **Hill JE**, Harris C, Danielle L C, Boland P, Doherty AJ, Benedetto V, Gita BE, Clegg AJ. The prevalence of mental health conditions in healthcare workers during and after a pandemic: Systematic review and meta-analysis. *J Adv Nurs* 2022; **78**: 1551-1573 [PMID: 35150151 DOI: 10.1111/jan.15175]
- 29 **Hao Q**, Wang D, Xie M, Tang Y, Dou Y, Zhu L, Wu Y, Dai M, Wu H, Wang Q. Prevalence and Risk Factors of Mental Health Problems Among Healthcare Workers During the COVID-19 Pandemic: A Systematic Review and Meta-Analysis. *Front Psychiatry* 2021; **12**: 567381 [PMID: 34211406 DOI: 10.3389/fpsyg.2021.567381]
- 30 **Chen Y**, Wang J, Geng Y, Fang Z, Zhu L, Chen Y, Yao Y. Meta-analysis of the prevalence of anxiety and depression among frontline healthcare workers during the COVID-19 pandemic. *Front Public Health* 2022; **10**: 984630 [PMID: 36176525 DOI: 10.3389/fpubh.2022.984630]
- 31 **Wu P**, Fang Y, Guan Z, Fan B, Kong J, Yao Z, Liu X, Fuller CJ, Susser E, Lu J, Hoven CW. The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. *Can J Psychiatry* 2009; **54**: 302-311 [PMID: 19497162 DOI: 10.1177/070674370905400504]
- 32 **Chirico F**, Nucera G, Leiter M. Measuring burnout syndrome requires reliable and standardized measures. *Hong Kong J Emerg Med* 2022; **29**: 325-326 [DOI: 10.1177/10249079221096920]
- 33 **Huang R**, Hewitt DB, Cheung EO, Agarwal G, Etkin CD, Smink DS, Shanafelt TD, Bilimoria KY, Hu YY. Burnout Phenotypes Among U.S. General Surgery Residents. *J Surg Educ* 2021; **78**: 1814-1824 [PMID: 33935019 DOI: 10.1016/j.jsurg.2021.03.019]
- 34 **Liu S**, Yang L, Zhang C, Xiang YT, Liu Z, Hu S, Zhang B. Online mental health services in China during the COVID-19 outbreak. *Lancet Psychiatry* 2020; **7**: e17-e18 [PMID: 32085841 DOI: 10.1016/S2215-0366(20)30077-8]
- 35 **Lefèvre H**, Stheneur C, Cardin C, Fourcade L, Fourmaux C, Tordjman E, Touati M, Voisard F, Minassian S, Chaste P, Moro MR, Lachal J. The Bulle: Support and Prevention of Psychological Decompensation of Health Care Workers During the Trauma of the COVID-19 Epidemic. *J Pain Symptom Manage* 2021; **61**: 416-422 [PMID: 32961219 DOI: 10.1016/j.jpainsymman.2020.09.023]
- 36 **Stoyanov D**. New Model of Burn Out Syndrome: Towards early diagnosis and prevention. Gistrup Denmark: River Publishers, 2014
- 37 **Stoyanova K**, Stoyanov DS. Sense of Coherence and Burnout in Healthcare Professionals in the COVID-19 Era. *Front Psychiatry* 2021; **12**: 709587 [PMID: 34408684 DOI: 10.3389/fpsyg.2021.709587]
- 38 **Magnavita N**, Chirico F, Garbarino S, Bragazzi NL, Santacroce E, Zaffina S. SARS/MERS/SARS-CoV-2 Outbreaks and Burnout Syndrome among Healthcare Workers. An Umbrella Systematic Review. *Int J Environ Res Public Health* 2021; **18** [PMID: 33924026 DOI: 10.3390/ijerph18084361]
- 39 **Abdulla EK**, Velladath SU, Varghese A, Anju M. Depression and anxiety associated with COVID-19 pandemic among healthcare professionals in India- A systematic review and meta-analysis. *Clin Epidemiol Glob Health* 2021; **12**: 100888 [PMID: 34751253 DOI: 10.1016/j.cegh.2021.100888]
- 40 **Chigwedere OC**, Sadath A, Kabir Z, Arensman E. The Impact of Epidemics and Pandemics on the Mental Health of Healthcare Workers: A Systematic Review. *Int J Environ Res Public Health* 2021; **18** [PMID: 34206264 DOI: 10.3390/ijerph18136695]
- 41 **Koontalay A**, Suksatan W, Prabsangob K, Sadang JM. Healthcare Workers' Burdens During the COVID-19 Pandemic: A Qualitative Systematic Review. *J Multidiscip Healthc* 2021; **14**: 3015-3025 [PMID: 34737573 DOI: 10.2147/JMDH.S330041]
- 42 **Salari N**, Khazaie H, Hosseinian-Far A, Khaledi-Paveh B, Kazeminia M, Mohammadi M, Shohaimi S, Daneshkhah A, Eskandari S. The prevalence of stress, anxiety and depression within front-line healthcare workers caring for COVID-19 patients: a systematic review and meta-regression. *Hum Resour Health* 2020; **18**: 100 [PMID: 33334335 DOI: 10.1186/s12960-020-00544-1]



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