

COVID-19, SARS-CoV-2: Impact on healthcare workers in the pandemic's initial months: Rapid review

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Abstract

On March 11, 2020 the World Health Organisation declared the SARS-CoV-2 viral outbreak a pandemic. This rapid review aimed to identify the pandemic's impact on frontline healthcare workers during the viral outbreak's initial months. Database searches December 1, 2019 to August 29, 2020 retrieved 18 relevant studies. Findings showed that healthcare workers internationally were negatively impacted by the pandemic. Compared to non-frontline healthcare workers a significantly greater proportion of frontline healthcare workers experienced: burnout, stress, and stressors regarding: childcare, job interference with work-family balance and difficulty getting off-duty time. Compared to male physicians, a significantly greater proportion of female physicians scored low for psychological well-being. Mean scores for stress were significantly higher among females and young healthcare workers (22 to 35 years). Mean scores for anxiety were significantly higher for: nurses compared to technicians, healthcare workers reporting extreme lack of protective equipment and those aged ≥ 30 years. The prevalence of depression among frontline healthcare workers across studies in this review ranged from 9% to 51%. The prevalence of sleep issues ranged from 24% to 60% with some reporting nightmares. However, these studies lack homogeneity. Healthcare workers experienced fear of: contracting the virus (89.8%), spreading it to family (91.3%) and fear of an uncontrollable epidemic (86.8%). Over 90% reported skin lesions due to prolonged use of personal protective equipment. Many lost their lives to the SARS-CoV-2 virus. One prominent impact of the SARS-CoV-2 pandemic is the reported loss of healthcare worker's lives and this paper wishes to pay them tribute.

1. INTRODUCTION

The novel virus (SARS-CoV-2) and its resultant disease COVID-19 were unknown prior to December 2019 (WHO, 2020a). On December 31, 2019, the world health organisation (WHO) was informed of cases of pneumonia of unknown cause in Wuhan, China (WHOb). Increasing outbreaks raised concerns within China and internationally (Wang et al., 2020a). Rapid person-to-person transmissibility (Wang et al., 2020b), high fatality (49%) among patients categorised as 'critical' and the viral spread from Wuhan to the entire country of China within approximately 30 days (CCDC-China, 2020) was an early warning that the virus could potentially become a pandemic. As of February 29, 2020, fifteen countries outside China had confirmed cases (WHO, 2020c) threatening to overwhelm healthcare systems (Miller et al., 2020).

1.1 Previous corona virus outbreaks of global concern and naming the novel coronavirus

Initially, the WHO and journal publications referred to the virus as (2019-nCoV) (WHO, 2020c; Wang et al., 2020a) and its disease was described as 2019 novel coronavirus: (2019-nCoV)-infected pneumonia (NCIP) (Wang et al., 2020b). Laboratory scientists in China, on January 7, 2020 isolated the SARS-CoV-2 virus and released its first genome

sequence on January 10, 2020 (Zheng, 2020a). On January 30, 2020 the WHO Director-General declared the novel coronavirus outbreak a public health emergency of international concern (WHO, 2020d). On February 11, 2020 the WHO designated "COVID-19" as the new disease's name (WHO, 2020e). On the same date the International Committee on Taxonomy of Viruses (ICTV) designated "severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)" as the name of the virus (WHO, 2020e). On March 11, 2020 the WHO declared the COVID-19 outbreak a pandemic (WHO, 2020f). As of August 30, 2020, 19:46 GMT (Greenwich Mean Time) 213 countries and territories around the world reported over 25 million cases of SARS-CoV-2 virus infection and 848,984 deaths (Worldometer, 2020). Within the last two decades, three highly pathogenic human coronavirus outbreaks occurred (Zhu et al., 2020): the SARS-CoV-2, outbreak in 2019-2020, the 2003 SARS-CoV first identified in China with spread to 4 other countries (WHO, 2020g) and 2012, MERS-CoV outbreak first identified in Saudi Arabia with spread to 26 other countries (WHO, 2019).

1.2 COVID-19 – Clinical presentation

In China, five patients hospitalised from December 18 to December 29, 2019 presented with fever, cough, headache, muscle pain, fatigue and diarrhoea, among other symptoms. All five had chest radiography showing diffuse opacities and consolidation, two required mechanical ventilation, two nasal cannula and one non-invasive ventilation (Ren et al., 2020). International reports suggest that some patients with COVID-19 report smell and taste impairment (Xydakis et al., 2020). Other study results from China reported that common symptoms among (n=138) patients hospitalised between January 1 to January 28, 2020 included: fever, fatigue and dry cough. Commonly found abnormal blood test results were: prolonged prothrombin time (58%), lymphopenia (70.3%) and elevated lactate dehydrogenase (39.9%). Chest computed tomographic scans showed bilateral patchy shadows or ground glass opacity in the lungs of all 138 patients (Wang et al., 2020b).

1.3 COVID-19 - Risk of viral transmission to healthcare workers (HCWs)

Where there is a potential for exposure to known or suspected sources of COVID-19, healthcare employees working directly with patients, healthcare support, medical transport, and mortuary workers are deemed to have a 'high exposure risk' to COVID-19 infection (OSHA, 2020). Nurses, the largest occupational healthcare group globally (WHO, 2017), provide one-to-one care for patients with COVID-19 (Jackson et al., 2020). The infection risk for nurses is significantly higher than for physicians ($p = 0.005$) or other HCWs ($p < 0.001$) (Scherer et al., 2020). For doctors, video or telephone consultations have begun to play an important role in medical practice to reduce the risk of SARS-CoV-2 transmission (Iyengar et al., 2020). During the 2003 SARS outbreak, HCWs performing or exposed to tracheal intubation procedures had a higher risk of infection compared HCWs not exposed to tracheal intubation (Tran et al., 2012). In Ireland, as of August 29, 2020, the most likely source of transmission of COVID-19 in 72.4% of HCWs (n=6289) was working in the healthcare setting as opposed to contracting COVID-19 in the community, travel-related or other sources (HPSC, 2020).

1.4 COVID-19- Prevalence among HCWs

As of April 8, 2020, 52 countries reported cases of COVID-19 among HCWs (n = 22,073) to the WHO. According to the WHO, many countries do not have systematic reporting of COVID-19 infections among HCWs to the WHO. As such, reported numbers are likely to be an under-representation of the true global figures of COVID-19 infections among HCWs (WHO, 2020h). For reporting purposes, the WHO defines COVID-19 (WHO, 2020h - Situation Report - 82) and emphasises the need for stronger data to facilitate comparable health statistics (WHO, 2020i). COVID-19 data relating to HCWs should be interpreted in relation to the definition of a HCW. For example, some research studies focus exclusively on Physician HCWs (Abdessater et al., 2020), or nurse HCWs

(Hoseinabadi et al., 2020), while others define HCWs as persons in active employment of any kind in a health facility (CCDC-China, 2020) and include physicians, nurses, paramedical, administrative, stretcher-bearers and cleaners (Martin et al., 2020).

2. METHODOLOGY

A rapid review approach was applied. In response to health systems facing increasingly complex challenges the WHO, in 2017, launched guidance for conducting rapid reviews (Tricco et al., 2017). Database searches with dates December 1, 2019 to August 29, 2020 were carried out in PubMed (advanced), PubMed including MEDLINE and Google Scholar. Searches were filtered for the English language and search terms were translated into Boolean terminology by PubMed advanced: ("novel coronavirus" OR "SARS-CoV-2" OR "COVID-19") AND ("healthcare worker" OR "nurses" OR "healthcare professional"). Search results are shown in the PRISMA flow diagram Figure 1.

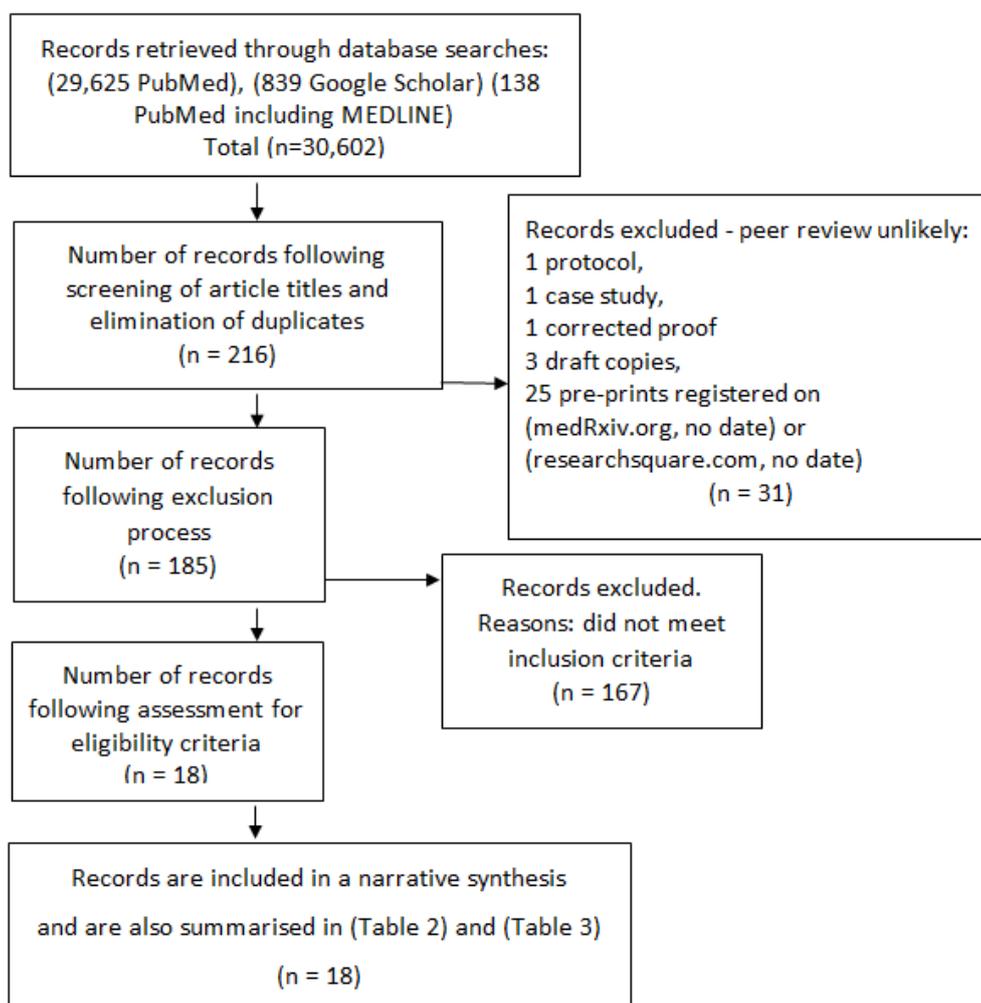


Figure 1. PRISMA Diagram

Eighteen articles met the inclusion criteria. The inclusion-exclusion criteria for retrieving records are outlined in Table 1. Separate Google searches targeting HCW deaths due to COVID-19 were conducted and are presented as a narrative in section 3.5.

Table 1. Inclusion and exclusion criteria based on the aim of this review i.e. to determine the impact of the COVID-19 pandemic on healthcare workers during the viral outbreak's initial months

	Inclusion Criteria	Exclusion Criteria
Impact or outcome	Negative or adverse impact/s occurring to healthcare workers due to working on the frontline during the COVID-19 pandemic. For example, physical, psychological or loss of life impacts.	Non-healthcare work related adverse impacts
Population	Persons of any age, gender and ethnicity in employment of any kind in a healthcare provision setting.	Non-healthcare staff such as general population groups or patients in a healthcare setting, home-care setting or residents in long-term residential settings
Measure	Adverse impacts or outcomes including the following: (1) Measured on a continuous scale and expressed as a mean or median. (2) Reported as percentages, prevalence or proportions. (3) Assessed using a scale, index, inventory or questionnaire and expressed for e.g. as mild, moderate or severe. (4) Data collected from interviews or focus groups. (5) Self-reported or objectively assessed outcomes.	No suitable metric
Settings	Primary care, hospital, home-care or residential settings or any setting that provides healthcare provision to people.	Non-healthcare provision settings
Study design	Peer reviewed cross-sectional studies, comparative studies, observational studies, mixed methods studies, qualitative /quantitative studies and reviews.	Non-peer reviewed records such as opinion pieces, protocols, commentaries, or articles registered on pre-print servers
Publication type	Journal articles or reputable websites, for example, the (WHO) website.	Anecdotal evidence

3. RESULTS

3.1. COVID-19: impact on HCWs

This review provides an insight into the physical and emotional impact of the SARS-CoV-2 outbreak on HCWs, including experiences of burnout, stress, anxiety, depression, fear and insomnia. A summary of findings (mean scores and percentages) for these symptoms among HCWs are presented in [Table 2](#). Statistical results from the comparative analysis between different groups are presented in [Table 3](#). Measuring tool acronyms are explained in [Table 4](#). The term 'other' HCWs is explained in [Table 2](#). The terms risk-exposed ([Kannampallil et al., 2020](#)) and frontline healthcare worker refers to HCWs engaged in direct diagnosis, treatment or care of patients with COVID-19 ([Lai et al 2020](#)).

Table 2. Summary findings from 18 papers: COVID-19, SARS-CoV-2 pandemic: Impact on HCWs in the pandemic's initial months. Published papers dated from January to August 2020. The term other HCWs include Technicians (Huang et al. 2020), Physiotherapists, Technicians & Assistants (Maqsood et al., 2020) Paramedics (Mehdi et al., 2020) Allied HCWs, Administration, Clerical and Maintenance workers (Paybast et al., 2020) Technicians and other hospital staff (Cai et al., 2020) *statistically significant, $p < 0.05$

Author, Region, Study type	Sample size and Response Rate	Occupation	Results: Mean scores or prevalence figures for HCW: stress, anxiety, fear, burnout, sleep issues, depression, well-being and skin lesions. Measuring scale abbreviations are explained in Table 4.
Abdessater et al., 2020, France, Survey	275 (R/rate 56%)	Physicians	Stress 90% among urology physicians (questionnaire data)
Badahdah et al., 2020, Oman, Web survey	194	Physicians	Mean values: (Anxiety, 6.41, GAD-7 scale) (Stress, 23.61, PSS-10 scale) (Well-being, 52.47, WHO-5 index)
Cai et al., 2020, Hunan, China, Cross-sectional survey	534	Nurses, Doctors Technicians & other HCWs	Stress re: Infecting family: (12.7% slight, 30.6% moderate, 53.7% very much) (Questionnaire data) Stress re: patient mortality: (13.1% slight, 31.5% moderate, 45.7% very much) (Questionnaire data) Nervous or frightened in the ward: (41% slight, 33.9% moderate, 6.7% very much) (Questionnaire data)
Farrukh et al., 2020 Pakistan, Cross-sectional	343	Nurses & Doctors	Anxiety: (mild 17%, moderate 44%, severe 39%) (HAM-A scale).
Ferini-Strambi et al., 2020, Italy, Observational study	40	Nurses & Doctors	Sleep issues 35% (PSQI Index & Actigraphy)
Hoseinabadi et al., 2020, Iran, Cross-sectional	245 (R/rate 92%)	Nurses 2 groups compared	Stress (JSQ Questionnaire): risk group mean score (3.2 ± 0.9) vs. (2.8 ± 0.7) $p = 0.006$ * (Independent t-test) Burnout (OLBI Inventory): risk group mean score (2.6 ± 0.2) vs. (2.5 ± 0.2) $p = 0.002$ * (Independent t-test)
Hu et al., 2020a, Wuhan, China. Cross-sectional	2,014	Nurses	(Skin lesions, 94.8%, SLS scale). Moderate or high levels of: (Anxiety 14.3%, SAS scale) (Depression 10.7%, SDS scale) (Emotional Burnout 60.5%, MBI-HSS inventory) (Fear: 91.2%, FS-HPs scale)
Hu et al., 2020b, Hubei province, China, Survey	61 (R/rate 94%)	Nurses & Doctors	Skin lesions due to: (N95 mask: 95%) (Gloves: 89%) (PPE clothing: 61%) (Questionnaire data)

Huang et al., 2020, Sichuan, China, Cross-sectional	364	Nurses/Technicians	(Anxiety 23.4%, SAS scale) (Fear of an uncontrollable epidemic 86.8%, Questionnaire data)
Kannampallil et al., 2020, USA. Cross-sectional web-based survey	393 (R/rate 29%)	Physician trainees 2 groups compared	Stress (DASS-21 scale): risk exposed group (29.4%) vs. (18.9%) $p = 0.016^*$ (Chi-square test) Burnout (PFI Index): risk exposed group (46.3%) vs. (33.7%) $p = 0.011^*$ (Chi-square test)
Lai et al., 2020, inside and outside the Hubei province, China, Cross-sectional, survey based study.	1,257 (R/rate 68.7%)	764 (Nurses) 493 (Physicians)	(Anxiety 44.6%, GAD-7 scale) (Depression 50.4%, PHQ-9 Questionnaire) (Distress 71.5%, IES-R scale) (Insomnia 34.0% , ISI index)
Lan et al., 2020, Hubei, China. Online questionnaire	542 (R/rate 77%)	Nurses & doctors	Prevalence of skin lesions due to wearing PPE (97%) (Online questionnaire)
Maqsood et al., 2020, Pakistan, Cross-sectional	1,346 (R/rate 96%)	Physicians, Nurses, Dental & others	(Stress: mean score $29.8 \pm SD 11.4$, PSS-10 scale) (Fear of contracting the virus 89.8%, Questionnaire data) (Fear of spreading the virus to family 91.3%, Questionnaire data)
Mehdi et al., 2020, Pakistan, Cross-sectional study	237	Doctors/Nurses	(Anxiety: severe 25%, borderline 17%, HADS scale) (Depression 34.6%, HADS scale)
Pappa et al., 2020, (Systematic review & Meta-analysis) (13 cross-sectional studies) 12 China, 1 Singapore)	33,062 (R/rates 43% - 95%, 9 studies)	Nurses Physicians & other HCWs	Anxiety: Range 10.4% - 44.7% (12 studies) (different scales) Depression: Range 8.9% - 50.7% (10 studies) (different scales) Insomnia: Range 23.6% - 45.5% (5 studies) (different scales)
(Paybast et al., 2020), China 7, India 1 (Systematic Review) (8 Cross-sectional studies)	8,582 (8 studies)	Nurses & Doctors & others	Prevalence of severe anxiety ranged from: 2.1- 15% (6 studies) (different scales) Prevalence of mild Anxiety ranged from 4.6 - 44.3% (6 studies) (different scales)
Tu et al., 2020, Wuhan, China, Cross-sectional	100 (R/rate 100%)	Nurses	(Anxiety: 40% GAD-7, scale) (Depression: 46%, PHQ-9 Questionnaire) (Sleep issues 60%, PSQI index)
Wang et al., 2020c, China, Cross-sectional survey	123	Doctors & Nurses	(Sleep disturbance 38%, PSQI index) (Depression: 25%, SDS scale) (Anxiety: 7%, SAS scale)

3.2. COVID-19: HCW stress, anxiety, depression, fear, burnout, well-being and sleep issues

The impact of COVID-19 on HCWs is presented in the following narrative:

China was the first country to be affected by the viral outbreak, so unsurprisingly, many early studies addressing the impact of the pandemic on HCWs are from China. A survey (completed February 3, 2020) with data from 34 hospitals in areas inside and outside Hubei province in China ($n = 1,257$ doctors and nurses) identified symptoms of depression 50.4% (PHQ-9 questionnaire), anxiety 44.6%, (GAD-7 scale), insomnia 34.0%, (ISI index), and distress 71.5% (IES-R scale) among HCWs (Lai et al., 2020). Questionnaire data collected from January 30, to February 7, 2020, from Renmin Hospital Wuhan China, identified a prevalence of depression 25% (SDS scale) and anxiety 7% (SAS scale) among 123 doctors and nurses during the viral outbreak (Wang et al., 2020c). Data collected from February 7 to February 25, 2020, in Huoshenshan Hospital, Wuhan, China, reported a prevalence of anxiety 40% (GAD-7 scale), and depression symptoms 46% (PHQ-9 questionnaire) among ($n=100$) nurses caring for patients with COVID-19 (Tu et al., 2020). A survey completed February 24, 2020, in two hospitals, Wuhan, China ($n = 2,014$), also showed that frontline nurses were psychologically challenged. The findings showed the prevalence for moderate or high levels of anxiety 14.3%, (SAS scale), depression 10.7%, (SDS scale), fear 91.2%, (FS-HPs scale) and emotional exhaustion burnout 60.5%, (MBI-HSS Inventory) (Hu et al., 2020a). Results from a survey (January to March 2020) from the Hunan province of China during the viral outbreak ($n = 534$ - doctors, nurses, and others) identified main stress factors which included: concerns for personal safety, worries about infecting their families, and patient mortality. Compared to other HCWs, (doctors, medical technicians and other hospital workers), a significantly greater proportion of nursing staff felt more nervous and frightened when on wards that treated patients with COVID-19 ($p = 0.02$, Chi-square) (Cai et al., 2020). Multi-centre survey results (February 2020) from the Sichuan Province, China ($n = 364$ nurses and technicians working in radiology departments with high exposure risk to COVID-19 reported that 23.4% experienced either mild ($n=63$), moderate ($n=19$) or severe anxiety ($n=3$) and 86.8% expressed fear of an uncontrollable epidemic. The survey results for this study also showed that anxiety level (mean scores) on the (SAS Scale) were significantly higher for: (a) nurses compared to technicians ($p = 0.001$). (b) HCWs aged ≥ 30 years ($p = 0.011$), (c) females ($p = 0.004$) (Independent t-tests) and (d) HCWs reporting extreme lack of protective equipment ($p = 0.001$, ANOVA) (Huang et al., 2020).

In Pakistan, during the COVID-19 pandemic, an analysis of survey results ($n=1346$, physicians, nurses, physiotherapists, dental and auxiliary staff) found significantly higher mean stress scores among female HCWs ($p = 0.04$) and young HCWs in the age range 22 to 35 years ($p < 0.001$). The participants (89.8%) expressed concern that they could contract the virus, and 91.3% feared that they would spread the virus to their family (Maqsood et al., 2020). Also, in Pakistan, survey results from 2 hospitals ($n=343$, doctors and nurses) working on the frontline during the pandemic showed that moderate anxiety was experienced by (44.0%), severe anxiety by (39.4%) and mild anxiety by (16.6%) (HAM-A scale) (Farrukh et al., 2020). Additionally, in Pakistan web-based survey results ($n=237$, doctors, nurses, and paramedics) identified severe anxiety (25%), borderline anxiety (17%) and depression (34.6%) (HADS scale) among HCWs on the COVID-19 frontline (Mehdi et al., 2020).

In Oman, during the COVID-19 outbreak, results from a web-based survey (194 physicians) showed significantly lower stress scores (PSS-10 scale) among married physicians ($p = 0.02$, Independent t-test). In the total group ($n=194$) the mean value for well-being was low: (52.47, SD = 22.94, WHO-5 index, cut-off point ≤ 50). Compared to males, significantly more female physicians scored ≤ 50 on the WHO-5 well-being index ($p = 0.03$, Chi-square test) (Badahdah et al., 2020).

In Iran, a comparison between two groups of nurses ($n=245$, total group) found significantly higher stress scores (JSQ Questionnaire, $p = 0.006$) and burnout scores

(OLBI Inventory, $p = 0.002$) among frontline nurses caring for patients with COVID-19 compared to nurses in other wards (Independent t-test) (Hoseinabadi et al., 2020).

In France, a national survey ($n=275$, urology physicians) found that 91.6% experienced greater stress than before the pandemic and a sense that their work's quality was negatively impacted due to the COVID-19 crisis. Stress was partly induced by the pandemic's constant learning curve (Abdessater et al., 2020).

Table 3. Comparative analysis between different groups

Authors	Comparative analysis between groups
Badahdah et al., 2020, Oman	Significantly more female physicians scored ≤ 50 , the cut-off for poor psychological well-being than male physicians on the (WHO-5 index), ($p = 0.03$, Chi-square test)
Cai et al., 2020, Hunan, China	Based on questionnaire data, a significantly greater proportion of frontline nursing staff felt more nervous or frightened when on wards that treated patients with COVID-19, compared to other frontline HCWs (doctors, technicians or other hospital staff) ($p = 0.02$, Chi-square test)
Huang et al., 2020, Sichuan, China	In radiology departments with high exposure risk to COVID-19 (multicentre study) the anxiety levels (mean scores) were significantly higher: (a) for nurses than that of technicians ($p = 0.001$), (b) for HCWs aged ≥ 30 years ($p = 0.011$), (c) for females ($p = 0.004$) (Independent t-tests) and for HCWs reporting extreme lack of protective equipment ($p = 0.001$, ANOVA testing)
Kannampallil et al., 2020, USA	Compared to non-risk exposed physician trainees, COVID-19 risk exposed physician trainees had a significantly higher prevalence of burnout (46.3% vs. 33.7%, $p = 0.011$) and stress (29.4% vs. 18.9%, $p = 0.016$). A significantly higher proportion of the risk exposed group also experienced stressors regarding childcare ($p = 0.026$), job interference with work-family balance ($p = 0.009$) and difficulty taking time off for family matters ($p < 0.001$) (Chi-square tests).
Maqsood et al., 2020, Pakistan	Age and gender: significantly higher stress scores were observed among young HCWs ($p < 0.001$) in the age range 22-35 years and female HCWs ($p = 0.04$) (Independent t-tests) The HCWs included nurses, medical, dental, physiotherapists, technicians and assistants
Hoseinabadi et al., 2020, Iran	Significantly higher stress scores (JSQ questionnaire, $p = 0.006$) and burnout scores (OLBI inventory, $p = 0.002$) were identified among COVID-19 frontline nurses compared to nurses in other wards (Independent t-test)

In the U.S., a survey was carried out among ($n=393$, physician trainees) working on the pandemic frontline. Compared to non-frontline physician trainees, a significantly higher proportion of COVID-19 risk exposed trainees experienced burnout (46.3% vs. 33.7%, $p = 0.011$) (PFI index) and stress (29.4% vs 18.9%, $p = 0.016$) (DASS-21 scale). Also, a significantly higher proportion of the risk exposed group experienced stressors regarding childcare ($p = 0.026$), job interference with work-family balance ($p = 0.009$) and difficulty taking time off for personal or family matters ($p < 0.0001$) (Chi-square test) (Kannampallil et al., 2020).

A systematic review of eight cross-sectional studies from China (7) India (1) with ($n = 8,582$ participants) measuring anxiety among HCWs during the COVID-19 pandemic concluded that the majority of HCWs reported a mild degree of anxiety, with some reporting severe anxiety. The study participants included doctors, nurses, technicians, non-medical hospital workers, allied HCWs, administration, clerical and maintenance workers. The prevalence of mild anxiety ranged from 4.6 – 44.3% (6 studies). The prevalence of severe anxiety ranged from 2.1% – 15% (6 studies) (Paybast et al., 2020).

Another, systematic review, (13 cross-sectional studies, from China (12), Singapore (1) with ($n = 33,062$ participants) focusing on depression, anxiety and insomnia among HCWs (physicians, nurses and others) during the pandemic identified prevalence rates

for depression ranging from 8.9% - 50.7% (10 studies), anxiety 10.4% - 44.7% (12 studies), and insomnia 23.6% - 45.5% (5 studies) (Pappa et al., 2020).

3.3. COVID-19 and HCW sleep quality

A study from Italy using the PSQI index and an actigraphy device to measure sleep parameters reported sleep disturbances among 35% of HCWs (n = 40, doctors and nurses) treating patients with COVID-19 infection. Before the pandemic, these participants did not experience sleep disturbance and did not take sleep medication (Ferini-Strambi et al., 2020). Study findings from Renmin Hospital, Wuhan, China, found that 47 of 123 (38%) of paediatric doctors and nurses were identified as having sleep disturbance (PSQI index) during the COVID-19 outbreak (Wang et al., 2020c). In Wuhan, China, among 100 nurses treating patients with COVID-19, (60%) had sleep disturbance (PSQI index), with almost half the participants (45%) reporting nightmares (Tu et al., 2020).

Table 4. Acronyms for measurement tools

Acronyms	Measurement Tools
(DASS-21)	Depression Anxiety Stress Scale.
(FS-HPs)	Fear Scale for Healthcare Professionals.
(GAD-7)	The Generalised Anxiety Disorders Scale
(HADS)	Hospital Anxiety and Depression Scale
(HAM-A)	Hamilton Anxiety Rating Scale.
(ISI)	Insomnia Severity Index; 7-item
(IES-R)	Impact of Event Scale-Revised; 22-item.
(JSQ)	Job Stress Questionnaire
(MBI-HSS)	Maslach Burnout Inventory: Human Services Survey for Medical Personnel (M.P.)
(OLBI)	Oldenburg Burnout Inventory.
(PFI)	Professional Fulfilment Index. Also measures burnout
(PHQ-9)	Patient Health Questionnaire - 9 item - measures depression
(PSS-10)	Perceived Stress Scale - 10 item
(PSQI)	Pittsburgh Sleep Quality Index.
(SAS)	Self-Rating Anxiety Scale
(SDS)	Self-Rating Depression Scale
(SLS)	Skin Lesion Scale
(WHO-5)	World Health Organisation - Five - well-being Index

3.4. COVID-19 – Adverse skin reactions of HCWs using personal protective equipment (PPE)

Skin lesions were common among HCWs due to wearing PPE for long periods on the frontline during the pandemic. Study findings from Wuhan China (n=2,014) reported that (94.8%) of nurses reported one or more skin lesions resulting from prolonged wearing of PPE (SLS scale) (Hu et al., 2020a). Survey findings from Hubei Province, China, also identified that HCWs experienced adverse skin reactions due to wearing PPE over long periods. Among (n=61, doctors and nurses), the occurrence of adverse skin reactions to the N95 mask was 95.1%, that latex gloves was 88.5%, and that to protective clothing was 60.7%. Commonly reported skin reactions included dry, itchy skin, nasal scar and wheals (Hu et al., 2020b). A study from Hubei, China (n=542, physicians and nurses) found a 97% prevalence rate of skin damage caused by enhanced infection-prevention measures. Commonly self-reported adverse skin reactions included dry skin, itchy skin, desquamation, fissures and maceration. While

the nasal bridge was the most frequently affected site, hands, cheeks and forehead were also affected (Lan et al., 2020).

3.5. Deaths amongst HCWs due to COVID-19

Separate Google searches, targeting HCW deaths due to COVID-19 were conducted. There is no global aggregated database tracking HCWs deaths. Researchers relying on other sources for data on HCWs deaths due to COVID-19 may encounter limitations, for example, under-reporting and the fact that the validity and reliability of the data are unknown (Jackson et al., 2020). However, many researchers have endeavoured to report figures for HCW deaths. In China, as of April 3, 2020, a total of 23 HCWs (21 physicians, one nurse, and one electrocardiography technician) deaths due to COVID-19 were reported (Zhan et al., 2020). As of April 15, 2020, a review of physician deaths due to COVID-19, reported 278 deaths across 21 countries. The top eight countries with physician deaths in multiple digits were: Italy (121), Iran (43), Philippines (21), Indonesia (17), China (16), Spain (12), the USA (12) and U.K. (11) (Ing et al., 2020). In the United Kingdom (U.K.), no central registry of HCWs deaths exists (Kursumovic et al., 2020). As of April 22, 2020, clinicians analysing media reports identified 106 UK HCW deaths due to COVID-19. These deaths included nurses (35), health support workers (27), doctors (18), administration/managerial (7), paramedic/transport (5) porters (4), housekeepers/cleaners (2) midwives (2) allied health professionals (2) dentists (1), pharmacists (1) radiographers (1) receptionists (1). Seven of these deaths were < 30 years, and eight were > 70 years, median, 54 years) (Cook et al., 2020a). As of April 27, 2020, researchers searching international resources counted (708) HCWs deaths due to COVID-19 across 52 countries. These figures included: doctors (365), nurses (126) and other HCWs, which included: technicians, hospital staff, medical directors, pharmacists and others. At this stage in the pandemic, the country with the highest documented HCW deaths was Italy (153), followed by the USA (135) (Beyazadam and Alimoglu, 2020). With a focus exclusively on physician and nurse deaths due to COVID-19, researchers accessing data, as of April 28, 2020, from various sources (governmental websites and health-related publications including (Medscape, 2020) reported 230 HCW deaths due to COVID-19 across seven countries. Nurses had significantly ($p < 0.05$) higher death rates than physicians in Italy, Brazil, Spain and France (Jackson et al., 2020). In Italy, as of May 3, 2020, a total of 151 physician and more than 40 nurses were reported to have died from COVID-19. The majority of doctors in Italy who died from COVID-19 worked as general practitioners, many of whom were responsible for home visits to patients with suspected COVID-19. During the pandemic, the distribution of physician deaths closely mirrored the curve of new cases among the Italian population (Nava et al., 2020). According to the International Council of Nurses ICN there is no systematic and standardised record of the number of nurses and other (HCWs) deaths due to COVID-19. However, as of June 3, 2020 the International Council of Nurses (ICN) reported more than 600 nurse deaths from COVID-19 worldwide (ICN, 2020). As of August 28, 2020, (Medscape, 2020), published a list of over 1800 names and occupations of HCWs deaths, directly or indirectly due to COVID-19 (age range from 20 to 99 years), including deaths for retired HCWs. The list of HCW deaths from 64 countries include physicians, nurses, assistants, technicians, orderlies, administrators, volunteers, drivers, porters, and emergency medical technicians. In Ireland, as of August 29, 2020, eight HCWs died due to SARS-CoV-2 infection (HPSC, 2020). In the USA, as of October 4, 2020, the COVID-19 data tracker quotes 739 deaths among HCWs (CDC-USA, 2020).

4. CONCLUSIONS

Based on 18 articles (two of which were reviews) retrieved from database searches from December 1, 2019 to August 29, 2020, this review shows that HCWs internationally were negatively impacted in many ways by the SARS-CoV-2 pandemic. Prevalence studies reported considerable prevalence rates among HCWs for stress, anxiety, depression, fear, and emotional burnout. These emotions were very often in the moderate to high levels. A considerable proportion of HCWs also experienced sleep issues and nightmares. A comparison of these prevalence rates are limited by (a)

different measurement tools used across the studies and in some studies when the same measurement tool was used different cut-off points were applied (b) variations in the definition/composition of healthcare worker groups, for example, restriction to one healthcare profession or inclusive of allied healthcare workers and support staff.

However, the comparative studies used the same measurement tool to examine the pandemic's impact among HCW groups. Compared to non-frontline trainees a significantly greater proportion of physician trainees on the frontline experienced: burnout, stress, interference with work-family balance and difficulty taking time off for family matters. In addition, compared to male physicians, significantly more female physicians scored low for psychological well-being. Mean scores for stress were also significantly higher for female HCWs, young HCWs (age range 22-35 years) and frontline nurses. Mean scores for anxiety were significantly higher in the group comparisons for nurses than for technicians, HCWs reporting extreme lack of protective equipment, HCWs aged ≥ 30 years and female HCWs. The majority of frontline HCWs expressed fear of contracting the virus, spreading it to their family, and fearing an uncontrollable epidemic. The majority of doctors and nurses reported skin lesions due to prolonged use of PPE. Sadly, many HCWs lost their lives due to infection with SAR-CoV-2 virus, and this paper would like to pay them tribute.

Until an effective SARS-CoV-2 vaccine is available and implemented globally, there will be continued pressure on the health care workforce (Adams and Walls, 2020). Counselling services (Badahdah et al., 2020), and evidence-based interventions (Benhamou and Piedra, 2020) for the management of HCWs psychosocial well-being during the COVID-19 pandemic is as important as managing their physical health (Abdessater et al., 2020). A systematic review identified practical strategies that help mitigate the psychological burden on HCWs during pandemics and these includes clear communication with staff, availability of adequate PPE, provision of infection control education and training, enforcement of infection control procedures, adequate rest and psychological support (Kisely et al., 2020). In the context of COVID-19, the WHO guides HCW risk assessment (WHO, 2020j) and infection prevention (WHO, 2020k). With the aim to minimise HCW exposure to SARS-CoV-2 a checklist for 'aerosol generating procedures' was devised by (Soma et al., 2020) and consensus guidelines were devised for safe airway management of patients with COVID-19 (Cook et al., 2020b). Following the 2003 SARS outbreak, HCWs experienced post-traumatic stress disorder (PTSD) (Lin et al., 2007). Healthcare policymakers need to consider preventative strategies for mitigating HCW post-traumatic stress disorder (Dutheil et al., 2020). International, standardised methods of reporting HCW deaths to the WHO should provide a more accurate characterisation of HCW deaths. Future reviews should; provide insights into possible long-term effects of the COVID-19 pandemic on HCWs, such as PTSD and the extent to which altered sleep patterns, stress, emotional burnout and anxiety levels return to normality.

5. LIMITATIONS

This is a rapid review. While a useful method to inform health policy, rapid reviews are typically limited (inter alia) to a search of two or more databases (Tricco et al., 2017). Also, this review is limited to the early months of the pandemic (January – August 29, 2020). With the fast-evolving pandemic, published literature has continued to grow exponentially (Al-Jabir et al., 2020).

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