

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Brain, Behavior, & Immunity - Health

journal homepage: www.editorialmanager.com/bbih/default.aspx

Review

The psychological impact of COVID-19 and other viral epidemics on frontline healthcare workers and ways to address it: A rapid systematic review



Sonja Cabarkapa^{a,b,*}, Sarah E. Nadjidai^{b,c}, Jerome Murgier^d, Chee H. Ng^{b,c}

^a St Vincent's Health, Melbourne, Australia

^b The Professorial Unit, The Melbourne Clinic, Melbourne, Australia

^c Department of Psychiatry, The University of Melbourne, Melbourne, Australia

^d Aguilera Private Clinic, Ramsey Générale de Santé, Biarritz, France

ARTICLE INFO

Keywords:
Epidemic
Pandemic
Mental health
Psychological impact
SARS
COVID-19

ABSTRACT

Background: As the world is battling the COVID-19 pandemic, frontline health care workers (HCWs) are among the most vulnerable groups at risk of mental health problems. The many risks to the wellbeing of HCWs are not well understood. Of the literature, there is a paucity of information around how to best prevent psychological distress, and what steps are needed to mitigate harm to HCWs' wellbeing.

Methods: A systematic review using PRISMA methodology was used to investigate the psychological impact on HCWs facing epidemics or pandemics, using three electronic databases (PubMed, MEDLINE and CINAHL), dating back to 2002 until the 21st of August 2020. The search strategy included terms for HCWs (e.g., nurse and doctor), mental health (e.g., wellbeing and psychological), and viral outbreaks (e.g., epidemic and pandemic). Only studies with greater than 100 frontline HCWs (i.e. doctors or nurses in close proximity to infected patients) were included.

Results: A total of 55 studies were included, with 53 using quantitative methodology and 2 were qualitative. 50 of the quantitative studies used validated measurement tools while 5 used novel questionnaires. The studies were conducted across various countries and included people with SARS (13 studies), Ebola (1), MERS (3) and COVID-19 (38). Findings suggest that the psychological implications to HCWs are variable with several studies demonstrating an increased risk of acquiring trauma or stress-related disorders, depression and anxiety. Fear of the unknown or becoming infected were at the forefront of the mental challenges faced. Being a nurse and being female appeared to confer greater risk. The perceived stigma from family members and society heightened negative implications; predominantly stress and isolation. Coping strategies varied amongst the contrasting socio-cultural settings and appeared to differ amongst doctors, nurses and other HCWs. Implemented changes, and suggestions for prevention in the future consistently highlighted the need for greater psychosocial support and clearer dissemination of disease-related information.

Conclusion: This review can inform current and future research priorities in the maintenance of wellbeing amongst frontline HCWs. Change needs to start at the level of policy-makers to offer an enhanced variety of supports to HCWs who play a critical role during largescale disease outbreaks. Psychological implications are largely negative and require greater attention to be mitigated, potentially through the involvement of psychologists, raised awareness and better education. The current knowledge of therapeutic interventions suggests they could be beneficial but more long-term follow-up is needed.

1. Introduction

Large-scale disease epidemics pose various challenges to individuals of all ages and cultures but the emotional stress experienced by frontline

health care workers (HCWs) is severe, and can be enduring (Tam et al., 2004; Maunder et al., 2004; Lancee et al., 2008). The 2019 novel coronavirus (COVID-19) which emerged in Wuhan, China, led to a pandemic unlike any other in the last century. The subsequent demand placed on

* Corresponding author. St Vincent's Health, Department of Mental Health 41 Victoria Parade, Fitzroy VIC, 3065, Australia.
E-mail address: sonjaac3@gmail.com (S. Cabarkapa).

<https://doi.org/10.1016/j.bbih.2020.100144>

Received 15 June 2020; Received in revised form 8 September 2020; Accepted 13 September 2020

Available online 17 September 2020

2666-3546/Crown Copyright © 2020 Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

HCWs is difficult to encompass in its entirety. Even less is known about the implications for their mental health and well-being. Evidence from studies during COVID-19 and similar past epidemics can help inform this, and how best to address it.

A pandemic is the worldwide spread of a new disease, otherwise known as an epidemic that has spread over several countries or continents. (*Emergencies preparedness*.) The world has faced several such bio-disasters including Severe Acute Respiratory Syndrome (SARS) in China, parts of Asia and Canada in 2003, Ebola in West Africa in 2014 and Middle East Respiratory Syndrome (MERS) in 2016. The most recent epidemic of COVID-19 led to an alarmingly high global death toll, with thousands of HCWs becoming infected (Baud et al.). The fast changing response to this novel virus was likely to have had a profound effect on the wellbeing of hospital employees working on the front-line. Furthermore, the rapid transmission rate of COVID-19 led to unparalleled tasks that HCWs may not have been adequately equipped to deal with, from both a professional and psychological viewpoint.

Dealing with a severe global health disaster is an uncharted journey into the unknown at various levels. Government bodies make plans using other countries' data to project infection rates. The high degree of uncertainty associated to novel pathogens further contributes to the communal anxiety held, and makes for an overall negative experience for most. However, the challenge encountered can also result in positive changes, as individuals harness their coping skills, work together in teams, and the change instrumented by leaders can strengthen nations' preparedness against future disasters.

In terms of mental health impact of epidemics, HCWs represent a particularly vulnerable group due to the high risk of infection, increased work stress and fear of spreading to their families (Xiang et al., 2020).

During the recent Ebola outbreak, an unprecedented number of HCWs were infected (Fischer et al., 2014; Unprecedented number of m, 2014) and survivors of infectious diseases have higher rates of post-traumatic stress disorder (PTSD) (Hong et al., 2009). Recommendations around the use of psychological first aid (PFA) have been made by global authorities (Psychological first aid d, 2014). However, the efficacy of this strategy is not well studied and barriers to its application exist (Workforce development at, 2003; Birkhead and Vermeulen, 2018).

The many risks to the wellbeing of HCWs are not well understood. Post-SARS, there has been some research into this area but little is known about the psychological impact during infectious disease outbreaks (Mak et al., 2009). Detrimental outcomes such as burnout, traumatic stress, anxiety, and depressive symptoms have been reported even after an outbreak, suggesting long-term implications (Lancee et al., 2008). Given the likely increased rate of psychological problems amongst HCWs, these factors must be addressed.

2. Purpose of this review

In the context of the COVID-19 pandemic, this timely review is both relevant and urgent. It is imperative that those working at the frontline with infected patients or in afflicted regions have the necessary strategies and resources to endure various challenges. There is a lack of systematic reviews published specifically on the mental health implications experienced by frontline HCWs during an epidemic. Of the literature, there is also a paucity of information around how to best prevent psychological distress, and what steps are needed to mitigate harm to HCWs' wellbeing. The purpose of this review is to explore the main findings from the literature examining the psychological impact on HCWs in times of severe epidemics, and to identify strategies to address this.

3. Search strategy and selection criteria

We performed a systematic literature review to identify all international research related to epidemics and pandemics. Specifically, we aimed to identify original research pertaining to severe viral outbreaks, from 2002 to the 21st of August 2020. To obtain relevant articles, we

systematically searched PubMed, MEDLINE and CINAHL. The following search terms were used: 'health worker', 'health care worker', 'medical', 'doctor', 'nursing', 'nurse', 'allied health', 'pandemic', 'outbreak', 'mental health', 'mental illness', 'psychiatric', 'psychological', 'coping', 'psycho-social', 'COVID-19', 'coronavirus', 'SARS', 'MERS' and 'Ebola'. The references of identified articles were also manually searched for additional studies meeting study criteria.

The studies included in this review had to be original research (i.e. commentaries, editorials and reviews were excluded), be published in peer-reviewed journals, be written in English, include frontline HCWs as study participants, and include factors associated with their mental health or psychological wellbeing. As the clear majority of papers used self-reported measures, to ensure inclusion of high quality and adequately powered research, studies needed to include at least 100 frontline HCWs. HCWs needed to be working in close proximity with infected patients. The initial search yielded 2,876 papers, of which 55 included relevant data and were included in this review. The screening process is depicted in Fig. 1.

3.1. Data extraction

One reviewer (SN) examined the titles and abstracts initially to yield the preliminary publications for inclusion (120). Two reviewers (SC and SN) examined the full text studies independently with identical study selection criteria and removed the articles (65) that did not fulfil inclusion criteria. A third reviewer (CN) examined studies that required further consideration.

4. Results

The studies were conducted across various countries and included people with SARS (13 studies), Ebola (1), MERS (3) and COVID-19 (38). Of the 55 articles, 53 were quantitative and 2 were qualitative. Details of the characteristics are listed in Table 1. Of the quantitative studies, fifty studies^{1-3, 14-58} incorporated validated questionnaires or measurement tools, while five (Bai et al., 2004; Wong et al., 2005; Khalid et al., 2016; Chan et al., 2005; Li et al., 2020c) used novel questionnaires.

4.1. The psychological impact of epidemics

4.1.1. Patterns of psychological impact

All the studies included in this review assessed the psychological impact of severe epidemics on HCWs. The most common psychiatric disorders diagnosed were post-trauma stress syndrome (PTSS), depression and anxiety, as assessed in 32 studies (Ji et al., 2017; Wu et al., 2009; Chan and Huak, 2004; Rossi et al., 2020; García-Fernández et al., 2020; Liu et al., 2020a; Kang et al., 2020; Zhang et al., 2020b; Mo et al.; Zhou et al., 2020; Xiaoming et al., 2020; Wilson et al., 2020; Wasim et al., 2020; Wańkiewicz et al., 2020; Wang et al., 2020; Tian et al., 2020; Shechter et al., 2020; Sandesh et al., 2020; Pouralizadeh et al., 2020; Liu et al., 2020b; Lin et al., 2020; Korkmaz et al., 2020; Juan et al., 2020; Hu et al., 2020; Hong et al., 2020; Elbay et al., 2020; Du et al., 2020; Di Tella et al., 2020; Chew et al., 2020; Cai et al., 2020b; An et al., 2020; Bai et al., 2004). In the COVID-19 pandemic, somatization was reported frequently (Xiaoming et al., 2020; Juan et al., 2020; Hong et al., 2020) with 42.7% (2,005 of 4,692) of frontline nurses identifying somatic symptoms (Hong et al., 2020), particularly headaches, throat pain and lethargy, which were significantly associated with psychological outcomes (Chew et al., 2020). Sleep disorders including insomnia were also frequently identified (Wasim et al., 2020; Wańkiewicz et al., 2020; Tian et al., 2020; Lin et al., 2020; Chew et al., 2020; Cai et al., 2020b).

Female nurses with close contact to COVID-19 patients appeared to have the highest mental health risks (Pouralizadeh et al., 2020), (Romero et al., 2020; Elbay et al., 2020) However, it is important to note that most studies included predominantly female participants, especially nurses, with only one study suggesting higher stress levels amongst males (Liu

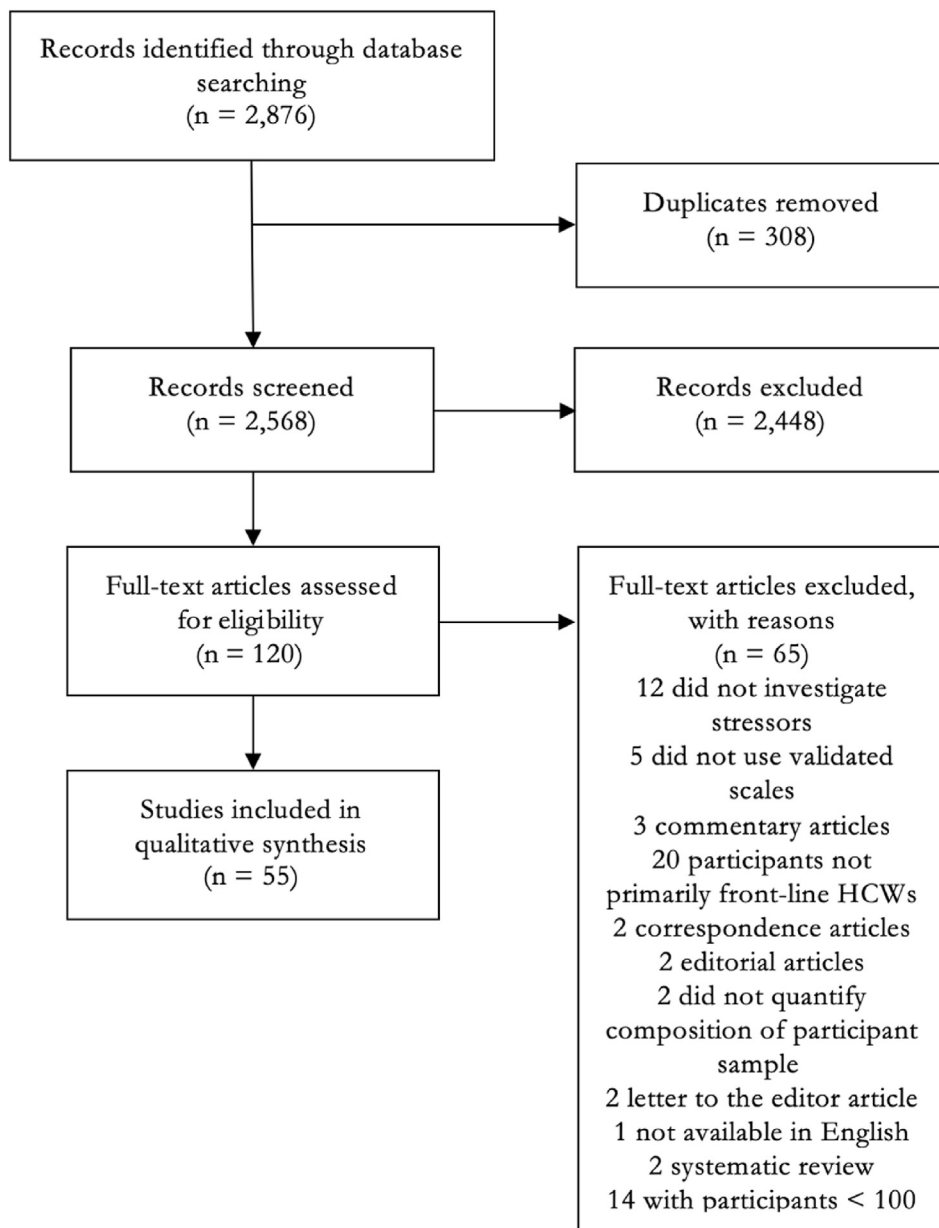


Fig. 1. Screening process of review.

et al., 2020b). Specifically, being female conferred greater risks for depression, anxiety and higher levels of stress (Xiaoming et al., 2020; Pouralizadeh et al., 2020; Elbay et al., 2020; Du et al., 2020; Di Tella et al., 2020; Babore et al., 2020). Suicidal ideation was identified amongst 6.5% (306 of 4,692) of HCWs with lower self-perceived health status listed as an additional risk factor (Xiaoming et al., 2020; Hong et al., 2020). At the early stages of the COVID-19 pandemic, a Wuhan study (Kang et al., 2020) found that 34.4% (342 of 994) of medical and nursing staff had mild mental health disturbances while 6.2% (62) had severe disturbances, while in another study (Cai et al., 2020a) of 1,521 Chinese HCWs 14.1% had psychological abnormalities. In the Hubei province, 12.5% (64 of 512) of medical staff had anxiety, being more severe in those with direct contact with infected patients (Liu et al., 2020a). Two-weeks after Wuhan went into lockdown, the proportion of female HCWs with depression, anxiety and acute stress symptoms were respectively 14.2% (621 of 4,369), 25.2% (1,101) and 31.6% (1,382) (Li et al., 2020b). One study found a moderate degree of burnout amongst 2,014 HCWs across two hospitals in Wuhan, with high levels of fear reported

(Hu et al., 2020).

Approximately 20% (127 of 661) of HCWs had PTSD two months after the SARS outbreak in Singapore (Chan and Huak, 2004). While 5% (17 of 338) of staff members at a hospital in East Taiwan met criteria for an Acute Stress Disorder (ASD) during the SARS pandemic (Bai et al., 2004). Similarly, HCWs and other staff with direct contact or exposure to Ebola patients, had a range of psychological symptoms, such as obsession-compulsion, interpersonal sensitivity, depression and paranoid ideation (Ji et al., 2017). During the 3-year period following their exposure to the 2003 SARS outbreak, around 10% (55 of 549) of Beijing hospital employees had a high degree of post-traumatic stress symptoms which were strongly associated with exposure to SARS, quarantine and a relative or friend acquiring SARS (Wu et al., 2009).

A study (Lee et al., 2018) of 1,800 HCWs assessed the psychological impact in the initial stages of the MERS outbreak and one month later. Those who performed MERS-related tasks reported greater distress and more intrusive phenomena. They also had the greatest risk for PTSD symptoms one-month later, and interestingly, this risk was increased

Table 1
Characteristics of included studies.

	Country or region	Design	Epidemic studied	Participants	Duration and year	Measures
An et al. (2020) (An et al., 2020)	China	Cross-sectional	COVID-19	1,103 nurses	6 days, March 2020	PHQ-9 and WHO-QOL-BREF
Babore et al. (2020) (Babore et al., 2020)	Italy	Cross-sectional	COVID-19	595 health care workers	6 days, April 2020	PSS and COPE-NVI-25
Bai et al. (2004) (Bai et al., 2004)	Taiwan	Cross-sectional	SARS	338 staff members (218 health care workers and 79 administrative personnel)	7 days, 2003	A newly-designed SARS-related stress reaction questionnaire, composed of acute stress disorder criteria from the DSM-IV
Cai et al. (2020) (Cai et al., 2020a)	China	Cross-sectional	COVID-19	1,521 health care workers (comprising doctors, nurses, allied health and non-clinical staff)	Unknown, 2019	SCL-90, CD-RISC and SSRS
Cai Q et al. (2020) (Cai et al., 2020b)	China	Case-control	COVID-19	1,173 frontline and 1,173 age- and sex-matched non-frontline medical workers (doctors and nurses)	15 days, February 2020	BAI, ISI and PHQ-9
Chan and Huak (2004) (Chan and Huak, 2004)	Singapore	Cross-sectional	SARS	661 hospital workers (113 doctors and 548 nurses)	Unknown, 2003	GHQ, IES and a newly-developed questionnaire on changes in life's priorities and coping
Chan et al. (2005) (Chan et al., 2005)	Hong Kong	Cross-sectional	SARS	1470 nurses	May 2003	SARS NSQ
Chew et al. (2020) (Chew et al., 2020)	Singapore and India	Cross-sectional	COVID-19	906 health care workers (268 physicians, 355 nurses and others)	2 months, February to April 2020	DASS-21 and IES-R
Chua et al. (2004) (Chua et al., 2004)	Hong Kong	Case-control	SARS	271 health care workers (roles unknown) and 342 healthy controls	1 month, 2003	PSS-10
Di Tella et al. (2020) (Di Tella et al., 2020)	Italy	Cross-sectional	COVID-19	145 health care workers (72 doctors and 73 nurses)	17 days, March to April 2020	VAS, STAI, BDI and PCL-5
Du et al. (2020) (Du et al., 2020)	China	Cross-sectional	COVID-19	134 health care workers (60 from Wuhan and 74 from outside Wuhan)	5 days, February 2020	PSS and BDI-II
Elbay et al. (2020) (Elbay et al., 2020)	Turkey	Cross-sectional	COVID-19	442 physicians	5 days, March 2020	DAS-21
García-Fernández (2020) (García-Fernández et al., 2020)	Spain	Cross-sectional	COVID-19	781 health care workers (385 physicians, 233 nurses and 164 other professionals)	8 days, March to April 2020	HARS, BDI and ASDI
Hong et al. (2020) (Hong et al., 2020)	China	Cross-sectional	COVID-19	4,692 nurses	7 days, February 2020	PHQ-9, GAD-7 and PHQ-15
Hu et al. (2020) (Hu et al., 2020)	China	Cross-sectional	COVID-19	2,014 nurses	February 2020	MBI-HSS, SAS, SDS, GSS, CD-RISC-10 and MSPSS
Ji et al. (2017) (Ji et al., 2017)	Sierra Leone	Cross-sectional	EVD	161 participants: local medical staff (59), logistic staff (21), medical students (22), and overseas medical staff (41) and Ebola survivors (18)	5 months, 2014 to 2015	SCL-90-R
Juan et al. (2020) (Juan et al., 2020)	China	Cross-sectional	COVID-19	456 health care workers (doctors and nurses)	14 days, February 2020	IES, GAD-7, PHQ-9, Y-BOCS and PHQ-15
Kang et al. (2020) (Kang et al., 2020)	China	Cross-sectional	COVID-19	944 hospital workers (811 nurses and 183 doctors)	7 days, January to February 2020	PHQ-9, GAD-7, ISI and IES-R
Khalid et al. (2016) (Khalid et al., 2016)	Saudi Arabia	Cross-sectional	MERS	117 health care workers (89 nurses, 16 physicians and 12 respiratory specialists)	1 month, 2014	A newly-developed 72 item MERS staff questionnaire to explore emotions, factors causing stress, factors that may have helped reduce stress and coping strategies
Khee et al. (2004) (Khee et al., 2004)	Singapore	Qualitative	SARS	188 health care workers (mainly nurses, composition of sample unknown)	unknown, 2003	16 supportive therapy group sessions conducted. Recordings of sessions analysed to determine the main issues and concerns faced by health care providers
Koh et al. (2005) (Koh et al., 2005)	Singapore	Cross-sectional	SARS	10,511 health care workers (comprising doctors, nurses, allied health and non-clinical staff), proportions unknown	unknown, 2003	A 3-part questionnaire: 1. Demo-graphic characteristics 2.88 questions: single choice, multiple choice, and open-ended questions on the perception of exposure to SARS, perceived risk of infection, and impact of the SARS outbreak on personal and work life 3. IES
Korkmaz et al. (2020) (Korkmaz et al., 2020)	Turkey	Cross-sectional	COVID-19	140 health care workers	Unknown, 2020	PSQI, PSI, WHOQOL-BREF and BAI
Lai et al. (2020) (Lai et al., 2020)	China	Cross-sectional	COVID-19	1,257 health care workers (493 physicians and 764 nurses)	6 days, January to February 2020	PHQ-9, GAD-7, ISI, IES-R
	Canada	Cross-sectional	SARS			

(continued on next page)

Table 1 (continued)

	Country or region	Design	Epidemic studied	Participants	Duration and year	Measures
Lancee et al. (2008) (Lancee et al., 2008)				139 health care workers (103 nurses, 15 clerical staff and 21 other hospital staff)	11 months, 2004 to 2005	CAPS, SCID (excluding the psychosis and PTSD modules) and IES, K10, the emotional exhaustion scale of the MBI and self-report of: smoking, drinking alcoholic beverages, using non-prescription drugs, or other problem activities
Lee et al. (2018) (Lee et al., 2018)	South Korea	Longitudinal	MERS	359 hospital workers (doctors, nurses, pharmacists and non-clinical staff [proportions unknown]) completed first survey and 77 workers completed the second	7 months, 2015	IES-R
Li et al. (2020) (Li et al., 2020b)	China	Cross-sectional	COVID-19	4,369 female frontline HCWs	8 days, February 2020	PHQ, GAD-7, IES-R
X. Li et al. (2020) (Li et al., 2020a)	China	Cross-sectional	COVID-19	948 medical staff	8 days, February 2020	AIS and SRQ-20
Z. Li et al. (2020) (Li et al., 2020c)	China	Case-control	COVID-19	234 frontline nurses and 292 non-frontline nurses	5 days, February 2020	Vicarious Traumatization Questionnaire (based on TSIBS, IES and VTS)
Lin et al. (2020) (Lin et al., 2020)	China	Cross-sectional	COVID-19	2,316 nurses and physicians (885 frontline health and 1431 non-frontline)	14 days, January to February 2020	PHQ-9, GAD-7, ISI and IES-R
Liu et al. (2020) (Liu et al., 2020a)	China	Cross-sectional	COVID-19	512 healthcare staff working in a clinical department (369), fever clinics (68) and administration (75)	11 days, February 2020	SAS
Y. Liu et al. (2020) (Liu et al., 2020b)	China	Cross-sectional	COVID-19	2,073 doctors and nurses	7 days, February 2020	DASS-21
Lu et al. (2020) (Lu et al., 2020)	China	Cross-sectional	COVID-19	2,042 medical staff and 257 administrative staff, with 213 working in isolation wards	2 days, February 2020	NRS, HAMA and HAMD
Lung et al. (2009) (Lung et al., 2009)	Taiwan	Longitudinal	SARS	127 (49 nurses, 24 physicians and 54 others [medical technicians, emergency attendants and respiratory therapists])	32 months, 2003 to 2005	PBI, EPQ and CHQ
Maunder et al. (2005) (Maunder et al., 2004)	Canada	Cross-sectional	SARS	1,557, majority were nurses (430). Also allied health (136), physicians, (115), research laboratory staff (117), clinical laboratory staff (106) and others	2 months, 2003	IES and 76 items probing attitudes toward SARS
Mo et al. (2020) (Mo et al.)	China	Cross-sectional	COVID-19	180 nurses	Unknown, 2020	SOS and SAS
Park et al. (2018) (Park et al., 2018)	South Korea	Cross-sectional	MERS	187 nurses	1 month, 2015	SF-36, PSS-10, DRS-15 and the newly developed STIGMA scale to assess the perceived stigma of nurses
Pouralizadeh et al. (2020) (Pouralizadeh et al., 2020)	Iran	Cross-sectional	COVID-19	441 nurses	6 days, April 2020	GAD-7 and PHQ-9
Romero et al. (2020) (Romero et al., 2020)	Spain	Cross-sectional	COVID-19	3,109 health care workers	10 days, April 2020	A Psychological Stress and Adaptation at Work Score (PSAS) based on the: Healthcare Stressful Test, Coping Strategies Inventory, Font-Roja Questionnaire and the Trait Meta-Mood Scale
Rossi et al. (2020) (Rossi et al., 2020)	Italy	Cross-sectional	COVID-19	1,378 health care workers (472 nurses, 433 physicians, 86 General Practitioners, 275 other [lab technicians, physiotherapists, radiotherapists] and 112 Health Care Assistants)	5 days, March 2020	GPS, PHQ-9, GAD-7, ISI and PSS
Sandesh et al. (2020) (Sandesh et al., 2020)	Pakistan	Cross-sectional	COVID-19	112 health care workers	May 2020	DASS-21
Schechter et al. (2020) (Shechter et al., 2020)	United States of America	Cross-sectional	COVID-19	657 health care workers, including physicians, advanced practice providers, residents, fellows and nurses	15 days, April 2020	PC-PTSD, PHQ-2, GAD-2 and questions modified from PSQI and ISI
Shih et al. (2007) (Shih et al., 2007)	Taiwan	Qualitative	SARS	200 nurses	Unknown, after SARS outbreak in 2003	25 semi-structured focus group interviews (6–10 persons per group), followed by a paper questionnaire requiring open-ended responses
Tam et al. (2004) (Tam et al., 2004)	Hong Kong	Cross-sectional	SARS	652 (62% nurses, 24% health care assistants and 3% medical professionals)	2 months, 2003	A 6-part questionnaire: 1. Demographics, exposure to SARS patients and subjective physical health 2. Job-related stress 3. Coping behaviours 4. GHQ 5. Adequacy of support systems 6. Positive and negative perspectives of the outbreak

(continued on next page)

Table 1 (continued)

	Country or region	Design	Epidemic studied	Participants	Duration and year	Measures
Tian et al. (2020) (Tian et al., 2020)	China	Cross-sectional	COVID-19	845 health care workers	5 days, April 2020	PSS-10, PHQ-9, GAD-7 and ISI-7
Wang et al. (2020) (Wang et al., 2020)	China	Cross-sectional	COVID-19	274 health care workers	6 days, February to March 2020.	GAD-7, PHQ-9, PSS-14, CD-RISC-10 and PSQI
Wankowicz et al. (2020) (Wańkowitz et al., 2020)	Poland	Cross-sectional	COVID-19	441 health care workers	14 days, May 2020	GAD-7, PHQ-9 and ISI
Wasim et al. (2020) (Wasim et al., 2020)	Pakistan	Cross-sectional	COVID-19	356 health care workers	14 days, May to June 2020	DAS-21 and IS
Wilson et al. (2020) (Wilson et al., 2020)	India	Cross-sectional	COVID-19	350 health care workers	April 2020	PHQ-9 and GAD-7
Wong et al. (2005) (Wong et al., 2005)	Hong Kong	Cross-sectional	SARS	466 health care workers (123 doctors, 257 nurses and 82 health care assistants)	Late June to early July 2003	Newly designed questionnaires: overall degree of mental distress caused by SARS measured by a single-item 11-point Likert scale, source of distress measured by an 18-item questionnaire
Wu et al. (2009) (Wu et al., 2009)	China	Retrospective cross-sectional	SARS	549 hospital employees in 3 categories (doctors, nurses and other hospital staff), proportions unknown	2006, dates unknown	Exposure to the SARS Outbreak, Other Exposure to Traumatic Events and During-Outbreak Perceptions of SARS-Related Risks questionnaires
Xiao et al. (2020) (Xiao et al., 2020)	China	Cross-sectional	COVID-19	180 medical staff	1 month, January to February 2020.	SAS, GSES, SASR, PSQI and SSRS
Xiaoming et al. (2020) (Xiaoming et al., 2020)	China	Cross-sectional	COVID-19	8,817 hospital workers	9 days, February 2020	PHQ-9, GAD-7 and PHQ-15
Zhang and Wang et al. (2020) (Zhang et al., 2020b)	China	Cross-sectional	COVID-19	2,182 Chinese medical (927) and non-medical (125) HCWs	3 weeks, February to March 2020	An online survey including the ISI, SCL-90-R and the PHQ-4, which included the PHQ-2
Zhang and Yang et al. (2020) (Zhang et al., 2020a)	China	Cross-sectional	COVID-19	1,563 medical workers (984 nurses 454 doctors, 95 other medical staff and 30 hospital administration)	6 days, January to February 2020	ISI, PHQ-9, GAD and IES-R
Zhou et al. (2020) (Zhou et al., 2020)	China	Cross-sectional	COVID-19	1,001 health care workers (doctors and nurses)	15 days, February to March 2020	SCL-90, PSQI and CPSS

AIIS = Athens Insomnia Scale. BAI=Beck Anxiety Inventory. BDI=Beck Depression Inventory. BDI-II= Beck Depression Inventory, Second Edition. CAPS=Clinician-Administered PTSD Scale. CD-RISC = Connor Davidson Resilience Scale. CHQ=Chinese Health Questionnaire. COPE-NVI-25 = Coping Orientation to the Problems Experienced. DASS-21 = Depression Anxiety Stress Scale. CPSS=The Chinese Perceived Symptom Scale (CPSS). DRS-15 = Dispositional Resilience Scale-15. DSM-IV = Diagnostic and Statistical Manual of Mental Disorders, 4th Edition. EPQ = Eysenck Personality Questionnaire. EVD = Ebola virus disease. GAD-2 = Generalised Anxiety Disorder Scale-2. GAD-7 = Generalised Anxiety Disorder Scale-7. GSS = General Self-Efficacy Scale. GHQ-28 = General Health Questionnaire 28. GPS = Global Psychotrauma Screen. GSES = General Self-Efficacy Scale. HAMA=Hamilton Anxiety Scale. HAMD=Hamilton Depression Scale. IES-R = Impact of Events Scale-Revised. IES= Impact of Events Scale. ISI=Insomnia Severity Index. K-6=Kessler Distress Scale. K10 = Kessler Psychological Distress Scale. MBI = Maslach Burnout Inventory. MERS = Middle East respiratory syndrome. MSPSS = Multidimensional Scale of Perceived Social Support. NRS=Numerical Rating Scale. PBI=Parental Bonding Instrument. PCL-5 = PTSD Checklist for DSM-5. PC-PTSD=The Primary Care PTSD Screen for DSM-5. PHQ-2 = Patient Health Questionnaire-2. PHQ-4 = Patient Health Questionnaire-4. PHQ-9 = Patient Health Questionnaire. PHQ-15 = Patient Health Questionnaire-15. PSQI=Pittsburgh Sleep Quality Index. PSS-10 = Perceived Stress Scale-10. SARS NSQ= SARS Nurses' Survey Questionnaire. SARS = severe acute respiratory syndrome. SAS = Zung Self-rating Anxiety Scale. SASR=Stanford Acute Stress Reaction Questionnaire. SCID=Structured Clinical Interview for DSM-IV. SCL-90-R = Symptom Checklist-90-Revised. SCL-90 = Symptom Checklist-90. SDS = Zung Self-rating Depression Scale. SF-12 = Medical Outcomes Study Short Form 12 Survey. SF-36 = Medical Outcomes Study Short Form 36 Survey. SOS=Stress Overload Scale. SRQ-20 = Self-Reporting Questionnaire-20. SSRS=Social Support Rating Scale. SSRS=Social Support Rating Scale. STAI=State-Trait Anxiety Inventory. TSIBS = Traumatic Stress Institute Belief Scale. VAS=Visual Analogue Scale. VTS=Vicarious Trauma Scale. WHO-QoL-BREF=World Health Organisation Quality of Life. Y-BOCS=Yale-Brown Obsessive Compulsive Scale.

even after home quarantine. Home quarantined HCWs had poorer sleep and a heightened degree of numbness than those who were not quarantined.

In terms of impact on different health professionals, a recent study (Zhang et al., 2020b) comparing medical HCWs (927) to non-medical HCWs (1,255) demonstrated significantly higher levels of insomnia, anxiety, depression, somatization, and obsessive-compulsive symptoms in medical HCWs. A Spanish study (García-Fernández et al., 2020) also found that HCWs (613) had higher symptoms of acute stress than compared with non-HCWs (164). Similarly, anxiety and insomnia were significantly higher in frontline HCWs compared to non-frontline HCWs (Wańkowitz et al., 2020; Lin et al., 2020; Cai et al., 2020b). Eight studies compared doctors and nurses (Tam et al., 2004; Maunder et al., 2004; Lung et al., 2009; Lai et al., 2020; Liu et al., 2020b; Korkmaz et al., 2020; Wong et al., 2005; Chan et al., 2005). Four of these studies focused on SARS and found that nurses experienced greater levels of stress. Of these,

one study (Maunder et al., 2004) reported higher distress for nurses and those with direct contact with infected patients. In two studies (Tam et al., 2004; Wong et al., 2005) from Hong Kong, the overall distress level for nurses was significantly higher than for other HCWs with the exception of doctors, and nurses also experienced higher levels of stress and psychological morbidity compared with other professionals. Interestingly, one study (Chan et al., 2005) of 1,470 nurses, showed that nurses in moderate-risk areas appeared to have more stress symptoms than those working in high-risk areas, but the reasons for this remain unclear. Alternate findings were depicted in two studies (Chan and Huak, 2004; Liu et al., 2020b) where doctors and single nurses were found to be at higher risk compared to nurses and those who were married, and doctors had more stress and anxiety compared to nurses. Further, 27% of participants (177 of 660) had psychiatric symptoms, with the doctors being 1.6 times more likely to experience psychiatric symptoms than nurses, and 20% (127 of 651) had PTSD. In contrast, a study (Lung et al.,

2009) comparing 127 HCWs impacted by SARS, found no significant difference in feelings of stress between the physicians, nurses and other HCWs. An Italian study (Rossi et al., 2020) of 1,379 HCWs during the COVID-19 pandemic, showed that general practitioners were more likely to have PTSS than other HCWs, while nurses and health care assistants were more likely to exhibit severe insomnia. Similarly, another Chinese study (Li et al., 2020c) found that nurses (234) working in the frontline against COVID-19 experienced significantly greater levels of vicarious traumatization when compared to non-frontline nurses (292). This theme was replicated with findings to suggest that frontline HCWs in close contact with infected patients were 1.4 times more likely to feel fear and twice more likely to suffer anxiety and depression when compared to non-clinical staff (Lu et al., 2020).

In a study (Lai et al., 2020) of 1,257 HCW's during the COVID-19 outbreak, high rates of depression, anxiety and insomnia were reported with over 70% reporting psychological distress. A survey (Zhang et al., 2020a) of Chinese HCWs during the COVID-19 outbreak found that 36.1% (564 of 1,563) had symptoms of insomnia. A comparison of HCWs in Wuhan, the epicentre of the COVID-19 outbreak, compared to those in a different Chinese province found that staff in Wuhan had higher rates of insomnia and stress responses (Li et al., 2020a). One study (Chua et al., 2004) compared HCWs with healthy controls and found that HCWs were not more stressed than controls (342) but 89% (241 of 271) of HCWs experienced negative psychological symptoms.

A total of six studies (Tam et al., 2004; Lancee et al., 2008; Lung et al., 2009; Wu et al., 2009; Lee et al., 2018; Shih et al., 2007) examined the psychological symptoms post-epidemic, with two studies (Lung et al., 2009; Wu et al., 2009) utilising long-term follow-up. Of Beijing HCWs who had high levels of PTS symptoms during the 2003 SARS outbreak, about 40% (22 of 55) still had a high PTS level at the time of the interview 3 years after (Wu et al., 2009). An investigation (Lung et al., 2009) of 123 HCWs recruited from a Taiwanese hospital found that 17.3% (22 of 127) had mental symptoms shortly after the SARS epidemic and 15.4% (19 of 123) had mental health symptoms one year later.

4.1.2. Stressors arising from an epidemic

The publications included in this review were predominantly focused on the stressors arising during an outbreak, however, six articles (Tam et al., 2004; Lancee et al., 2008; Lung et al., 2009; Wu et al., 2009; Lee et al., 2018; Shih et al., 2007) focused either entirely on the period following the outbreak, or in part, had follow-up. Two (Tam et al., 2004; Lancee et al., 2008) articles examined predictors and one study (Shih et al., 2007) considered the stressors before care was given.

Predictors of the incidence of new-onset episodes of psychiatric disorders after the SARS outbreak included; a past history of psychiatric illness, years of health care experience (inversely associated) and the perception of adequate training and support. New episodes of psychiatric disorders occurred among 5% (7 of 139) of HCWs (Lancee et al., 2008). A greater degree of psychiatric morbidity was identified amongst nurses and younger HCWs (Tam et al., 2004). Taiwanese nurses found that the pre-care stage contributed to fear, as all (200) reported having difficulties keeping up with daily changing knowledge and skills and being anxious about their safety and of their families, clients, and colleagues (Shih et al., 2007).

4.1.2.1. Infection related fears. Participants across seventeen studies (Tam et al., 2004; Maunder et al., 2004; Ji et al., 2017; Wu et al., 2009; Chua et al., 2004; Koh et al., 2005; Mo et al.; Hu et al., 2020; Du et al., 2020; Bai et al., 2004; Wong et al., 2005; Khalid et al., 2016; Chan et al., 2005; Khee et al., 2004; Shih et al., 2007) reported fear as the prominent stressor. Particularly, fear of the unknown, becoming infected and threats to their own mortality. The vulnerability of colleagues and family member were also a major cause of concern as reported in an Italian study (Rossi et al., 2020), being exposed to contagion was associated with symptoms of depression, while having a colleague hospitalised or

placed in quarantine was associated with PTSS, whereas, a colleague dying was associated to depression and insomnia.

A major theme was anxiety, especially across most of the COVID-19 studies (Lai et al., 2020; Cai et al., 2020a; Rossi et al., 2020; García-Fernández et al., 2020; Liu et al., 2020a; Zhang et al., 2020b; Mo et al.; Lu et al., 2020; Xiaoming et al., 2020; Wilson et al., 2020; Wasim et al., 2020; Wańkiewicz et al., 2020; Wang et al., 2020; Tian et al., 2020; Shechter et al., 2020; Sandesh et al., 2020; Pouralizadeh et al., 2020; Liu et al., 2020b; Lin et al., 2020; Korkmaz et al., 2020; Juan et al., 2020; Hu et al., 2020; Hong et al., 2020; Elbay et al., 2020; Du et al., 2020; Di Tella et al., 2020; Chew et al., 2020; Cai et al., 2020b). In a Chinese study (Liu et al., 2020a) the most important factor in HCWs with high anxiety was being suspected of having COVID-19 infection when compared to those who were not suspected of infection. Of 10,511 HCWs in Singapore, 76% perceived an increased risk of becoming infected, 56% reported work stress and 53% had increased workloads. Doctors, nurses and staff in daily contact with SARS patients, and staff from SARS-affected institutions expressed significantly higher levels of anxiety than other HCWs (Koh et al., 2005).

In 466 questionnaires (Wong et al., 2005) of doctors and nurses during the SARS outbreak, fear was most attributed to the following variables; loss of control/vulnerability, fear for self-health and spread of the virus. The psychological morbidity of HCWs in Hong Kong was associated with perceptions of personal vulnerability, stress and support in the workplace. 68% (444 of 652) reported a high level of stress while approximately 57% (370 of 652) experienced psychological distress. Similarly, a survey (Khalid et al., 2016) of 117 HCWs after the MERS outbreak found that safety fears for themselves and others were a major concern, with worries that they would transmit the disease to their families and friends. All nurses (200) responding to a qualitative study (Shih et al., 2007) expressed that a lack of defensive protection against the disease, and difficulties keeping up with daily changing knowledge/skills contributed to fear. The media was also noted to play a role in amplifying uncertainty (Shih et al., 2007).

4.1.2.2. Social and cultural aspects. Ten studies (Tam et al., 2004; Maunder et al., 2004; Chan and Huak, 2004; Zhou et al., 2020; Wańkiewicz et al., 2020; Korkmaz et al., 2020; Hu et al., 2020; Hong et al., 2020; Babore et al., 2020; Khee et al., 2004) highlighted the importance of social support, with emphasis on the need for increased social support mechanisms (Korkmaz et al., 2020) and regular contact with families (Wańkiewicz et al., 2020). A lack of family support and social isolation had a negative psychological impact on nurses who chose to isolate away from their families while treating SARS patients (Chan and Huak, 2004). Correspondingly, the lack of social support during the SARS outbreak brought out discrimination from the community as well as distancing behavior from HCWs' own families (Khee et al., 2004). A study (Maunder et al., 2004) of 1,557 nurses identified three attitudinal factors (health fear, social isolation and job stress) mediated the association between contact with SARS patients and psychological stress. The levels of anxiety, stress, and self-efficacy exhibited amongst Chinese HCWs in Wuhan during the COVID-19 pandemic appeared dependent on their degree of social support and quality of sleep (Xiao et al., 2020).

Stigma was a major factor identified across five studies (Maunder et al., 2004; Park et al., 2018; Koh et al., 2005; Juan et al., 2020; Khee et al., 2004), and during the COVID-19 pandemic, it was associated to a higher risk of depressive symptoms (Juan et al., 2020). In a large-scale study (Koh et al., 2005) of 10,511 HCWs, 49% experienced social stigmatization and 31% ostracism by family members. Analogous findings, amongst nurses (187) during a MERS outbreak in Korea found that stigma contributed negatively to the mental health of nurses through a direct effect but also indirectly via stress (Park et al., 2018). Amongst 338 HCWs findings showed that 20% (66 of 338) felt stigmatized and rejected in their neighborhood because of their hospital work, and 9% (20 of 218) reported reluctance to work or had considered resignation (Bai et al.,

2004).

4.1.2.3. Hospital and systems-related aspects. HCWs often found themselves working under high levels of physical and psychological stress (Koh et al., 2005), sometimes attributed to work conditions (Zhang et al., 2020b). During the COVID-19 pandemic, long work hours were found to increase stress levels amongst nurses (Mo et al.). Similarly, the burden of adhering to strict protective measures seemed to increase distress levels (Zhang et al., 2020a). The heavy protective gear was found to add to the physical difficulties of carrying out procedures (Liu et al., 2020a). Spanish HCWs who perceived protection as insufficient rated higher levels of depression, anxiety and acute stress than those who perceived it to be adequate (García-Fernández et al., 2020). Contrastingly, findings from 10,511 HCWs during the SARS outbreak demonstrated that 96% reported that the personal protective measures implemented were effective, 93% felt that institutional policies and protocols were clear and 90% felt they were timely (Koh et al., 2005). Similar findings were depicted by HCWs who generally declared confidence in infection-control measures (Chua et al., 2004).

4.2. Measures to address the psychological risks to HCWs during epidemics

4.2.1. Self-coping strategies

Thirteen studies (Lung et al., 2009; Chan and Huak, 2004; Cai et al., 2020a; Kang et al., 2020; Zhang et al., 2020b; Wang et al., 2020; Shechter et al., 2020; Romero et al., 2020; Korkmaz et al., 2020; Babore et al., 2020; Wong et al., 2005; Khalid et al., 2016; Shih et al., 2007) considered coping strategies, such as acceptance, resilience, active coping and positive framing (Wong et al., 2005). Of 466 HCWs, doctors were significantly more likely than nurses and health care assistants (HCAs) to use planning as a coping strategy, while nurses were more likely than doctors to use behavioural disengagement, and HCAs were more likely than doctors to use self-distraction (Wong et al., 2005). Amongst 657 American HCWs, exercise was the most commonly used coping strategy (59%), and access to an individual therapist with online self-guided counselling (33%) generated the most interest (Shechter et al., 2020).

Support from supervisors and colleagues was found to be a significant negative predictor for psychiatric symptoms and PTSD (Chan and Huak, 2004). Further mental health predictors amongst a group of Chinese emergency HCWs included the tenacity, strength and the availability of support (Cai et al., 2020a). In a study of 652 HCWs, psychological support and practical support with insurance and compensation matters had a protective effect against stress (Tam et al., 2004). In parallel with this, positive feedback emerged when counsellors asked the medical staff to share how they coped with this difficult situation (Khee et al., 2004). Another study (Khalid et al., 2016) of 117 HCWs found that positive attitudes in the workplace helped them through the epidemic. Of note, a recent study (Kang et al., 2020) found that 36.3% (361 of 994) of medical and nursing staff had accessed psychological materials, 50.4% (501) had accessed psychological resources through media and 17.5% (174) participated in counselling or psychotherapy. Hence, the development of coping strategies appeared to integrate HCW preferences which differed cross-culturally and across health professions.

4.2.2. Psycho-social interventions

The target of interventions were predominantly stress and fear. Forty-four studies (Tam et al., 2004; Ji et al., 2017; Lee et al., 2018; Chan and Huak, 2004; Lai et al., 2020; Zhang et al., 2020a; Cai et al., 2020a; Rossi et al., 2020; Liu et al., 2020a; Kang et al., 2020; Zhang et al., 2020b; Mo et al.; Li et al., 2020a; Lu et al., 2020; Xiao et al., 2020; Li et al., 2020b; Zhou et al., 2020; Xiaoming et al., 2020; Wilson et al., 2020; Wasim et al., 2020; Wańkiewicz et al., 2020; Wang et al., 2020; Tian et al., 2020; Shechter et al., 2020; Sandesh et al., 2020; Romero et al., 2020; Pouralizadeh et al., 2020; Liu et al., 2020b; Lin et al., 2020; Korkmaz et al., 2020; Hu et al., 2020; Elbay et al., 2020; Du et al., 2020; Di Tella et al.,

2020; Chew et al., 2020; Cai et al., 2020b; Babore et al., 2020; An et al., 2020; Bai et al., 2004; Wong et al., 2005; Chan et al., 2005; Li et al., 2020c; Shih et al., 2007) recommended psychosocial interventions and in general, there was a strong emphasis on the need for additional psychosocial support (Chan and Huak, 2004) with effective strategies (Lu et al., 2020) and precise care (Li et al., 2020a).

Several studies (Lancee et al., 2008; Ji et al., 2017; Xiao et al., 2020; Wong et al., 2005; Shih et al., 2007) identified a need for greater support through collaboration, training and education. This appeared to strengthen teams (Ji et al., 2017) and reduce HCW stress (Chua et al., 2004) as simple protective measures were reassuring for HCWs (Koh et al., 2005). Additionally, clear communication was seen to reduce psychiatric symptoms (Chan and Huak, 2004).

The duration of follow-up was not specified in most studies and there was a lack of studies on the long-term supports for HCWs post-epidemic. While others emphasised the need for prompt and continuous psychiatric interventions in high mortality infectious disease outbreaks (Lee et al., 2018; Wang et al., 2020; Pouralizadeh et al., 2020; Li et al., 2020c). Imminent utilisation of interventions promoting wellbeing for HCWs facing COVID-19 was suggested for frontline workers, females and nurses (Lai et al., 2020).

Furthermore, it is important that nurses are not stigmatized and policy-makers should make efforts to ensure this stress is minimised and also allow them to focus on patient care (Park et al., 2018). Stigma could also be minimised through an integrated administrative and psychosocial response to challenges that are caused by outbreaks (Bai et al., 2004). There is a need for the development of prevention programs for stress related psychiatric disorders (Lung et al., 2009). In addition, health authorities should provide proactive psychological support for staff by offering support and training, counselling hotlines and offer reimbursements to staff (Chua et al., 2004).

4.2.3. Workplace awareness and measures

Many recommendations focused on enhanced awareness amongst authorities or hospital administrators of their employees' mental health (Hu et al., 2020; An et al., 2020). Leaders need to be aware of the extent and sources of stress among HCWs during disease outbreaks (Tam et al., 2004). Moreover, hospital support systems and occupational health policy should be designed to promote the psychological wellbeing of HCWs (Chan et al., 2005). Improving the understanding of employees' fears and the factors associated with those fears would be helpful to people involved in response planning for future outbreaks of infectious disease (Wu et al., 2009).

4.3. Strengths of studies

The high number of studies during the COVID-19 pandemic within a short period is impressive given the understandable difficulties in conducting research in HCWs under often stressful circumstances. Most studies used validated tools for identifying psychological stressors, although some used novel questionnaires. The implications of this review highlight a range of psychological impacts and multiple factors contributing at different levels affecting HCWs when responding to epidemics. There was a high degree of consistency in findings making it generalisable to a variety of health-related disasters. This can inform research priorities and development of measures against the deleterious mental health outcomes of the COVID-19 pandemic.

4.4. Limitations of studies

The majority of studies used online survey methodology and self-report measures which have inherent limitations. There was a lack of longitudinal studies and therefore little evidence on the long-term psychological sequelae and treatment needs. There is a lack of in-depth research considering the pre- and post-outbreak psychological risk factors, the effects of stigma and discrimination or impact on families.. Of

note, it was difficult to compare studies due to heterogeneity of design and outcome measures. Geographic factors may have influenced results due to unique social and cultural contexts amongst the study locations where research was conducted.

5. Discussion

From this review of HCWs, fear of uncertainty or becoming infected were at the forefront of the psychological challenges faced. Providing medical care during a global epidemic generates fear and heightens stress levels, with one large-scale study (Tam et al., 2004) reporting over 70% identified that becoming infected was most distressing. During the COVID-19 pandemic, HCWs have been exposed to high infection risks, death and dying, moral dilemmas in deciding who qualifies for intensive care, and excessive workloads. The entire experience can be traumatising and heighten the risk of mental health conditions in a group that are already at increased risk, for instance HCWs are at higher risk of suicide than the general population (Dutheil et al., 2019). It is likely that the psychological effects of epidemics on HCWs are variable across different contexts with several studies demonstrating an increased risk of acquiring a trauma or stress-related disorder. The risk to the mental well-being of HCWs are likely to be multi-faceted and more research is needed to elucidate the underlying mechanisms that can potentially be mitigated with appropriate measures. Collection of high quality data is urgently needed, especially for vulnerable groups exposed to a pandemic (Holmes et al.). Interventions to reduce morbidity and severity of psychological problems in HCWs in the early stage may prevent adverse short-term and long-term implications.

It is important to note that professional recognition and ethics can positively reinforce hard work but the value of these are diminished when they are applied in a punitive way that stereotypes HCWs. The emphasis on their self-sacrifice while providing essential and life-saving services becomes magnified in the midst of an epidemic and often HCWs are portrayed as heroes. This in turn can impose certain expectations on them, to demonstrate personal strength and resilience, both emotionally and professionally. However, this can also impede their ability to recognise vulnerabilities or share traumatic experiences, similar in some aspects to military personnel. This may inadvertently increase their mental health risks and stigmatising beliefs, thus prevent them from seeking psychological help (Jones et al., 2018). As such, HCWs must feel free to express their emotions and share experiences, both positive and negative, even when society portrays them as faceless masked agents, and hails them as heroes.

By acknowledging the positive dimensions of any global health disaster, it is pertinent to understand factors that can build greater resilience among HCWs, either working as individuals or in groups. Of HCWs in the SARS epidemic, 82% reported feeling appreciated by their employer and 77% by society (Koh et al., 2005). HCWs felt that they were more devoted to helping others, having survived the disaster (Tam et al., 2004). Professional and ethical values were identified as predominant motivators driving HCWs to fulfil their duties during the MERS epidemic (Khalid et al., 2016). It is thus necessary and pressing to study systematically the resilience factors that can promote the mental well-being of HCWs at the psychological, professional, workplace and societal levels.

To enhance recovery and wellbeing, a range of psychological measures to address the mental health challenges during previous epidemics has been reported, especially through moderation of stress levels, education and workplace supports. Strategies can be adapted to local contexts, variable conditions, and be scaled up or down depending on the needs of HCWs over time. PFA can provide support to survivors following a serious crisis event, as it reduces the initial distress of the traumatic event by enhancing adaptive functioning and coping in the face of extraordinary stress (Pekevski, 2013). However, this is simply not enough in responding to a pandemic such as COVID-19. An element of preparedness must also be considered to approach the under-recognised mental health problems in a more proactive way. Furthermore, even in

the recovery phase of an epidemic, there is a clear need for consistent and long-term support to promote and protect the well-being of HCWs.

6. Conclusions

Managing the emerging mental health issues amongst HCWs during an epidemic is imperative particularly in the current COVID-19 pandemic crisis. The potential psychological consequences faced by this highly vulnerable group can have profound and long-term implications. While some elements of tackling an epidemic are difficult to modify, many preventable aspects can be considered. Fear can be minimised through the correct dissemination of information and the provision of adequate training and resources. Education to HCWs, their families and the wider public can help lessen stigma and discrimination. Hospital and health policy-makers must also consider the importance of a preventative approach to mitigate the development of psychological manifestations. Psychosocial support and effective measures need to be readily available in multiple modalities and levels, and designed to suit the specific characteristics of HCWs to empower them in the critical role they play against epidemics. Further high-quality and longitudinal research is needed especially on measures to reduce their mental health burden should be a priority.

Author statement

Sonja Cabarkapa: Responsible for writing the manuscript, data extraction, corresponding author – approval of the manuscript. Sarah Nadjidai: Literature search, data extraction, critical review of the manuscript. Jerome Murgier: Critical review of the manuscript. Chee Ng: Critical review of the manuscript

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: The corresponding author is not a recipient of a scholarship. There is no funding associated to this study. Sonja Cabarkapa, Sarah Nadjidai and Jerome Murgier have no conflicts of interest. Chee Ng declares receiving the following over the last 36 months; travel support and honorarium for delivery of talk from both Lundbeck and Pfizer. He has also received travel support and honorarium for consulting service for Janssen.

References

- An, Y., et al., 2020. Prevalence of depression and its impact on quality of life among frontline nurses in emergency departments during the COVID-19 outbreak. *J. Affect. Disord.* 276, 312–315.
- Babore, A., et al., 2020. Psychological effects of the COVID-2019 pandemic: perceived stress and coping strategies among healthcare professionals. *Psychiatr. Res.* 293, 113366.
- Bai, Y., et al., 2004. Survey of stress reactions among health care workers involved with the SARS outbreak. *Psychiatr. Serv.* 55 (9), 1055–1057.
- Baud D, et al. Real estimates of mortality following COVID-19 infection. *Lancet Infect. Dis.*
- Birkhead, G.S., Vermeulen, K., 2018. Sustainability of psychological first aid training for the disaster response workforce. *Am. J. Publ. Health* 108 (S5), S381–S382.
- Cai, W., et al., 2020a. A cross-sectional study on mental health among health care workers during the outbreak of Corona Virus Disease 2019. *Asian J Psychiatr* 51, 102111.
- Cai, Q., et al., 2020b. The mental health of frontline and non-frontline medical workers during the coronavirus disease 2019 (COVID-19) outbreak in China: a case-control study. *J. Affect. Disord.* 275, 210–215.
- Chan, A.O., 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.
- Chan, S.S., et al., 2005. The impact of work-related risk on nurses during the SARS outbreak in Hong Kong. *Fam. Community Health* 28 (3), 274–287.
- Chew, N.W.S., et al., 2020. A multinational, multicentre study on the psychological outcomes and associated physical symptoms amongst healthcare workers during COVID-19 outbreak. *Brain Behav. Immun.* 88, 559–565.
- Chua, S.E., et al., 2004. Psychological effects of the SARS outbreak in Hong Kong on high-risk health care workers. *Can. J. Psychiatr.* 49 (6), 391–393.

- Di Tella, M., et al., 2020. Mental health of healthcare workers during the COVID-19 pandemic in Italy. *J. Eval. Clin. Pract.* n/a(n/a).
- Du, J., et al., 2020. Psychological symptoms among frontline healthcare workers during COVID-19 outbreak in Wuhan. *Gen. Hosp. Psychiatr.* S0163-8343 (20), 30045-1.
- Dutheil, F., et al., 2019. Suicide among physicians and health-care workers: a systematic review and meta-analysis. *PloS One* 14 (12) e0226361-e.
- Elbay, R.Y., et al., 2020. Depression, anxiety, stress levels of physicians and associated factors in Covid-19 pandemics. *Psychiatr. Res.* 290, 113130.
- Emergencies preparedness, response website: world health organization.** Available from: https://www.who.int/csr/disease/swineflu/frequently_asked_questions/pandemic/en/.
- Fischer II, W.A., et al., 2014. Protecting health care workers from Ebola: personal protective equipment is critical but is not enough. *Ann. Intern. Med.* 161 (10), 753-754.
- García-Fernández, L., et al., 2020. Mental health impact of COVID-19 pandemic on Spanish healthcare workers. *Psychol. Med.* 1-3.
- Holmes EA, et al. **Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science.** *The Lancet Psychiatry.*
- Hong, X., et al., 2009. Posttraumatic stress disorder in convalescent severe acute respiratory syndrome patients: a 4-year follow-up study. *Gen. Hosp. Psychiatr.* 31 (6), 546-554.
- Hong, S., et al., 2020. Immediate psychological impact on nurses working at 42 government-designated hospital during COVID-19 outbreak in China: a cross-sectional study. *Nurs. Outlook.*
- Hu, D., et al., 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* 24.
- Ji, D., et al., 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.
- Jones, N., et al., 2018. UK military doctors; stigma, mental health and help-seeking: a comparative cohort study. *J. Roy. Army Med. Corps* 164 (4), 259-266.
- Juan, Y., et al., 2020. Psychological distress surveillance and related impact analysis of hospital staff during the COVID-19 epidemic in Chongqing, China. *Compr. Psychiatr.* 152198.
- Kang, L., et al., 2020. 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 Behav. Immun.*
- Khalid, I., et al., 2016. Healthcare workers emotions, perceived stressors and coping strategies during a MERS-CoV outbreak. *Clin. Med. Res.* 14 (1), 7-14.
- Khee, K.S., et al., 2004. The psychological impact of SARS on health care providers. *Crit. Care Shock* 100-106.
- Koh, S., et al., 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? *Med. Care* 676-682.
- Korkmaz, S., et al., 2020. The anxiety levels, quality of sleep and life and problem-solving skills in healthcare workers employed in COVID-19 services. *J. Clin. Neurosci.* 80, 131-136.
- Lai, J., et al., 2020. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. *JAMA Network Open* 3 (3) e203976-e.
- Lancee, W.J., et al., 2008. Prevalence of psychiatric disorders among Toronto hospital workers one to two years after the SARS outbreak. *Psychiatr. Serv.* 59 (1), 91-95.
- Lee, S.M., et al., 2018. Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients. *Compr. Psychiatr.* 87, 123-127.
- Li, X., et al., 2020a. Prevalence, risk factors, and clinical correlates of insomnia in volunteer and at home medical staff during the COVID-19. *Brain Behav. Immun.* S0889-1591 (20), 30734-0.
- Li, G., et al., 2020b. Psychological impact on women health workers involved in COVID-19 outbreak in Wuhan: a cross-sectional study. *Journal of Neurology, Neurosurgery & Psychiatry* jnnp-2020-323134.
- Li, Z., et al., 2020c. Vicarious traumatization in the general public, members, and non-members of medical teams aiding in COVID-19 control. *Brain Behav. Immun.* S0889-1591 (20), 30309-3.
- Lin, K., et al., 2020. The mental health effects of COVID-19 on health care providers in China. *Am. J. Psychiatr.* 177 (7), 635-636.
- Liu, C.-Y., et al., 2020a. The prevalence and influencing factors in anxiety in medical workers fighting COVID-19 in China: a cross-sectional survey. *Epidemiol. Infect.* 148 e98-e.
- Liu, Y., et al., 2020b. Mental health status of paediatric medical workers in China during the COVID-19 outbreak. *Front. Psychiatr.* 11, 702.
- Lu, W., et al., 2020. Psychological status of medical workforce during the COVID-19 pandemic: a cross-sectional study. *Psychiatr. Res.* 288, 112936.
- Lung, F.W., et al., 2009. Mental symptoms in different health professionals during the SARS attack: a follow-up study. *The Psychiatric quarterly* 80 (2), 107-116.
- Mak, I.W., et al., 2009. Long-term psychiatric morbidities among SARS survivors. *Gen. Hosp. Psychiatr.* 31 (4), 318-326.
- Maunder, R.G., et al., 2004. Factors associated with the psychological impact of severe acute respiratory syndrome on nurses and other hospital workers in Toronto. *Psychosom. Med.* 66 (6), 938-942.
- Mo Y, et al. **Work stress among Chinese nurses to support Wuhan in fighting against COVID-19 epidemic.** *J. Nurs. Manag.* n/a(n/a).
- Park, J.-S., et al., 2018. Mental health of nurses working at a government-designated hospital during a MERS-CoV outbreak: a cross-sectional study. *Arch. Psychiatr. Nurs.* 32 (1), 2-6.
- Pekevski, J., 2013. First responders and psychological first aid. *Journal of emergency management (Weston, Mass)* 11 (1), 39-48.
- Pouralizadeh, M., et al., 2020. Anxiety and depression and the related factors in nurses of guilan university of medical sciences hospitals during COVID-19: a web-based cross-sectional study. *Int J Afr Nurs Sci* 13, 100233.
- Psychological First Aid during Ebola Virus Disease Outbreaks (Provisional Version)** [online], 2014. World Health Organisation, CBM, World Vision International & UNICEF, Patent. Available from: <http://tinyurl.com/PFA-Eb>.
- Romero, C.-S., et al., 2020. COVID-19 psychological impact in 3109 healthcare workers in Spain: the PSIMCOV group. *Psychol. Med.* 1-14.
- Rossi, R., et al., 2020. Mental health outcomes among frontline and second-line health care workers during the coronavirus disease 2019 (COVID-19) pandemic in Italy. *JAMA Network Open* 3 (5) e2010185-e.
- Sandesh, R., et al., 2020. Impact of COVID-19 on the mental health of healthcare professionals in Pakistan. *Cureus* 12 (7) e8974-e.
- Shechter, A., et al., 2020. Psychological distress, coping behaviors, and preferences for support among New York healthcare workers during the COVID-19 pandemic. *Gen. Hosp. Psychiatr.* 66, 1-8.
- Shih, F.-J., et al., 2007. Dying and caring on the edge: taiwan's surviving nurses' reflections on taking care of patients with severe acute respiratory syndrome. *Appl. Nurs. Res.* 20 (4), 171-180.
- Tam, C.W., et al., 2004. Severe acute respiratory syndrome (SARS) in Hong Kong in 2003: stress and psychological impact among frontline healthcare workers. *Psychol. Med.* 34 (7), 1197-1204.
- Tian, T., et al., 2020. Mental health burden of frontline health professionals treating imported patients with COVID-19 in China during the pandemic. *Psychol. Med.* 1-2.
- Unprecedented Number of Medical Staff Infected with Ebola [Online], 2014.** World Health Organization, Geneva. Available from: <https://www.who.int/mediacentre/news/ebola/25-august-2014/en/>.
- Wang, L.-Q., et al., 2020. Psychological impact of coronavirus disease (2019) (COVID-19) epidemic on medical staff in different posts in China: a multicenter study. *J. Psychiatr. Res.* 129, 198-205.
- Wasim, T., et al., 2020. Effect of COVID-19 pandemic on mental wellbeing of healthcare workers in tertiary care hospital. *Annals of King Edward Medical University* 26 (Special Issue), 140-144.
- Wańkiewicz, P., et al., 2020. Assessment of mental health factors among health professionals depending on their contact with COVID-19 patients. *Int. J. Environ. Res. Publ. Health* 17 (16), 5849.
- Wilson, W., et al., 2020. Prevalence and predictors of stress, anxiety, and depression among healthcare workers managing COVID-19 pandemic in India: a nationwide observational study. *Indian J. Psychol. Med.* 42 (4), 353-358.
- Wong, T.W., et al., 2005. The psychological impact of severe acute respiratory syndrome outbreak on healthcare workers in emergency departments and how they cope. *Eur. J. Emerg. Med.* 12 (1), 13-18.
- Workforce development at the local level: the NACCHO perspective. *J. Publ. Health Manag. Pract. : JPHMP* 9 (6), 2003, 440-442.
- Wu, P., et al., 2009. The psychological impact of the SARS epidemic on hospital employees in China: exposure, risk perception, and altruistic acceptance of risk. *Can. J. Psychiatr.* 54 (5), 302-311.
- Xiang, Y.-T., et al., 2020. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *The Lancet Psychiatry* 7 (3), 228-229.
- Xiao, H., et al., 2020. 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. Mon. Int. Med. J. Exp. Clin. Res.* 26 e923549-e.
- Xiaoming, X., et al., 2020. The psychological status of 8817 hospital workers during COVID-19: a cross-sectional study in chongqing. *J. Affect. Disord.*
- Zhang, C., et al., 2020a. Survey of insomnia and related social psychological factors among medical staff involved in the 2019 novel coronavirus disease outbreak. *Front. Psychiatr.* 11, 306.
- Zhang, W.R., et al., 2020b. Mental health and psychosocial problems of medical health workers during the COVID-19 epidemic in China. *Psychother. Psychosom.* 1-9.
- Zhou, Y., et al., 2020. Tackling the mental health burden of frontline healthcare staff in the COVID-19 pandemic: China's experiences. *Psychol. Med.* 1-5.