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# BMJ Open

## Interventions to support the mental health and wellbeing of frontline health care workers in hospitals during pandemics: an evidence review and synthesis

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# Interventions to support the mental health and wellbeing of frontline health care workers in hospitals during pandemics: an evidence review and synthesis

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**Key words** Front line health care workers, pandemics, mental health, co-designed interventions, digital health interventions, mobile health apps, COVID-19

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**Word Count: 3837 (including in-text citations)**

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2 32   **Abstract**

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5 33   **Objective:** Pandemics impact negatively on Health Care Workers’ (HCWs) mental health and

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7 34   wellbeing causing additional anxiety, depression, moral distress and post-traumatic stress. A

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9 35   comprehensive review and synthesis of interventions to support HCW mental health and wellbeing

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11 36   through pandemics and their reported effectiveness was conducted. The use of digital components in

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13 37   the reported interventions was recorded. Data was extracted and synthesised.

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17 38   **Design:** A narrative evidence synthesis was conducted using the Cochrane Criteria for synthesizing and

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19 39   presenting findings using other methods.

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22 40   **Data Sources:** The Cochrane Library; key bibliographic databases; preprint sources; clinical trial

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24 41   registries; grey literature sources; and the EPPI-Centre Living Systematic Map of the Evidence were

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26 42   included in the search.

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30 43   **Eligibility criteria:** Subject heading terms and keyword searches for three key concepts were searched:

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32 44   SARS-CoV-2 coronavirus (or similar infectious diseases) epidemics, health workforce, and mental

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34 45   health support interventions. Searches were limited to English-language items published from January

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36 46   1<sup>st</sup> 2000 to March 11<sup>th</sup> 2021. No publication-type limit was used.

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40 47   **Data Extraction and synthesis:** Manuscripts were assessed by two authors to determine eligibility and

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42 48   extract data. Data were extracted into tables that were refined by co-authors.

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45 49   **Results:** 1,007 studies were identified and 31 met inclusion criteria. Included interventions were

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47 50   directed at the individual and/or organisational level and a large number responded to the COVID-19

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49 51   pandemic. Many interventions included a digital component but mostly to deliver online training and

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51 52   support. Only one purposively designed mobile app was identified. Heterogeneity between studies

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53 53   meant that a systematic review as not possible.

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**Conclusion:** Interventions are rapidly designed and implemented and few are comprehensively evaluated. Tailored interventions are needed with process and outcome evaluation data reported to identify effective supports for HCWs' mental health and wellbeing in pandemic settings.

**Abstract word count:** 282

For peer review only

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**Article Summary**

**Strengths and limitations of this study**

- This is the most comprehensive review of interventions to support health care worker mental health and wellbeing through pandemics that has been conducted to date.
- The review explored and a wide range of sources including key bibliographic databases, the EPPI-Centre's Living Systematic Map of the Evidence 21, preprint servers, clinical trial registers and grey literature from reputable health sources.
- The review outcomes were limited by heterogeneous research outcomes that were largely descriptive, lacked appropriate outcome measures or used single group designs.

Peer review only

## Introduction

Health care workers (HCWs) experience a high burden of mental distress<sup>1</sup> which increases through pandemics. Mental health and wellbeing impacts have been reported<sup>2 3</sup> but as increased rates of anxiety, depression, moral distress and post-traumatic stress disorders<sup>4</sup> and occupational stress are identified as a consequence of COVID-19, support for HCWs' mental health and wellbeing are becoming paramount.<sup>5</sup> Increased mental distress is being driven by increased risk of COVID-19 infection,<sup>6</sup> radically altered healthcare systems and practices, and the impact of physical distancing on professional team interactions and patient relationships.<sup>3</sup> Morally complex decision-making in the allocation of scant health resources has increased mental distress and HCWs have had to evaluate risks to their own health and for loved ones.<sup>7 8</sup> Australian HCWs have described intense stress associated with pandemic preparedness and the emotional costs of working in an environment where human contact is restricted.<sup>9</sup> <sup>10</sup> Despite these concerns, limited mental health and wellbeing support has been delivered for HCWs particularly in hospitals.

Since 2003, pandemics have become frequent with severe acute respiratory syndrome (SARS), Middle Eastern Respiratory virus (MERS), influenza H1N1 and H7N9, Ebola, and now SARS-CoV-2, causing COVID-19, emerging. Pandemic preparedness has become a feature of healthcare system planning and several reviews published early in the pandemic examined the mental health of HCWs and potential interventions that could support HCW mental health and wellbeing.<sup>2 11 12</sup> While the significant mental health impacts on HCWs working within pandemics is recognised, there is a mismatch between the interventions offered (which commonly focus on relieving individual symptoms), versus HCWs' expressed preference for social support.<sup>3</sup> Evidence-based interventions supporting the short and long-term mental health of HCWs in pandemics are required.<sup>12-15</sup> Reviews have indicated an increased need for technological innovation and digital interventions following the COVID-19 pandemic.<sup>16 17</sup> Digital mental health interventions and mobile apps exist, but there was a paucity of evidence about HCW specific digital interventions both inside and outside of pandemics.<sup>16 18</sup>



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2 93 To address the need for HCW support during pandemics, we used an experience based co-design  
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4 94 method to develop, implement and evaluate a mobile app for Australian HCWs' working in the COVID-  
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6 95 19 pandemic.<sup>19</sup> This review of the published literature on mental health and wellbeing interventions  
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9 96 delivered for HCWs was conducted as part of the development and implementation process. We used  
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11 97 the Cochrane approach to evidence synthesis where meta-analysis is not appropriate and applied a  
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13 98 narrative evidence synthesis method.<sup>20</sup> The review addressed two questions: 1. What interventions have  
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16 99 been reported in recent pandemics, and have they been effective in improving the mental health and  
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18 100 wellbeing of HCWs?: And, 2. What mobile apps have been designed and implemented to support  
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20 101 HCWs' mental health and wellbeing during pandemics with performance, acceptability, and outcomes  
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23 102 reported?

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28 104 **Method**

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31 105 Heterogeneity in the study designs and a lack of common outcome measurements prohibited meta-  
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33 106 analysis. Following the narrative evidence synthesis method<sup>20</sup> the following combinations of resources  
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35 107 was searched to identify relevant publications (Table 1). A Prisma 2020 Checklist is included as  
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37 108 Supplementary File 1.

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40 109 **Table 1.**

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43 110 *Databases included in search strategy*

Resource type	Titles searched	Latest search date
Evidence summaries and Cochrane Library; guidelines	Epistemonikos; Oxford COVID-19 Evidence; NICE Rapid guidelines on COVID-19; National COVID-19 Living Guidelines; VA	11 Mar 2021

## Evidence Synthesis Project COVID-19

## Reviews

Literature databases	Medline (Ovid, 1946 -); CINAHL Complete (EBSCOhost); Embase Classic (Ovid, 1947 -); APA PsycInfo (Ovid)	11 Mar 2021
	EPPI-Centre Living Systematic Map of the Evidence; LitCOVID; Scopus	18 Sep 2020
Preprint sources	ArXiv; MedRxiv (COVID-19 SARS-CoV-2 sub-sets)	11 Mar 2021
Clinical trials registers	Australian New Zealand Clinical Trials registry COVID-19 Studies; ClinicalTrials.gov COVID-19 subset; Cochrane COVID-19 Trials register	18 Sep 2020
Grey literature	Agency for Healthcare Research and Quality; Australian Commission on Safety and Quality in Health Care; Canadian Agency for Drugs and Technologies in Health; Health Quality Ontario; National Institute for Health and Care Excellence; World Health Organisation	11 Mar 2021

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Evidence summaries and guidelines were searched using a combination of thesaurus terms (where available) and keyword searches. Database search strategies used subject heading terms and keyword searches for three key concepts: SARS-CoV-2 coronavirus (or similar infectious diseases) epidemics, health workforce, and mental health support interventions. Searches were limited to English-language

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2 116 items published from 2000. No publication-type limit was used. The detailed search strategy is included  
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4 117 in Supplementary File 2.  
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7 118 Reference lists of relevant items were checked, and forward citation searches were conducted to  
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10 119 discover related items. Grey literature sources and the websites of key health organisations were also  
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12 120 checked. The EPPI-Centre directly provided 468 citations assigned to the Mental Health Impacts  
13  
14 121 category from its Living Systematic Map of the Evidence<sup>21</sup>. COVID-19 subsets of three clinical trials  
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16 122 registers were examined to identify randomised controlled trials in progress at the time of conducting  
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18  
19 123 the search. Specific study characteristics, such as type of intervention, length of follow-up and outcome  
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21 124 measures, were not used as criteria for initial selection.  
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24 125 From 1,007 publications identified, comprised of reviews and single studies, 327 items were screened  
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26 126 for inclusion using the criteria shown in Table 2.  
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32 128 **Table 2.**  
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34 129 *Manuscript inclusion and exclusion criteria for literature synthesis*  
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Inclusion	Exclusion
Pandemic or epidemics: SARS, MERS, H1N1 H7N9, COVID-19, Ebola	Pandemics prior to 1 <sup>st</sup> of January 2000
Clinical and non-clinical health workers in hospitals	Paramedic, disaster and retrieval staff. Primary care and community healthcare workers.
Intervention that had been implemented in a hospital setting in any country at any time after the 1 <sup>st</sup> of January 2020 with the intention to	Interventions that had been proposed or recommended without having been implemented.

improve HCWs' mental health and wellbeing Educational materials intended to inform  
in the pandemic setting the institution's workforce

E-learning and web-based interactive Mobile app used only as a platform of  
programmes were included as general communication.  
interventions. Only mobile apps, specifically  
developed to address HCWs' mental health in  
pandemics were included to address the second  
question.

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Identified manuscripts were assessed by two authors (KRB and CG) to determine if they met eligibility  
criteria. Data from eligible studies was extracted into tables. Studies reporting outcome data were  
prioritised over those that did not, with those including mental health outcomes given the highest  
priority. Intervention details were charted by type of intervention and outcomes (where reported) were  
tabulated. This table was reviewed and refined at research meetings attended by co-authors (KRB, CG,  
VP, LB, ML, AK).

Institutional ethics was not required as this project does not involve human or animal participants.

### **Patient and Public Involvement**

No patient involved.

**INSERT FIGURE 1 ABOUT HERE**

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**Results**

Figure 1 presents the PRISMA flow diagram of the study review and selection process. The details of studies that reported outcome data are included in Table 3.<sup>22-30</sup> The majority of studies provided only a description of an intervention, or were in process and did not have outcome data to report. The details of these studies and interventions are included in Supplementary Table 1.<sup>31-50</sup> Each reported on the development and/or implementation of an intervention aimed to improve and/or support the HCWs' mental health and/or wellbeing. Studies were charted to display: study location, associated pandemic, goal/s of intervention/s, target group of HCWs (e.g. professional group), whether the intervention was individually or organisationally directed and the outcome data (general health or mental health-specific) reported. Although nine papers provided some quantitative outcome data, due to the heterogeneity of study designs and the outcomes reported, it was not possible to apply a standardised outcome metric, or to synthesise the effects of each outcome.

Broadly the interventions described in the literature are targeted at organisations or individuals. Organisational focused interventions aimed to improve working conditions communication and staff support while individual level interventions focused on clinical education, psychological and mental health and wellbeing, stress management and coping or directed counselling and psychological support. The majority of papers (25/31) related to the COVID-19 pandemic while influenza, SARS, and Ebola were the focus of 2 papers each. Many of these interventions were premised on mitigating acute stress to prevent or to delay longer-term mental health problems.

**Table 3** Interventions to Improve Health Care Workers' Mental Health during Pandemics

Author Year	Country	Pandemic	Intervention Description	Target Population	Study Design	Digital / Online	Outcome data reported for general health or other areas	Outcome data reported for mental health specifically
			Intervention Delivery	Total who completed measures (where included/reported)	Paper Type	Mobile App Yes or No		
<b>Pre-pandemic Interventions for Prevention and Preparedness</b>								
Aiello, et al. <sup>22</sup>	Canada	Influenza & H1N1	Pre-pandemic resilience training intervention to increase coping skills. Rolled out over five months.	1250 staff in 22 hospital departments	Pre-post design	No. Training delivered face to face	Yes –self-reported confidence to be prepared for a pandemic increased from 34.9% to 69.7%.	None reported
			Organisation-wide delivery.	1020 (82%) returned questionnaires	Empirical Report	No		
Maunder, et al. <sup>29</sup>	Canada	Influenza	Pre-pandemic training intervention called the Pandemic Influenza Stress Vaccine to reduce stress related effects of subsequent pandemic exposure, absenteeism and to identify optimal training duration. Participants randomly assigned to different lengths of training modules: short (7 sessions), medium (12 sessions), long (17 sessions).	265 staff at Toronto hospital consented to participate: 158 commenced training	Dose-finding using a pre-post design	Yes Computer based training as interactive package	Yes – pandemic perceived self-efficacy scale increased 5.1 (87.7 to 92.9), confidence in pandemic preparedness training increased 1.1 (2.6 to 3.8), total inventory of interpersonal problems (IPP-32) score reduced 3.7 (from 31.4 to 27.6). Between-group differences not significant.	None reported
			Individual, self-directed computer based training.	127 (80.3%) completed session	Empirical Report	No		
<b>During any contemporary pandemic with a primary focus on mental health related outcomes</b>								
Chen, et al. <sup>25</sup>	Taiwan	SARS	To record anxiety, depression and sleep quality of nurses facing a new infectious disease and to record changes to mental state after a multifactorial prevention plan (including a mental health team) had been implemented in the hospital. 53 classes available.	120 nurses in SARS designated hospital.	Pre - post design	No	Not reported	Yes – Zung anxiety scale (SAS) decreased from T1:60 to T2:46 Zung depression scale (SDS) decreased from T1:61 to T4:48. Improved Pittsburgh Sleep Quality Index (PSQI) (T1:12; T2: 8)
			Individual directed, training and implementation of prevention plan.	116 nurses completed all measures 4 times: T1: pre- pandemic, T2: 2 weeks into pandemic, T3: 1 month into pandemic and T4: 1 month post pandemic	Empirical report	No		
Hong, et al. <sup>27</sup>	China	COVID-19	Stress management of medical staff in a hospital. Maintain physiological-psychological wellbeing through stress management procedures, via telephone hotline, special rostering (reduced work hours) and quarantine accommodation for protection of family to reduce contagion plus family supports.	105 HCWs across disciplines - doctors, nurses and laboratory technicians working in the fever clinic or with specimens from the clinic.	Cross Sectional Study Design.	No	Yes - Impact of Event scale-Revised (22 item) identified 6% with IES-R scores $\geq 20$ . Median IES-R scores was 3 (IQR:0,8);	Yes - Sources of Distress (18 item) median total score was 0.44 (IQR: 0.22-0.94). Greatest source of distress health of family/ others; virus spread; changes in work
			Individual directed.	102 HCWs	Empirical report	No		

166	Wu and Wei <sup>30</sup>	China	COVID-19	Between group comparison of prescribed exercise programme on depression, anxiety, sleep quality and PTSD symptoms in HCWs providing care to COVID-19 patients compared with HCWs who are caring for non-COVID patients at a separate facility.	120 Frontline HCW from a COVID-19 designated hospital and a non-COVID-19 hospital.	Observational between groups	Assessment and exercise prescription only	Yes. Reports that staff who exercised based on prescription generally had better psychological stress and sleep status (no data provided).	Yes – COVID-facing staff had higher Symptom Checklist-90 (SCL90) scores (144.67 vs 94.87); Self-rating Anxiety Scale scores 45.89 vs 41.02); Self-rating Depression Scale scores (50.13vs 36.11); PTSD Checklist Civilian version scores (33.73 vs 29.89) and Pittsburgh Sleep Quality Index (PSQI) scores (16.07 vs 10.49)
				Individual directed.	60 COVID facing staff 60 non COVID facing Hospital – 31 nurses	Empirical report	No mobile app		
	Kameno, et al. <sup>28</sup>	Japan	COVID-19	Psychological first aid system for ward nurses caring for COVID-19 inpatients in hospital. The system was designed to detect individuals at high risk of mental health problems and to provide brief psychotherapy interventions.	T1:+7-16 days; T2:+33-49 days; T3:+70-86 days post COVID-19 admission	Pre-Post Design	No	Yes. 2 sleep disturbance questions; 1 question on alcohol misuse; one question on appetite change. High risk nurses had >appetite loss; >sleep disturbance; >alcohol misuse.	Yes: Kessler Psychological Distress Scale (K6). 8 nurse high risk on K6 offered psychotherapy. 3/8 accepted. Improved K6, sleep, appetite change and alcohol misuse in high risk nurse compared with no intervention
				Individual Directed		Letter	No		
During pandemic with a primary focus on uptake related outcomes									
	Blake, et al. <sup>23</sup>	UK	COVID-19	Digital psychological wellbeing package for UK healthcare staff. Actions for team leaders, psychological first aid, self-care, social support, managing emotions and expert advice.	All HCWs in United Kingdom	Design and evaluation study	Yes - online learning package	Yes –User satisfaction was high on their measure of fidelity and implementation	Not reported
				Individually directed	Accessed 17633 times in 7 days. 55 users provided feedback	Empirical report	No		
	Chen, et al. <sup>24</sup>	China	COVID-19	Psychological intervention plan to reduce pressures on staff by delivery of (a) online courses for HCWs about psychological problems, (b) a hotline for support; (c) group interventions for stress reduction.	HCWs at COVID designated hospital	Correspondence	Yes – online courses to help HCWs with psychological problems.	Yes - found a reluctance of staff to participate in individual or group psychological interventions.	Not reported
	Geoffroy , et al. <sup>26</sup>	France	COVID-19	Organisation-wide - preventive program To prevent or intervene early in mental health problems, by rapid design and implementation of a hotline (telephone based) psychological support system for all hospital workers during the COVID-19 outbreak in Paris.	Not described HCWs across 39 hospitals	Commentary Descriptive Design	No	Yes: Average 5.7 calls/day. Main reason for calling was anxiety (49%). Referrals made in 70% of cases to psychosocial, COVID and general support.	Not reported
				Individual directed.	149 calls in first 26 days	Empirical paper	No		

## **Interventions Delivered Pre Pandemic.**

Two papers examined the development of an organisational approach to pandemic preparedness in a Toronto based hospital based on their 2003 experience with SARS.<sup>22 29</sup> An inter-professional Psychological Pandemic Committee was formed to develop interventions to reduce HCW stress and facilitate adaptation as a primary prevention. The aim was to support staff and to reduce absenteeism through future pandemics. As a part of this program a computer-based educational intervention was used as a “pandemic influenza stress vaccine” to deliver audio and video lectures on pandemics and working outside your comfort zone as well as relaxation skills and self-assessment modules.<sup>29</sup> Several course durations were offered and all led to improved Pandemic self-efficacy, confidence in training and support but completion rates were higher with the shorter training programs. An additional face to face education intervention was offered<sup>22</sup> focusing on coping principles and organisational and personal resilience to increase confidence with results indicating a 41% increase in participants’ confidence to cope with pandemic induced situations. The absence of pre-training session data regarding perceived ability to cope is a significant limitation of this study, and despite the proposition that HCWs who have received specialised training are at lower risk of mental health problems during a pandemic<sup>51-54</sup> it was not clear whether increasing HCWs’ confidence in their ability to improved mental health outcomes during or following a pandemic.

## **Interventions delivered during a pandemic**

Five papers reported mental health outcomes following intervention delivery through a pandemic and report positive impacts on mental health outcomes. However the reported data is limited or incomplete, there are few studies with control groups and baseline data is not adequately reported to determine the magnitude of any pre-post changes.

Chen et al.<sup>25</sup> described an intervention in a Taiwanese SARS designated hospital for nursing staff that included an epidemic prevention plan with in-service training to minimise the risk of transmission when



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2 192 caring for SARS patients, staff allocation to ensure appropriate shift lengths and time away from work,  
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4 193 adequate PPE supplies, and the establishment of a mental health team to provide direct staff support.  
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6 194 Participant mental health was assessed using Zung's self-rating anxiety scale (SAS<sup>55</sup>), Zung's self-  
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8 rating depression scale (SDS<sup>56</sup>) and the Pittsburgh sleep quality index (PSQI<sup>57</sup>) at four time points (see  
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11 196 Table 3). Of 120 nurses surveyed, 116 completed questionnaires at all four time points showing  
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13 197 decreased scores for mean anxiety (60 at T1; 46 at T4) and depression (61 at T1; 48 at T2) after the  
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15 implementation of the prevention programme. At baseline (T1) the mean scores on the SAS and SDS  
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17 indicated moderate anxiety and depression, which reduced to mild anxiety and depression at two weeks  
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19 (T2) and one month (T3) after the intervention, with no anxiety or depression at the final assessment  
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21 (T4). Progressive improvements in sleep quality were observed at each follow-up time, but sleep quality  
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23 201 remained poor on the PSQI. No control group was included making it difficult to determine whether  
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25 202 outcomes were affected by uncontrolled factors.  
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30 204 Two papers reported a multifaceted intervention delivered to HCWs in a COVID-19 fever clinic in a  
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32 Beijing tertiary hospital.<sup>27 58</sup> The intervention aimed to improve stress management and protect the  
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34 physiological and psychological wellbeing of HCWs (including doctors, nurses and laboratory  
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36 technicians). To address concerns regarding SARS-CoV-2 transmission to family members, HCWs  
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38 were provided with accommodation during their rostered work days at the fever clinic and quarantine  
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40 period. Support was provided to family members where necessary. PPE and training to minimise  
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42 209 transmission risk were provided, along with adjustments to the work roster, and a telephone hotline,  
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44 210 staffed by psychiatrists and psychologists, was available from 9am-9pm seven days a week. The first  
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46 211 36 participants in the study completed the Patient Health Questionnaire-9 (PHQ-9<sup>59</sup>) and the Maslach  
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49 212 Burn-out Inventory (MBI<sup>60</sup>) at the completion of their two weeks rostered onto the clinic.<sup>58</sup> Seven  
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51 213 HCWs met the PHQ-9 depression criteria 9 and 13 of 32 HCWs who completed the MBI, 13 met criteria  
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53 214 for burn-out (one - emotional, four - depersonalisation, and eight - professional burnout). The authors  
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55 215 suggested that these scores were lower than expected and therefore the intervention was effective. The  
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58 216 Impact of Events Scale-Revised (IES-R <sup>61</sup>) and a source of distress scale developed for use during the  
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SARS outbreak in Hong Kong<sup>27</sup> were completed by 102 HCWs in two batches with three HCWs from each batch showing positive scores on the IES-R. The source of distress score was higher for the first batch. Qualitative outcomes from the first batch were used to make improvements to the intervention, and this may have coincided with improvements to COVID-19 knowledge and clinic activity. Both papers did not report baseline or any control data making it difficult to interpret the true impact of the intervention. The authors acknowledge that multiple factors impacted on HCW stress and that there were no infections among participants during the study period, and that findings may not be generalizable to other settings given clinic specific factors.<sup>27 58</sup>

One study reported that an exercise intervention improved stress and sleep quality in HCWs,<sup>30</sup> but presented no data to support this. Their sample consisted of an “intervention” group of 60 frontline HCWs from a designated COVID-19 hospital with a “control” group of 60 frontline HCWs drawn from a non-COVID-19 designated hospital. Outcomes included the symptom check-list (SCL-90<sup>62</sup>), SAS, SDS, PSQI and the PTSD Checklist Civilian Version.<sup>63</sup> A description of the intervention was not provided and adherence to the exercise program or its impact was not described or included in the analysis making it impossible to assess the efficacy of the intervention.

Kameno, et al.<sup>28</sup> reported on the delivery of a brief psychotherapy intervention (30-60 minutes long) to 31 ward nurses. Using the Six-Item Kessler Psychological Distress Scale,<sup>64</sup> eight participants were identified as high risk and eligible for the intervention. Despite reporting a positive outcome, only three of the eight who were invited to the intervention participated.

### **Uptake of interventions delivered during a pandemic**

Intervention uptake was used as the key outcome of three larger scale studies who did not report mental health outcomes.<sup>23 24 26</sup> Blake, et al.<sup>23</sup> reported the only mobile app based mental health support intervention in this synthesis. The app was made available to all HCWs in the United Kingdom and included content on the psychological impact of pandemics, psychologically supportive teams,

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2 243 communication, social support, self-care and managing emotions. Fifty-five participants (49 employees  
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4 244 and six students) completed a fidelity assessment one week after the intervention launched. Within the  
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7 245 first week the package was accessed 17,633 times with over 50,000 exposures on social media. Over  
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9 246 80% of participants indicated they had used the information in their daily life and 100% believed they  
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11 247 would continue to use it. Acceptability of app content was 100% and 100% of users said they would  
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14 248 recommend it to others. None of the users said that time, technical or financial challenges impacted on  
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16 249 their use of the app.  
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19 250 Geoffroy, et al. <sup>26</sup> developed a psychological support telephone hotline for clinical and non-clinical staff  
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21 251 employed across 39 hospitals in France. The hotline was staffed by certified, volunteer psychologists  
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23 252 who received brief (30 minute) training on crisis intervention who could on-refer when needed. In the  
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26 253 first 26 days of operation there had been 149 calls (average 5.75/day) with an average call duration of  
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28 254 18 minutes. Eighty-six percent of callers were female and 19% were nurses. Most calls were from  
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30 255 HCWs in frontline departments including the emergency department, intensive care unit, infectious  
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32 256 diseases unit, COVID-19 units and the nursing school across 44 different departments. The most  
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35 257 common reason for calling was anxiety which accounted for just under half the calls. Other reasons  
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37 258 included being worried about COVID-19, exhaustion, trauma reactivation, insomnia, anger and  
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39 259 depression.  
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42 260 Chen, et al. <sup>24</sup> presented an intervention involving a psychological intervention team who offered online  
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45 261 courses in dealing with common psychological problems, a psychological assistance hotline, and group  
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47 262 activities to reduce stress in a Chinese hospital. HCWs were reluctant to utilise the service, and 13  
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49 263 HCWs were interviewed to better understand needs. The interviews revealed that staff were not worried  
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52 264 about their own infection risk, but had greater concerns for family infection and burden. Staff lacked  
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54 265 confidence when dealing with uncooperative patients, were concerned about a lack of PPE, and felt  
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56 266 incapable when caring for critically ill patients. HCWs described needing a place to rest, access to PPE,  
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59 267 and to develop skills in dealing with patient psychological distress. The intervention was subsequently  
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268 modified to provide staff with a place where they could rest, with guaranteed food and daily living

support. Work and daily life routines were videoed for their families, and pre-job training included skills in dealing with psychological distress in patients. Security staff were made available to assist with uncooperative patients, detailed PPE guidelines were developed, leisure activities provided, and counsellors were available to staff. The authors indicated that HCWs were more engaged with the modified intervention, however quantitative data was not reported.

## Discussion

The COVID-19 pandemic has impacted all HCWs across the world, particularly those in hospital settings. As successive waves of COVID-19 continue, it is essential that research evidence be rapidly distilled to effectively support HCWs' mental health and wellbeing. The findings of this evidence synthesis suggest that HCWs impacted by all contemporary pandemics value interventions that support their practical needs (access to PPE, food and sleep) and those which ameliorate acute stressors (infection risk and being separated from family). This is also reflected in recent reviews,<sup>2 12</sup> which recommended and reviewed a range of individual, service, and societal strategies for reducing psychological distress but emphasised a pressing need to determine their effectiveness. It has been difficult to determine the true impact on the psychological health and wellbeing of HCWs from the studies included in this evidence synthesis as studies were limited by pre-post study designs, small samples and presented little to no baseline data to allow impact to be determined. Many interventions have focused on individual behaviour and psychological change by fostering resilience to increase coping skills and offering additional support to those in crisis, rather than addressing the factors HCWs identify as important such as adequate PPE, family and social supports and clear communication.

The negative impact of pandemics on HCWs' mental health and wellbeing is indeed now well established<sup>2 3 65</sup> and it is positive that interventions are being implemented to sustain the mental health and wellbeing of HCWs. However, it is unclear how best to provide supports to HCWs in the hospital setting. A preference has been identified for socially oriented interventions over psychotherapeutic

approaches.<sup>3</sup> Some interventions delivered at organisational levels have ensured adequate PPE supply and clear communication, and offered psychological education, peer support programmes and embedding mental health workers within a team or unit to support individuals.<sup>24</sup> Although mental health interventions have been delivered to HCWs, few studies included outcome data and, where outcomes are reported, they were often of low quality.

Generating evidence in pandemic settings is understandably complex<sup>15</sup> with interventions rapidly implemented to support HCWs' mental health within the pandemic. This synthesis illustrates that descriptions of these interventions often focus on their practical and operational characteristics which can inform other institutions to develop their own pandemic response plans. In this process the reporting of outcome data is limited which means that the effectiveness of interventions implemented to support the mental health and wellbeing of HCWs remains unknown.

Two papers included outcome data on pre-pandemic interventions that were designed to improve HCW resilience to decrease stress and mental health during a pandemic.<sup>22 29</sup> The observed positive outcomes carry over to real world pandemic situations. Interestingly, the intervention with the strongest evidence focused on organisational changes and staff education around minimisation of the risk of transmission, rather than specific mental health focussed interventions.<sup>25</sup> This fits with conclusions reached by Muller, et al.<sup>3</sup> that primary concerns for HCWs are PPE and the management of workload rather than individual professional psychological support. There is a risk that through emphasising individual responsibility for mental health, larger system and organisational level impacts are not regarded. Nonetheless, Blake, et al.<sup>23</sup> and Geoffroy, et al.<sup>26</sup> indicated that HCWs will engage with individually directed supportive interventions, but limited evidence exists regarding the effectiveness of these interventions for improving mental health outcomes.

Digital components featured in many of the included studies with resources made available online or through delivery of remote education and tele-health support. Some mobile apps were used for communication purposes. Only one mobile app was identified in our searches designed specifically in

response to the COVID-19 pandemic aside from our study protocol.<sup>23</sup> Mobile apps can provide safe intervention delivery during a pandemic where social/physical distancing can make in-person interventions challenging, and app-based interventions can be scalable to the work force. A mobile app may also reach those with severe symptoms of mental illness and those with subsyndromal responses. Additionally, people who may feel stigmatised accessing helplines or professional services can receive support in the privacy of own home or elsewhere. A mobile app could be designed to identify those who are at higher risk of psychological distress and provide matched intervention options and could allow individuals to retain their own mental health data and track their wellbeing over time. However, in the design and development of mobile apps, personalised and tailored content will be essential to facilitate greater engagement and uptake and engagement with the services or interventions provided within it. Hence, this makes methods such as experience-based co-design highly relevant and central to the development and implementation of such interventions.

The strength of this evidence synthesis is the breadth of search terms and studies included. Unlike previous reviews, the search was not limited to studies conducted during the COVID-19 pandemic<sup>3 16</sup> and was solely focused on health care worker focused interventions rather than also including wider populations.<sup>12</sup> In addition to bibliographic databases, a wide range of sources were searched including the EPPI-Centre's Living Systematic Map of the Evidence,<sup>21</sup> preprint servers, clinical trial registers and grey literature from reputable health sources. The synthesis was limited by the descriptive nature of many included studies and study designs that lacked comparator groups or adequate baseline and post-intervention measures. Work is underway to address these shortcomings. The Battle Buddies programme includes measures of burnout out and mental health syndromes at multiple time points, including prior to the intervention.<sup>66</sup> Fukuti, et al. <sup>67</sup> are using mental health questionnaires at multiple time points to determine risk and deliver targeted interventions. Mobile apps have significant potential in this space, however effectiveness studies will be essential. Evidence regarding the effectiveness of mobile apps for HCWs' mental health outside of the pandemic setting, such as the SHIFT app study,<sup>68</sup>



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2 344 may also advance the field of research further. This synthesis should be updated once these studies are  
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4 345 completed.  
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7 346 Reviews of studies intended to improve HCW resilience<sup>4</sup> and decrease occupational stress<sup>5</sup> outside  
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10 347 pandemics demonstrated a lack of evidence with many studies lacking adequate numbers and  
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12 348 longitudinal data which is amplified in pandemic settings. Authors and publishers of future studies could  
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14 349 better report population and intervention details. Concerns regarding waste in all research and in  
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16 350 particular in COVID-19 research have been raised elsewhere.<sup>69 70</sup> Our findings reflect these concerns.  
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19 351 While randomised controlled trials of HCW mental health support interventions may be unfeasible in a  
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21 352 pandemic context, other study designs, such as the adaptive trial design utilised by Chen et al <sup>25</sup> would  
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23 353 offer valuable information. In addition, real time data collection methods and monitoring using mobile  
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26 354 methods should be further evaluated for application in pandemics.  
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29 355 This evidence synthesis has shown that the efficacy of existing interventions to support the mental health  
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31 356 and wellbeing of HCWs is unable to be determined. Descriptive studies and single group designs are  
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33 357 common, and while it is heartening that efforts are being made to support HCW wellbeing, efficacy  
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36 358 cannot be determined from these study designs. In this context the importance of experience-based co-  
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38 359 design methods to develop interventions to support HCW mental health and wellbeing must be  
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40 360 emphasised as it becomes vital that the needs of end-users and the best methods and modalities to meet  
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42 361 these needs are understood. Through deep engagement with HCWs we can gain an understanding of  
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45 362 the work and life challenges they face through the pandemic; the challenges to their mental health and  
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47 363 wellbeing; and the best ways that mental health and wellbeing can be supported.  
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50 364 Despite recognition of the impact pandemics have on HCWs' mental health relatively few attempts have  
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52 365 been possible to develop evidence-based interventions to address this problem. Many interventions  
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55 366 focus on individuals and increasing individual coping skills and offering additional support to those in  
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57 367 crisis, rather than addressing the factors HCWs identify as important such as adequate PPE, family and  
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59 368 social supports and clear communication. Future studies should offer interventions that reflect HCWs'  
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self-identified needs and preferences, and the effectiveness of these should be measured using pre-specified outcomes.

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**Figure Legend:** Figure 1. PRISMA 2020 flow diagram for new reviews which included searches of databases, registers and other sources

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## Contributors Statement

VP and LB conceptualised the evidence review and synthesis. VP, LB, KRB and CG developed the search criteria, KRB and CG performed the searches and screened and extracted the data, CG performed an updated search and VP reviewed abstracts to determine papers that met the inclusion criteria. JP supported data extraction. KRB analysed the data, with input from CG, VP, LB, ML, and AK. KRB drafted the manuscript with input from all other study authors. All authors read and revised the whole manuscript.

## Declaration of Interests

No interests to declare.

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## Registration:

The review was not registered and no protocol is available.

## Supplementary Material

- Supplementary File 1: PRISMA 2020 checklist
- Supplementary File 2: Literature Synthesis Search Strategies.
- Supplementary Table 1: Studies reporting mental health and well-being support interventions for HCWs that did not report outcome data.

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2 397 **Data Sharing Statement**

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4 398 No additional data available.

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8 400 **Ethics statements**

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10 401 Participant consent

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12 402 There were no participants. This is not applicable.

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14 403  
15 404 Ethics approval

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17 405 Institutional ethics was not required as this project does not involve human or animal participants.

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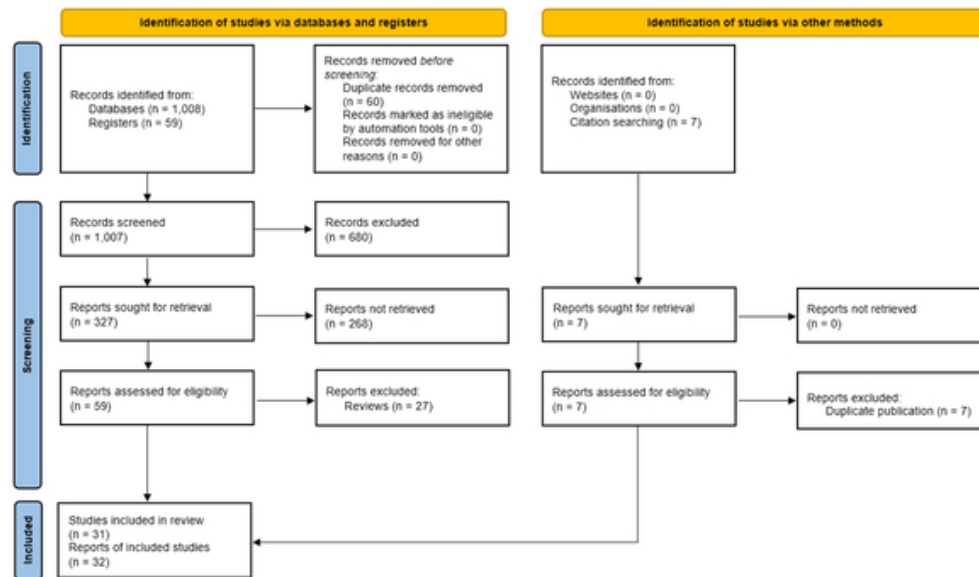


Figure 1. PRISMA 2020 flow diagram for new reviews which included searches of databases, registers and other sources

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PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	P1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	P2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Table 2 &p7-9
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Table 1.
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Supplementary file 2
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	P8-9
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	P9
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	P9
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Table 3
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	n/a
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	n/a
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	P7-8
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	n/a
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	P8-9
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	P7-9
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	n/a
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	n/a
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	n/a
Certainty	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	n/a

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# PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			
<b>RESULTS</b>			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Figure 1; Table 3 and Supplementary Table 1; p9
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	n/a
Study characteristics	17	Cite each included study and present its characteristics.	Table 3 and Supplementary Table 1
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	n/a
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 3 and Supplementary Table 1
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Table 3 and p10-17 and Supplementary Table 1
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	n/a
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	n/a
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	n/a
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	n/a
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	n/a
<b>DISCUSSION</b>			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	P19-23
	23b	Discuss any limitations of the evidence included in the review.	P19
	23c	Discuss any limitations of the review processes used.	P19
	23d	Discuss implications of the results for practice, policy, and future research.	P18-21
<b>OTHER INFORMATION</b>			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	P23
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	P23
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	n/a
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	P23
Competing interests	26	Declare any competing interests of review authors.	P23



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
interests			
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	n/a

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71  
For more information, visit: <http://www.prisma-statement.org/>

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## Supplementary File 1 Literature Synthesis Search Strategies

Database and date of search	Search terms	Results
Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily <1946 to Aug 17, 2020>	1. health personnel/ or "health care facilities, manpower, and services".mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word 2. limit 1 to (english language and yr="2000 -Current") 3. stress, psychological/ or burnout, psychological/ or burnout, professional/ or occupational stress/ or compassion fatigue/ 4. limit 3 to (english language and yr="2000 -Current") 5. exp Pandemics/ 6. limit 5 to (english language and yr="2000 -Current") 7. 2 and 4 and 6	42,902 32,850 131,163 85,339 18,898 17,497 43
PubMed, 10 Jul 2020	1. emergency OR frontline OR front-line 2. corona* OR covid*[All fields] 3. mental OR psychology*[All fields] 4. 2 AND 3 5. 1 AND 4	989,055 594,736 2,086,916 18,835 1,457
CINAHL EBSCOhost, 8 Aug 2020	1. MW Health Personnel 2. Coronavirus or covid-19 or 2019-ncov or MW Severe Acute Respiratory Syndrome or TI SARS or AB SARS or TI 'swine flu' or AB 'swine flu' or MW Middle East Respiratory Syndrome or TI 'MERS' or AB 'MERS' or MW influenza, human or TI 'influenza' or AB 'influenza' or MW hemorrhagic fevers, viral or MW ebola 3. MW mental health or MH 'Behavioral and Mental Disorders+' 4. 1 AND 2 AND 3, published 20100101-20201231, English language 5. MH 'Mobile Applications' or TI 'mobile app*' or AB 'mobile app*' or TI 'smartphone*' or AB 'smartphone*' 6. 4 AND 5	102,550 40,943 867,676 183 14,337 4
PsycInfo, Ovid platform, 17 Aug 2020	1. exp Occupational Stress/ or exp Working Conditions/ or exp Health Personnel/ or exp Health Care Services/ or exp Physicians/ 2. limit 1 to (english language and yr="2000 -Current")	375,853 276,454



	3. exp Pandemics/ 4. limit 3 to (english language and yr="2000 -Current") 5. exp Mental Health/ 6. 2 and 4 and 5	757 726 66,671 36
Scopus, 30 Sep 2020	TITLE-ABS-KEY ( staff* OR worker* ) AND TITLE-ABS-KEY ( emergency OR frontline OR front-line ) AND TITLE-ABS-KEY ( mental OR psych* OR stress OR anxiety ) AND TITLE-ABS-KEY ( pandemic OR epidemic OR covid* OR influenza* OR mers OR sars OR ebola ) AND PUBYEAR > 2009	523
ClinicalTrials.gov, 12 July 2020 (COVID-19 trials subset)	1. SARS-COV-2" OR "Sars-CoV2" OR nCoV OR COVID OR Coronavirus OR Corona, limited to Interventional Studies 2. 1 AND (mental OR stress)	1,472  11

**Supplementary Table 1.** Studies reporting mental health and well-being support interventions for HCWs that did not report outcome data.

<i>During pandemic with multi-level approaches (organisational, individual)</i>								
Albott, et al. <sup>66</sup>	USA	COVID-19	1.To support HCW in maintaining their sense of physiological wellbeing, self-efficacy, and hope, so they can work and avoid posttraumatic stress reactions or burnout using Battle Buddies program – a peer support program and a designated mental health consultant who can facilitate training in stress inoculation methods and facilitate referrals. 2. To identify and support at-risk individuals who may be predisposed to stress reactions.	HCW across multiple hospital departments	Descriptive paper	No	In progress: level of mental health resources required, how to pay for those resources, and how to measure the organizational impact of this initiative on workforce resilience.	Mental health questionnaires are being completed at multiple time points.
			Organisational and individual	Not described	Protocol describing the intervention program	No		
Fukuti, et al. <sup>67</sup>	Brazil	COVID-19	A multi-level intervention (COMVC19) for mental health and psychosocial support and psychological/psychiatric treatment to hospital employees. This includes prevention and secondary prevention training packages and therapeutic interventions.	Approximately 20,000 hospital employees	Descriptive paper	Yes	Still in progress but not reported	Mental health questionnaires are being completed at multiple time points.
			Organisational and individual level	Not described	Editorial	No		
<i>During pandemic - no evaluation components that include outcome data</i>								
Arango <sup>31</sup>	Spain	COVID-19	A 24 hour, 7 day per week support service for HCW in processing emotions using phone, email for counselling and provision of support to relatives of patients to provide videoconference link up while a family member is hospitalised.	HCW in ICU, ED and high demand ward	Descriptive paper	No	No	No
			Individual – HCWs and patients with family in ICU	Not described	Correspondence / Letter	No		
Bridson, et al. <sup>32</sup>	Australia	COVID-19	Non-clinical peer support model that offers one-off guided support sessions on COVID-19 using a webinar or small group discussion format. Hand-n-Hand initiative. Has a dedicated triage manager — an experienced psychiatrist for health care workers. Offers possibility of one-on-one or tailored small group peer support.	HCWs in hospitals, community and primary care	Descriptive paper	Yes: intervention or peer support model is delivered via social media channels	No	No
			Individual or group	Not described	Perspective descriptive	No		
Cao di San Marco, et al. <sup>33</sup>	Italy	COVID-19	Goal to treat and prevent psychological distress and PTSD in HCW, by supporting debriefing and making moral distress a shared experience. Provision	HCWs hospital		No	No	No

of a decompression room for staff, small group sessions follow up phone calls to patients after a family member has died from COVID-19.

Individual level	Not described	Letter to the editor	No
To provide psychological support and alleviate stress by adapting an existing acceptance commitment therapy based psychological intervention into a narrated power point for health care professionals to watch in their own time. Contained exercises and recommendations for HCW actions.	British dermatological nursing group	descriptive	Yes
Individual	Not applicable	Descriptive paper on intervention components	No
To provide crisis psychological support and a peer based intervention for the frontline HCW using social media and via the mobile app WeChat of interdisciplinary professionals providing peer support.	Frontline HCWs in China	Descriptive paper	Yes
Individual	Approx. 300 people participated in counselling groups	Descriptive paper of the intervention	No – part of program used WeChat
To offer workplace excellence strategies for concrete practices and recommendations to promote staff wellbeing and moral resilience.	Hospital staff	Descriptive	Yes
Individual	Not applicable	Editorial	No
To incorporate a psychological crisis intervention into the overall deployment of epidemic prevention and control to minimise psychological damage and provide timely assistance to the prevention and control of the epidemic.	Medical staff but inclusive of patients, medical staff, close contacts, people in affected areas, as well as the general public	Descriptive paper	No
Individual	Not described		No
To protect the mental health of HCW for their own health and to prevent the spread of the epidemic. Provision of information via a web platform, phone support shifts for rest and delivery of psychological interventions by a team.	HCWs in Wuhan	Short Communication Descriptive paper	No
Organisation wide	Hundreds of HCWs are receiving these interventions	Correspondence	No

1	Khee, et al. <sup>39</sup>	Singapore	SARS	To allow HCW to externalise emotion and support one another using a 16 different groups to deliver a group therapy approach.	Single hospital	Observational	No	No	Yes: qualitative reported emotions reviewed by a mental health professional. Key emotions fear; vigilance; detachment.
2									
3									
4				Hospital wide	188 HCWs in a SARS designated hospital from multiple units	Empirical report	No		
5									
6									
7	Klomp, et al. <sup>40</sup>	USA	Ebola	To protect and support public health professionals fighting Ebola: pre-deployment preparedness training (stress, peer support, coping skills, referral processes, triage, and psychological first aid) and a sub-set trained in virtual reality immersive intervention pre-deployment to field.	Clinical and non-clinical CDC staff being deployed to Ebola outbreak between 2014 and 2016.	Descriptive paper	Yes, only for subset who were trained using virtual reality.	No. Effectiveness of deployment safety resilience team training improved training and Self Efficacy	Yes. Pre-deployment: 1. Connor-Davidson Resilience Scale (CD-RISC); 2. Kessler Psychological Distress Scale (K-10); and 3. 4 Item Primary Care PTSD Screener (PC-PTSD). Data not reported
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9				Organisation wide	Almost 1,300 CDC staff completed resilience-related training; 2,868 staff participated in other wellness training; approx. 100 people completed Deployment Safety Resiliency Team training	Special Report	No		
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20	Krystal <sup>41</sup>	USA	COVID-19	To provide mental health support to HCW using a virtual Town Halls model offered daily, and a mindfulness web program	HCWs at Yale	Descriptive paper	Yes – virtual town hall and mindfulness awareness program	No	No
21									
22									
23									
24				Individual	Not described	Viewpoint	No – mobile phone based tools are mentioned.		
25									
26	Lissoni, et al. <sup>42</sup>	Italy	COVID-19	Aims were to promote safety restore calmness, normalise acute stress reactions, promote self-efficacy, promote sense of belonging and maintain mental openness.	ICU staff (and family members) from 2 hospitals	Descriptive paper	No	No	No
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30				Individual	Not described	Descriptive paper of intervention	No		
31									
32									
33	Makino, et al. <sup>43</sup>	Japan	COVID-19	To address mental health of nurses by providing psychoeducational materials to normalise stress response	Nurses across Japan	Descriptive paper	Yes	No	No
34									
35				Individual	Not applicable	Short report	No		
36									
37	Miotto, et al. <sup>44</sup>	USA	COVID-19	Set up wellness mental health group three tier public mental health model for disaster intervention involving screening, phone/text support; townhalls; screening and support across 25 units; direct support.	All HCWs across hospital	Descriptive paper	Yes	State impact monitored but no data provided	No
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				Individual	Not described	Commentary	No		
1	Ping, et al.	Malaysia	COVID-19	To deploy an ultra-brief psychological intervention approach tailored to COVID-19 pandemic. Included self-guided manual based on dialectical behaviour therapy DBT, teaching problem solving skills, mindfulness and validation, online delivery and social media adoption for components.	Initial Single hospital roll-out, then second hospital and national population release	Descriptive	Yes – delivery via a platform to increase availability. Adoption on social media platforms	No. Online delivery effective in lockdown	No. Informal qualitative feedback indicated positive experiences. User heterogeneity complicates quantitative assessment.
2				Individually reported	Initially 25 nurses in contact with patients with COVID-19.	Empirical Paper	No		
3	Poonian, et al.	Australia	COVID-19	Implementation of staff wellbeing plan throughout the pandemic. Provision of safe space, peer support, drop in wellbeing, sessions, training and education, leadership.	All emergency department staff	Descriptive paper	No – videos were however provided on different topics and for advice	Not reported	Not reported
4				Organisation wide.	Not described	Perspective	No		
5	Rentrop, et al.	Germany	COVID-19	Implementation of the Psychological Emergency Care program which includes COPE training and resources for staff and mental health resource activation, triaging services to patient experience supports, palliative medicine and grief support resources.	Single hospital	Descriptive paper	Yes –delivered via telehealth/ teleconference and online COPE IT intervention embedded within	Not reported	Not reported.
6				Individual.	Medical staff and extended to patients with COVID-19 and families	Correspondence / commentary	No		
7	Ripp, et al.	USA	COVID-19	To promote and maintain the system-wide wellbeing of HCWs based on three key factors; meeting basic daily needs; effective communication of current, reliable, and reassuring messages; and developing accessible and effective psychosocial and mental health supports.	Entire Mount Sinai Health System workforce	Descriptive paper	Yes	Not reported	Not reported
8				Organisation-wide.	Not described	Commentary	Yes but used existing apps		
9	Schreiber, et al.	USA	Ebola	To manage the full range of risk and resilience in the responder workforce and their families. To monitor population risk of post-traumatic stress level for group of responders. Uses the Anticipated Plan Deter Respond Resilience Model and online self-monitoring and self-triaging tool. Use of PsySTART-R to triage and track stressors	HCWs deployed to Africa for Ebola	Intervention description and summary aggregate intervention effects.	Yes – PsySTART-R self-triage real time monitoring for PTSD risk and triage to intervention with deter plan.	No. Approx. 80% below PTSD cut-off on PsySTART-R	Not reported
10				Pre-deployment training for individuals and development of individual plan	186 self-triage encounters among 45 staff	Empirical Paper	Yes – mobile optimised web application (PsySTART-R)		

Zhang, et al. <sup>50</sup>	China	COVID-19	Psychological crisis management using psychological first aid training, counselling, the Anticipated Plan Deter Respond Resilience Model, online resources and mobile apps.	Single Hospital	Descriptive paper	Yes - included a technology platform to support staff	Not reported	Not reported but collected mood data for individuals to self-reflect.
			Individual and System-Wide	Hospital staff and quarantined people	Descriptive Paper / Perspective	Yes WeChat and Huayitong mobile apps		

Notes: HCW(s) – Health Care Worker(s); SARS – Severe Acute Respiratory Syndrome; COVID-19 - Coronavirus Disease 2019; ICU – Intensive Care Unit; ED – Emergency Department; IQR – interquartile range; PTSD – Post Traumatic Stress Disorder;

# BMJ Open

## Interventions to support the mental health and wellbeing of frontline health care workers in hospitals during pandemics: an evidence review and synthesis

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# Interventions to support the mental health and wellbeing of frontline health care workers in hospitals during pandemics: an evidence review and synthesis

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**Key words** Front line health care workers, pandemics, mental health, co-designed interventions, digital health interventions, mobile health apps, COVID-19

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**Abstract**

**Objective:** Pandemics negatively impact Health Care Workers’ (HCWs) mental health and wellbeing causing additional anxiety, depression, moral distress and post-traumatic stress. A comprehensive review and synthesis of HCW mental health and wellbeing interventions through pandemics with mental health outcomes was conducted addressing two questions: 1. What mental health support interventions have been reported in recent pandemics, and have they been effective in improving the mental health and wellbeing of HCWs?: And, 2. Have any mobile apps have been designed and implemented to support HCWs’ mental health and wellbeing during pandemics?

**Design:** A narrative evidence synthesis was conducted using Cochrane Criteria for synthesizing and presenting findings when systematic review and pooling data for statistical analysis are not suitable due to the heterogeneity of the studies.

**Data Sources:** Evidence summary resources, bibliographic databases, grey literature sources, clinical trial registries and search protocol registries were searched.

**Eligibility criteria:** Subject heading terms and keywords covering three key concepts were searched: SARS-CoV-2 coronavirus (or similar infectious diseases) epidemics, health workforce, and mental health support interventions. Searches were limited to English-language items published from 1<sup>st</sup> January 2000 to 14<sup>th</sup> June 2022. No publication-type limit was used.

**Data Extraction and synthesis:** Two authors determined eligibility and extracted data from identified manuscripts. Data was synthesised into tables and refined by co-authors.

**Results:** 2,694 studies were identified and 27 papers were included. Interventions were directed at individuals and/or organisations and most were COVID-19-focused. Interventions had positive impacts on HCW mental health and wellbeing, but variable

study quality, low sample sizes, and lack of controls conditions were limitations. Two mobile apps were identified with mixed outcomes.

**Conclusion:** Interventions were rapidly designed and implemented with few comprehensively described or evaluated. Tailored interventions that respond to HCWs' needs for mental health and wellbeing are needed with process and outcome evaluation.

**Abstract word count:** 298

For peer review only

**Article Summary**

**Strengths and limitations of this study**

- This is the most comprehensive review of interventions to support health care worker mental health and wellbeing through pandemics that has been conducted to date.
- The review explored a wide range of sources including key bibliographic databases, the EPPI-Centre's Living Systematic Map of the Evidence, preprint servers, clinical trial registers and grey literature from reputable health sources.
- The review outcomes were limited by heterogeneous research outcomes that were largely descriptive, lacked appropriate outcome measures or used single group designs.
- A large number of studies were excluded as they describe mental health focused interventions for health care workers, but did not report outcomes or impact.

## Introduction

Health care workers (HCWs) experience high levels of mental distress[1] which increases through pandemics. Pandemic-related mental health and wellbeing impacts have been reported[2 3] but as increased rates of anxiety, depression, moral distress and post-traumatic stress disorders[4] and occupational stress are identified as a consequence of COVID-19, mental health and wellbeing supports for HCWs are becoming paramount.[5] Early in the pandemic, increased mental distress was being driven by increased risk of COVID-19 infection,[6] radically altered healthcare systems and practices, and the impact of physical distancing on professional team interactions and patient relationships.[3] Now, almost three years into the pandemic, distress and burnout are driven by impacts of staff shortages and absenteeism, increased workload attributable to treating and preventing COVID-19, and the impact of successive waves of infection.[7 8] Morally complex decision-making in the allocation of scant health resources increased mental distress and HCWs needed to evaluate risks to their own health and for loved ones.[9 10] Australian HCWs described intense stress associated with pandemic preparedness and the emotional costs of working in an environment where human contact is restricted.[11 12] Despite these concerns, there is a lack of evidence-based HCW mental health and well-being interventions and supports, even outside of the pandemic setting.[4 5]

Since 2003, pandemics have become frequent with severe acute respiratory syndrome (SARS), Middle Eastern Respiratory virus (MERS), influenza H1N1 and H7N9, Ebola, and now SARS-CoV-2, causing COVID-19, emerging. Pandemic preparedness has become a feature of healthcare system planning and several reviews published early in the pandemic examined the mental health of HCWs and potential interventions that could support HCW mental health and wellbeing.[2 13 14] While significant mental health impacts on HCWs working within pandemics is recognised, there is a mismatch between the interventions offered, focusing on relieving individual symptoms, versus HCWs'

expressed preference for social support.[3] Evidence-based interventions supporting the short and long-term mental health of HCWs in pandemics are required.[14-17] Reviews have indicated an increased need for technological innovation and digital interventions following the COVID-19 pandemic.[18 19] Digital mental health interventions and mobile apps exist, but there remains a paucity of evidence about HCW specific digital interventions both inside and outside of pandemics.[18 20]

This literature synthesis informed a larger project that involved the development, design and implementation of a mobile app to support HCWs’ mental health and wellbeing during COVID.[21] The project utilised experienced-based co-design (EBCD[22]) which employs narrative and story-telling approaches alongside facilitated co-design to centre the lived-experience of services users.[21] It typically involves two interconnected stages (1) information gathering and (2) engaging people with lived-experience as content co-creators and developers of collaborative solutions through a co-design process[22 23].

We used the Cochrane approach to evidence synthesis where meta-analysis is not appropriate and applied a narrative evidence synthesis method.[24] The review addressed two questions:

1. What mental health support interventions have been reported in recent pandemics, and have they been effective in improving the mental health and wellbeing of HCWs?: And
2. Have any mobile apps have been designed and implemented to support HCWs’ mental health and wellbeing during pandemics?

## Method

Following the narrative evidence synthesis method[24] the following combinations of resources was searched to identify relevant publications (Table 1). A Prisma 2020 Checklist is included as Supplementary File 1.

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Table 1. Databases included in search strategy

Resource type	Titles searched	Latest search date
Cochrane Library resources	Cochrane Reviews, Cochrane Protocols, Cochrane Trials	6 June 2022
Evidence summaries and guidelines	Cochrane Living Guidelines; Epistemonikos; Oxford Covid-19 Evidence; NICE Rapid guidelines on COVID-19; VA Evidence Synthesis Project COVID-19 Reviews	18 Sep 2020
Literature databases	Medline (Ovid, 1946 -)	6 June 2022
	Web of Science Core Collection	14 June 2022
	Scopus	17 Aug 2020
	PsycInfo (Ovid)	14 Mar 2021
	Embase Classic+Embase (Ovid)	14 Mar 2021
	CINAHL Complete (EBSCOhost)	14 Mar 2021
	LitCovid	17 Aug 2020
	EPPI-Centre Living Systematic Map of the Evidence	30 Jul 2020
EPPI-Centre Register	- Provided an extract of their mental health impacts references (n=468 with the last update (published 30/7)	
Preprint servers	ArXiv; MedRxiv (COVID-19 SARS-CoV-2 preprints sub-sets)	18 Aug 2020
Clinical trials registers	Australian New Zealand Clinical Trials registry COVID-19 Studies; ClinicalTrials.gov COVID-19 subset; Cochrane COVID-19 Trials register	20 Aug 2020
Systematic reviews protocols	PROSPERO International prospective register of systematic reviews	7 June 2022
Grey literature	Agency for Healthcare Research and Quality; Australian Commission on Safety and Quality in Health Care; Canadian Agency for Drugs and Technologies in Health; Health Quality Ontario; National Institute for Health and Care Excellence; World Health Organisation	18 Sep 2020

Evidence summaries and guidelines were searched using a combination of thesaurus terms (where available) and keyword searches. Database search strategies used subject heading terms and keyword searches for three key concepts: SARS-CoV-2 coronavirus (or similar



infectious diseases) epidemics, health workforce, and mental health support interventions.

Searches were limited to English-language items published from 2000. No publication-type limit was used. The detailed search strategy is included in Supplementary File 2.

Reference lists of relevant items were checked, and forward citation searches were conducted to discover related items. Grey literature sources and the websites of key health organisations were also checked. COVID-19 subsets of three clinical trials registers were examined to identify randomised controlled trials in progress at the time of conducting the search.

From 2,694 publications identified, comprised of reviews and single studies, 2,603 papers were screened for inclusion using the criteria shown in Table 2.

**Table 2.**

*Manuscript inclusion and exclusion criteria for literature synthesis*

Inclusion	Exclusion
Pandemic or epidemics: SARS, MERS, H1N1 H7N9, COVID-19, Ebola	Pandemics prior to 1 <sup>st</sup> of January 2000
Clinical and non-clinical health workers in hospitals	Paramedic, disaster and retrieval staff. Primary care and community healthcare workers.
Intervention that had been implemented in a hospital setting in any country at any time after the 1 <sup>st</sup> of January 2000 with the intention implemented to improve HCWs’ mental health and wellbeing in the pandemic setting	Interventions that had been proposed or recommended without having been implemented. Educational materials intended to inform the institution’s workforce
E-learning and web-based interactive programmes were included as general interventions. Only mobile apps, specifically developed to address HCWs' mental health in pandemics were included to address the second question.	Mobile app used only as a platform of communication.
Reported mental health outcomes	Did not report mental health outcomes

Each manuscript was independently assessed by two authors (KRB, CG, ML, VP) to determine eligibility with discrepancies resolved through discussion between the authors. Where required, a third author made the final determination.

Quantitative and qualitative data from eligible studies were extracted into tables. Studies that did not trial a specific intervention or include mental health outcomes were excluded. Intervention details were charted by type of intervention and mental health-related outcome data and reviewed and refined at research meetings by co-authors (KRB, CG, VP, LB, ML, AK). A formal quality appraisal tool was not applied, but the limitations of each study were considered in presenting the results.

Institutional ethics was not required as this project does not involve human or animal participants.

### **Patient and Public Involvement**

No patients involved.

**INSERT FIGURE 1 ABOUT HERE**

### **Results**

Figure 1 presents the PRISMA flow diagram of the study review and selection process. Twenty-seven papers, from 26 studies (2 papers reported aspects of the same study) met the inclusion criteria.[25-51] . Heterogeneity of study designs and outcomes meant that it was not possible to synthesise the effects of each outcome.

Most studies (22/26) related to the COVID-19 pandemic;[28-32 34-51] two related to influenza;[25 26] and one each for SARS[27] and Ebola.[33] Many interventions were premised on mitigating acute stress to prevent or minimise longer-term mental health problems. Three studies described pre-pandemic interventions,[25 26 37] 23 described interventions delivered during pandemics,[27-32 34-36 38-51] and one described a post-pandemic intervention.[33]

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A summary of included studies is included in Table 3. The aims and methods of each included study are presented in more detail in Supplementary Table 1, and mental health assessments and outcomes in Supplementary Table 2.

Broadly the interventions described in the literature are targeted at organisations aiming to improve working conditions, communication, and staff support; and at individuals focusing on clinical education, mental health and wellbeing, stress management and coping or directed counselling and psychological support.

**Table 3** *Interventions to Improve Health Care Workers' Mental Health during Pandemics*

Author Year	Pandemic	Design	Aim	Intervention	Population	Intervention impacts
Aiello, et al. [25]	Influenza	Post-evaluation	↑ resilience	Education session	HCWs	↑ coping
Amsalem, et al. [32]	COVID-19	RCT	↑ help seeking	3-minute video	HCWs with anxiety, depression or PTSD	↑ intention to seek treatment
Beverly, et al. [38]	COVID-19	Pre-post	↓ stress	3-minute virtual reality	HCWs	↓ perceived stress
Blake, et al. [28] Blake, et al. [48]	COVID-19	Post-evaluation survey ('20) Interviews ('21)	Support psychological wellbeing	Drop-in wellbeing centres	HCWs	↑ wellbeing and work place engagement/ Positive view of centres
Chan, et al. [41]	COVID-19	Post-evaluation	Support mental health	Virtual continuing medical education	Obstetric and gynaecology trainees	↑ coping
Chen, et al. [27]	SARS	Pre-post	↓ anxiety and depression, improve sleep	Multifactorial education, support, and mental health	Nurses	↓ depression, anxiety; ↑ sleep quality
Cheng, et al. [31]	COVID-19	Validation	↑ positive emotions, team work; ↓ burnout.	Mental health support	HCWs	mood 7-9/10. ↑ gains and ↓ challenges.
Cole, et al. [33]	Ebola	Pre-post	↓ anxiety and depression	Small group cognitive behavioural therapy	Past Ebola treatment staff with anxiety/depression.	↓ anxiety, depression, functional impairment
De Kock, et al. [43]	COVID-19	RCT	↑ psychological health	2 different digital apps	HCWs	Both apps: ↓ anxiety & depression; 1 app: ↑ mental toughness
Dincer and Inangil [45]	COVID-19	RCT	↓ stress, anxiety and burnout	Emotional Freedom Technique	Nurses	↓ stress, anxiety and burnout
Fiol-DeRoque, et al. [42]	COVID-19	RCT	↓ depression, anxiety, stress, PTS, burnout and insomnia, ↑ self-efficacy	Digital app	HCWs	No difference primary or secondary outcomes
Giordano, et al. [51]	COVID-19	Pre-post	↓ stress and ↑ wellbeing	Music therapy and guided imagery	HCWs	↓ tiredness, sadness, fear and worry
Ha, et al. [49]	COVID-19	Cluster RCT	↑ physical activity and sleep quality	Mobile wellness: online exercise classes, weekly health coaching	Nurses	↑ sleep quality, intrinsic motivation to exercise and wellness.

Hong, et al. [30]	COVID-19	Mixed methods	↑ stress management and psychological wellbeing	Practical support; clinical education; mental health support	HCWs	6% met cut off for high level of distress
Kameno, et al. [29]	COVID-19	Pre-post	Support high risk staff	Individual psychotherapy	Nurses	↓ psychological distress; ↑ anxiety sleep and appetite
Maunder, et al. [26]	Influenza	Pre-post	↑ support and training satisfaction, coping, pandemic-related self-efficacy; ↓ interpersonal problems.	Computer assisted clinical education and relaxation training.	HCWs	↑ pandemic perceived self-efficacy, confidence pandemic preparedness; ↓ interpersonal problems
Nourian, et al. [47]	COVID-19	RCT	↑ sleep quality	Mindfulness-based stress reduction	Nurses	No difference ↑ sleep subscales
Osman, et al. [36]	COVID-19	Mixed methods pre-post	↓ stress, burnout and mindful awareness.	Mindfulness sessions	HCWs and healthcare students	↓ stress; ↑ burnout, subscales
Sun [39]	COVID-19	RCT	↑ time management	Time management training; Balint group	Nurses	↓ Symptom Checklist Score and work stress; ↑ wellbeing
Thimmapuram, et al. [46]	COVID-19	RCT	↑ sleep and perceptions of loneliness	Heartfulness meditation practice	HCWs	↓ Loneliness; ↑ sleep quality
Trottier, et al. [50]	COVID-19	uncontrolled trial	↓ anxiety, depression, and PTSD	online guided intervention	HCWs	↓ anxiety, depression, and PTSD
Wu and Wei [34]	COVID-19	Between group Observational	↓ stress and ↑ sleep	Exercise prescription	HCWs	↑ psychological stress and sleep
Yıldırım and Çiriş Yıldız [44]	COVID-19	RCT	↓ stress, work-related strain and ↑ psychological well-being	Mindfulness based breathing and music	Nurses	↓ stress and work related strain ↑ psychological wellbeing
Zhan, et al. [35]	COVID-19	RCT	↓ anxiety and ↑ sleep	Tai Chi	HCWs	↑ sleep ↓ anxiety
Zhou, et al. [40]	COVID-19	Pre-post	↓ anxiety and depression	Mindfulness; Education; psychological support	Nurses	↓ anxiety
Zingela, et al. [37]	COVID-19	Descriptive	↑ coping, stress management.	Education on mind care; relaxation; team care	HCWs	↑ coping, stress and anxiety management.

### Interventions Delivered Pre-Pandemic

Three papers examined programs to prepare HCWs for pandemics. Two papers reported on elements of an organisational approach to pandemic preparedness focussed on building resilience in a Toronto based hospital based on their 2003 experience with SARS. An inter-professional Psychological Pandemic Committee developed interventions to reduce HCW stress and facilitate adaptation as a primary prevention, aiming to support staff and reduce absenteeism through future pandemics. A computer-based educational intervention, intended as a “pandemic influenza stress vaccine,” that delivered audio and video lectures on pandemics and working outside your comfort zone as well as relaxation skills and self-assessment modules was evaluated.[26] Three course durations were offered, 1.75 hours, 3 hours and 4 hours and all improved pandemic self-efficacy, confidence in training and support, but a non-significant trend toward higher drop-out with longer course duration was observed. In the second study, Aiello, et al. [25] reported findings from an in-person education intervention focusing on coping principles and organisational and personal resilience. Post-session questionnaire data indicated that 35% of participants felt prepared to deal confidently with a pandemic before the session improving to 76% of participants after the session. The absence of pre-training session data regarding perceived ability to cope is a significant limitation of this study.

Zingela, et al. [37] reported that a 60-90 minute in-person group education session, covering mind care, relaxation techniques and team care, on the psychological preparedness of HCWs to the COVID-19 pandemic improved coping, ability to manage stress in others and anxiety in themselves.

It is unclear whether increasing HCWs’ confidence in their abilities improved mental health outcomes during or following a pandemic consistent with the expected outcomes of specialised training on mental health outcomes. [52-55]

**Interventions delivered during a pandemic**

Twenty-four studies reported mental health outcomes for interventions delivered during or after a pandemic.[27-36 38-51] Most studies (18/24) were individually directed with diverse aims, including improving sleep, or decreasing stress, anxiety, depression, burnout and PTSD. Interventions were commonly selected based on findings from studies conducted outside the pandemic setting and with non-HCW populations. The five studies that describe organisational level changes often incorporated interventions targeted at individuals and included additional elements.

An intervention to improve mental health treatment seeking rather than mental health outcomes was assessed in a 3 arm RCT.[32] Group one watched an intervention video twice (baseline; +14 days); Group two watched it once (baseline); and the Control Group did not watch it. The intervention increased treatment seeking intentions from pre-viewing to 30-days post in both intervention groups with group one showing an increased intention to seek treatment. No data was presented linking intention to seek treatment translated into treatment seeking.

A range of interventions were studied. Seven studies explored elements of relaxation, mindfulness and meditation.[36 38 44-47 51]. Three studies examined exercise based interventions[34 35 49], two each focused on CBT-based interventions[33 50] or mobile apps,[42 43] and three explored other interventions[28 29 39 48].

Four studies reported on mindfulness interventions with three involving multi-week interventions.[36 46 47] A seven week online mindfulness based stress reduction program (weekly mindfulness based exercise and mindfulness education), did not demonstrate any difference in sleep quality on the Pittsburgh Sleep Quality Index (PSQI[56]) total score, but some PSQI subscales showed improvement.[47] Osman, et al. [36] reported statistically significant improvements on the emotional exhaustion and personal accomplishment elements of the Maslach Burnout Inventory (MBI[57]) and in mean perceived stress, following four weekly, hour-long on-line mindfulness sessions. Online meditation, with participants listening to 6-minute audio meditations twice daily for 4 weeks, improved



sleep quality on the PSQI while remaining above the threshold for poor quality sleep, and decreased loneliness on the University of California Los Angeles Loneliness Scale.[46] Yıldırım and Çiriş Yıldız [44] reported that a single 30-minute, online, mindfulness based breathing session decreased work related strain and anxiety and improved psychological wellbeing.

Beverly, et al. [38] reported decreased HCWs stress on a visual analogue scale after viewing a 3-minute immersive virtual reality nature scene. Dincer and Inangil [45] showed that a 20-minute online education session about the Emotional Freedom Technique, where points on the skin are tapped to send activating and deactivating signals to the brain decreased stress, anxiety and burnout.

Giordano, et al. [51] trialled a five-week music therapy intervention with three 15–20-minute playlists (breathing, tranquil and energy). In week one, participants received generic playlists and at week's end they spoke with a music therapist who tailored a playlist. This process was repeated weekly over 4 weeks. The authors observed statistically significant changes in tiredness, sadness, fear, and worry using a bespoke instrument. Participants indicated the presence of the music therapist was of greater help than the playlists.

Three studies described exercise-based interventions.[34 35 49] Ha, et al. [49] described a 12-week fitness program aiming to increase physical activity and improve sleep quality. The intervention group had access to online exercise classes, health coaching, and were given step count targets which significantly increased daily step counts but did not change sleep quality on the PSQI. Wu and Wei [34] reported on an exercise prescription where the intervention group were HCWs at a COVID-19 designated hospital and the control group were HCWs at a non-COVID-19 designated hospital. The authors did not provide any details regarding the nature of the exercise prescription or numerical outcome data. They stated that those who followed the exercise prescription had better sleep and stress than those that did not, but no data was presented.

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2 75 Zhan, et al. [35] reported that 30 minutes of online Tai Chi, daily for two weeks, significantly improved  
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4 76 sleep on the PSQI at day 14, compared against 30 minutes of free exercise, but did not alter anxiety  
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6 77 outcomes on the Beck Anxiety Inventory.  
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9 78 Two studies investigated CBT-based interventions.[33 50] Cole, et al. [33]described a small group,  
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12 79 post-pandemic, CBT based intervention that involved six, 3-hour weekly, in-person small group CBT  
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14 80 sessions supplemented by a workbook, for former Ebola Treatment Centre (ETC) workers with  
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16 81 evidence of anxiety, depression and/or PTSD. The intervention decreased depression on the Patient  
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18 82 Health Questionnaire-9 (PHQ-9), functional impairment on the Work and Social Adjustment Scale  
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21 83 (WASAS), and anxiety on the Generalised Anxiety Disorder-7 (GAD-7). Trottier, et al. [50] reported  
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23 84 preliminary findings from a self-directed online intervention in which participants completed eight,  
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26 85 CBT based modules over a maximum of 8 weeks. The 30-day outcomes, based on intention to intervene,  
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28 86 showed improvements to anxiety on the GAD-7; depression on the PHQ-9; and PTSD on the PCL-5,  
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30 87 with large, reported effect sizes.  
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33 88 Two studies reported on the use of digital apps.[42 43] De Kock, et al. [43] described a three arm RCT  
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36 89 comparing: an existing digital app for HCWs psychological health called My Possible Self (MPS[58]);  
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38 90 an app designed specifically for HCWs during the pandemic, called the National Health Service  
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40 91 Highland Wellbeing Project (NHSWBP) app; and a wait list control. In the first two weeks the  
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42 92 NHSWBP app focused on happiness, resilience and wellbeing, and in the final two weeks focused on  
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45 93 low mood and anxiety. The study was not appropriately powered for efficacy and there was high attrition  
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47 94 (36.7%). Nonetheless, depression, on the PHQ-9, decreased in both the MPS and NHSWBP groups,  
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49 95 anxiety, on the GAD-7, decreased in only the NHSWBP group, and mental toughness on the Mental  
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52 96 Toughness Index, improved in the NHSWBP and control groups. All three groups showed  
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54 97 improvements in mental wellbeing, on the Warwick-England Mental Well-Being scale, and in gratitude,  
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56 98 on the Gratitude Questionnaire.  
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2 99 A RCT evaluated the impact of two weeks of access to the PsyCovidApp on depression, anxiety, stress  
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4 100 (DASS-21[59]), PTSD (Davidson Trauma Scale[60]), burnout (MBI[57]), insomnia (Insomnia Severity  
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6 101 Index[61]) and self-efficacy (General Self-Efficacy Scale[62]). [42] PsyCovidApp is a CBT and  
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9 102 mindfulness-based intervention over 4 content areas (emotional skills, healthy lifestyle, work stress and  
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11 103 burnout, and social supports). The control group accessed an app with brief information about HCW  
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13 104 mental health during pandemics. No between group differences were observed post-intervention on  
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16 105 primary outcomes.

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19 106 Three studies utilised other interventions. One group[28 48] evaluated wellbeing centres designed to  
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21 107 be relaxing spaces allowing quiet time and social interaction for employees, bank staff and volunteers  
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23 108 in two UK acute hospital trusts. The centres were staffed by buddies, volunteers whose usual workload  
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26 109 had decreased due to the pandemic, who were trained in psychological first-aid and able to provide  
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28 110 mental health support information. The centres were evaluated via survey[28] and qualitative  
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30 111 interviews.[48]

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33 112 The survey compared centre users to non-users, and of 819 respondents, 94% were aware of the centres  
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36 113 and 55.2% had accessed a centre. Users and non-users reported similar job stressfulness, job  
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38 114 satisfaction, turnover intention or presenteeism. Those who accessed the centres had higher wellbeing  
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40 115 (Warwick Edinburgh Mental Wellbeing Scale) and higher workplace engagement (Utrecht Work  
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42 116 Engagement Scale). Respondents appreciated the centres and described them as having a positive  
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45 117 impact on their wellbeing. There was a strong desire for the centres to be retained post-pandemic.

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48 118 In their qualitative analysis[48] drawn from 24 interviews with centres users and operational staff,  
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50 119 including managers and buddies, the centres were seen as an essential support and a source of pride in  
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52 120 the NHS that addressed an unmet need. Staff described pre-pandemic wellbeing initiatives as focussing  
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55 121 on healthy lifestyle changes rather than addressing the core issues that impact staff. Buddies described  
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57 122 their role as an opportunity to contribute to the pandemic response when their usual role had decreased.

Users appreciated the information buddies offered, being able to offload their worries and talking through coping strategies.

Kameno, et al. [29] reported that individual psychotherapy for nurses experiencing high levels of psychological distress decreased distress over the following two months. Of 31 nurses screened, 8 met the inclusion criteria, and 3 accepted psychotherapy. While the authors reported efficacy, the numbers were small and reasons for refusing the intervention were not specified.

A RCT reported that a 16-week time management intervention involving 1-hour Balint groups that ran 1-2 times a week, and weekly 40-minute time management training over 8 weeks improved mental health, subjective wellbeing and stress response.[39] The intervention is poorly described, and the findings are presented using a paired t-test of the difference between the intervention and control group, with no data regarding the mean pre-post scores for each group.

Five studies reported interventions that included changes beyond the individual level.[27 30 31 40 41]

Four of these involved multicomponent interventions. Chen, et al. [27] described an intervention for nursing staff in a Taiwanese SARS designated hospital that included an epidemic prevention plan with in-service training to minimise transmission risk when caring for SARS patients, staff allocation to ensure appropriate shift lengths and time away from work, adequate PPE supplies, and the establishment of a mental health team to provide direct staff support. Participant mental health was assessed using Zung's self-rating anxiety scale (SAS[63]) and depression scale (SDS[64]) and the PSQI[56] at four time points: pre-intervention (T1); 2 weeks post intervention (T2); 1 month post-intervention (T3); and 1 month after the hospital was no longer a designated SARS hospital (T4). Of 120 nurses surveyed, 116 completed questionnaires at all four time points. At T1 the mean scores on the SAS and SDS indicated moderate anxiety and depression, which reduced to mild anxiety and depression at T2 and T3, and to no anxiety or depression at T4. Progressive improvements in sleep quality were observed at each follow-up time, but sleep quality remained above the threshold indicating poor quality sleep at all timepoints.

There was no control condition making it difficult to determine the true impact of the intervention on outcomes.

Cheng, et al. [31] described a 5-module intervention including self-rate mood, positive self-feedback training, psychological peer-support, weekly psychiatry-led Balint Group, and active monitoring of wellbeing by a support team, for 155 HCWs from a Shanghai hospital who were sent to work in a COVID-19 designated hospital in Wuhan. teamwork In the week after leaving Wuhan, while in quarantine, 125 HCWs completed follow-up questionnaires. Daily mood reports across the 6 weeks showed improvements, while daily challenges decreased. However the number of HCWs who completed the daily self-reported mood ratings was low. The authors concluded that the whole team maintained a positive outlook.

A multifaceted intervention to improve stress management and protect the physiological and psychological wellbeing of HCWs was delivered to 105 staff in a Beijing tertiary hospital COVID-19 fever clinic.[30 65] To address concerns regarding SARS-CoV-2 transmission to family members, HCWs were provided with accommodation during their rostered workdays at the fever clinic and quarantine period. Families were supported where necessary. PPE and training to minimise transmission risk were provided, along with adjustments to the work roster, and a telephone hotline, staffed by psychiatrists and psychologists, was available from 9am-9pm seven days a week. Feedback from the first 37 HCWs who participated was used to modify the intervention for the following 68 participants. The Impact of Events Scale-Revised (IES-R[66]) and a source of distress scale developed for use during the SARS outbreak in Hong Kong.[30] Source of distress scores were higher for the first 37 HCWs. Decreased source of distress score for the second group may have reflected program modifications but could have related to improved COVID-19 knowledge and clinic activity.

Zhou, et al. [40] delivered an on-line and in-person training program covering diagnosis, infection prevention and psychological support including mindfulness decompression for nurses designated to a COVID-19 ward which significantly decreased anxiety (SAS[63]) and non-significantly decreased

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2 172 depression (SDS[64]). The authors concluded that knowledge regarding infection prevention and  
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4 173 psychological support decreased anxiety, but that not enough time had elapsed to decrease depression.  
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7 174 One intervention delivered virtual continuing medical education (vCME) for 44 obstetrics and  
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10 175 gynaecology trainees in Singapore to support trainee mental health to allow trainees to continue training  
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12 176 and maintain skills when elective surgeries were cancelled.[41] Twenty-eight trainees completed a  
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14 177 program audit including three questions about wellbeing. The authors reported on only one question,  
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16 178 with 75% of respondents indicating that the sessions helped them cope with the difficulties of team  
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18 segregation.  
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22 180 Across the 26 studies, 41 mental health-focused outcome measures were reported with 30 only being  
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24 181 used in one study each, six in two studies, two in three studies (Zung's Self-rating Anxiety Scale, Zung's  
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26 182 Self-rating Depression Scale[63 64]), two in four studies (GAD-7, PHQ-9[67 68]) and one in five  
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28 studies (PSQI[56]). Some studies used well recognised and validated instruments, whereas other studies  
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30 used modified versions of existing instruments or developed their own instruments, with little  
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32 presentation of how these instruments were developed or validated, if at all.  
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36 186 Data trends across included studies are evident. Six studies demonstrated improvements in sleep,[27 34  
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38 187 35 46 47 49] three in wellbeing,[28 39 44 48] and two in coping[37 41] and in confidence[25 26]. Seven  
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40 studies demonstrated decreased anxiety,[27 33 35 40 43 45 50] five in stress,[34 36 38 44 45] four in  
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42 depression,[27 33 43 50] two in burnout,[36 45] and one each in PTSD[50] and functional  
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44 impairment[33]. The conclusions that can be drawn from these findings are limited by the wide range  
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46 of instruments used, variability in interventions and approaches, frequent lack of control data, and the  
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49 limited or incomplete data reported within papers.  
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## Discussion

The COVID-19 pandemic has impacted all HCWs across the world, and this was most acutely experienced in hospital settings. As successive waves of COVID-19 continue, it is essential that research evidence be rapidly distilled and updated to effectively support HCWs' mental health and wellbeing as the pandemic evolves. The challenges to HCWs mental health and wellbeing are shifting. Early pandemic wellbeing challenges were driven by the lack of information regarding infection prevention and effective treatment pathways, no vaccines and infections risk, and rapidly changing guidelines and protocols. HCWs experienced uncertainty regarding how to protect themselves and their loved ones, while caring for patients. Two and half years later, vaccination has significantly decreased the risk of severe disease and evidence regarding infection prevention and treatment is increasing. HCWs wellbeing and mental health remain challenged by pandemic conditions as they are still required to navigate uncertainty and the challenges of contested knowledge, against a background of high workloads, ongoing waves of COVID-19 infections and staffing shortages to due COVID-19 exposure and staff leaving the profession. This has all occurred in the context of high rates of pre-pandemic mental health challenges and high rates of burnout.[1 69]

This literature synthesis reports on a wide range of HCW mental health and wellbeing interventions. It is encouraging that there is such a focus on supporting HCW mental health, and most studies reported some positive impact of their interventions. The true impact on the psychological health and wellbeing of HCWs however is difficult to determine from the included studies as many were limited by pre-post study designs, small samples and presented limited baseline or comparative data. Most interventions focused on individual behaviour and psychological change by fostering resilience to increase coping skills and offering additional support to those in crisis, rather than addressing the factors HCWs identified as important such as adequate PPE, family and social supports and clear communication.[2 14]



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2 219 The evidence synthesis draws attention to two interconnected problems regarding work in this area: the  
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4 220 gap between what HCWs want and the supports that are offered; and, the variable quality of the reported  
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6 221 research. Literature reviews on the mental health impacts of pandemics suggest that social and practical  
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9 222 support are important mechanisms for alleviating psychological distress and may be preferred to  
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11 223 professional psychological support.[2 3] This was reported early in the pandemic by Chen, et al. [70]  
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13 224 who interviewed HCWs and found that the psychological support intervention they offered did not  
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16 225 address HCWs' self-identified concerns. Interviews with UK HCWs and social care workers found  
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18 226 they valued practical support from their organisations during the COVID-19 pandemic including the  
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20 227 provision of food, flexibility around work, clear communications and being consulted regarding their  
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23 228 needs.[7] Direct psychological support was valued but was one element in what was needed to support  
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25 229 their mental health. Most included interventions focused on individual behaviour, fostering resilience  
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27 230 to increase coping skills or offering support to those in crisis.  
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30 231 This misalignment likely reflects complexity, and time and costs constraints organisations face  
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32 232 especially if interventions require cultural change or reorganisation of existing systems. COVID-19  
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34 233 forced healthcare systems to make rapid large-scale systemic and environmental changes including  
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36 234 increased use of telehealth, social distancing measures, the wearing of PPE, and the cancellation of  
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38 235 elective procedures. It is conceivable that systems, and people within these systems, would have  
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40 236 struggled to accommodate further complex reorganisation at that time. Second, many mental health and  
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42 237 wellbeing intervention were locally driven by departments, groups, and individuals within hospitals that  
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44 238 the pandemic impacted and were developed with limited resourcing and with a sense of urgency.  
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49 239 Generating evidence within pandemics is understandably complex[17] as interventions are rapidly  
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51 240 developed and deployed, participants are already burdened, and the system is under strain. Our review  
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53 241 excluded many papers describing interventions that did not present efficacy data. The included studies  
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55 242 had variable design quality. Most studies had small samples and no indication of power, and only 10/26  
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57 243 studies included control data. Long-term follow-up was infrequent. There was significant heterogeneity  
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59 244 in the interventions, reported outcomes, dosage description, and rigour of the evaluations. The use of  
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proxy outcome measurements was common such that confidence was used as a proxy for resilience[25 26] and sleep quality as a proxy for mental health and wellbeing.[47 49]

Our search identified two HCW mobile mental health app studies designed specifically in response to the COVID-19.[42 43] Despite a good retention rate and being adequately powered, Fiol-DeRoque, et al. [42] demonstrated no difference in any of the primary or secondary outcomes aside from pre-specified sub-group analysis. Given that participants only had access to the app for two weeks and no data was reported on app usage, the lack of impact could reflect low dosage both in term of usage and time to see a change. De Kock, et al. [43] showed their COVID-19 specific app was of greater benefit than a non-specific mental health app, however they showed a high attrition rate (36.7%) and the study was not powered for efficacy. Sample attrition is a concern in pandemic situations where high demands on HCWs are likely to impact on research participation. These findings provide preliminary support that HCW focused mental health mobile applications have some promise through pandemics, however, the app design needs to centre HCWs needs and use-case to overcome pre-existing reluctance to access mental health and wellbeing supports[1] and time limitations in pandemic conditions. Methods such as experience-based co-design become highly relevant and central to the development of support interventions.[22 23]

The strength of this evidence synthesis is the breadth of search terms and the focus on studies only reporting HCWs mental health outcomes. Unlike previous reviews, the search extended to other pandemics apart from COVID-19 pandemic[3 18] and was solely focused on HCWs mental health. [14] A wide range of sources were searched including the EPPI-Centre's Living Systematic Map of the Evidence,[71] preprint servers, clinical trial registers and grey literature from reputable health sources. Outcomes were limited by the heterogeneity of and quality of the evidence, and we elected not to use a formal quality appraisal tool.

Reviews of interventions to improve HCW resilience[4] and decrease occupational stress[5] outside pandemics reported limited evidence with many studies lacking adequate numbers and longitudinal data

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2 270 which is mirrored in this review. In future, researchers should better report population and intervention  
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4 271 details, ensure the studies are adequately powered and have a control condition. Our findings reflect  
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6 272 concerns regarding waste in research and, particularly, COVID-19 research which have been raised  
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9 273 elsewhere.[72 73] While large scale randomised controlled trials of HCW mental health support  
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11 274 interventions may be unfeasible in a pandemic context, other study designs, such as the adaptive trial  
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13 275 design utilised byChen, et al. [27] would offer valuable information. In addition, real time data  
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16 276 collection methods and monitoring using remote methods should be further evaluated for application in  
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18 277 pandemics.  
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24 279 **Conclusion**

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27 280 HCW mental health support needs are clearly of increased prominence with 22 of the included studies  
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29 281 conducted through COVID-19 and health organisations taking steps to address this challenge. The next  
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31 282 step is to develop proactive organisational responses that better align with HCWs’ self-identified  
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34 283 preferences for support. While individually focused supports are intuitively valuable, it can be  
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36 284 counterintuitive to ignore potential systemic factors in HCW wellbeing, and place increased  
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38 285 responsibility for mental health and wellbeing on an already burdened individual, with the unintended  
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41 286 consequence of blame for a failure to maintain wellbeing. HCWs are highly time-pressured, facing  
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43 287 huge workloads and could struggle to incorporate activities such as exercise or mindfulness. In this  
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45 288 context the importance of experience-based co-design methods to support HCW mental health and  
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48 289 wellbeing must be emphasised as it seeks to understand the needs of end-users and co-produce methods  
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50 290 and modalities to best address identified needs. Through deep engagement with HCWs we can gain an  
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52 291 understanding of the work and life challenges they face through the pandemic; the challenges to their  
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55 292 mental health and wellbeing; and the best ways that mental health and wellbeing can be supported.  
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**Figure Legend:** Figure 1. Study Selection PRISMA 2020 flow diagram

For peer review only

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2 295 **Contributors Statement**

3  
4  
5 296 VP and LB conceptualised the evidence review and synthesis. VP, LB, KRB and CG (health librarian)  
6  
7 297 developed the search criteria, KRB and CG performed the searches. CG performed the updated search  
8  
9  
10 298 and wrote the Literature Synthesis Search Strategies. KRB, CG, VP and ML screened abstracts and  
11  
12 299 manuscripts and extracted the data. JP supported data extraction. KRB analysed the data, with input  
13  
14 300 from CG, VP, LB, ML, and AK. KRB drafted the manuscript with input from CG, VP, LB, ML, AK,  
15  
16 301 JP, MO and CJ. All authors (KRB, CG, VP, LB, ML, AK, JP, MO and CJ) read and revised the whole  
17  
18  
19 302 manuscript.

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22 303 **Declaration of Interests**

23  
24  
25 304 No interests to declare.

26  
27  
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29  
30  
31 306 This research was funded by a grant from the Australian Government Department of Health, the Peter  
32  
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34  
35 308 The funding bodies had no role in study design, data collection, data analysis, data interpretation, or  
36  
37  
38 309 writing of the manuscript. The corresponding author has full access to all the data in the study and had  
39  
40 310 final responsibility for the decision to submit for publication.

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43 311 **Registration:**

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46 312 The review was not registered and no protocol is available.

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49 313 **Supplementary Material**

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52 314 - Supplementary File 1: PRISMA 2020 checklist  
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54 315 - Supplementary File 2: Literature Synthesis Search Strategies.  
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56 316 - Supplementary Table 1: Characteristics of Studies.  
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59 317 - Supplementary Table 2: Mental Health Outcomes and Measures  
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## **Data Sharing Statement**

No additional data available.

## **Ethics statements**

### Participant consent

There were no participants. This is not applicable.

### Ethics approval

Institutional ethics was not required as this project does not involve human or animal participants.

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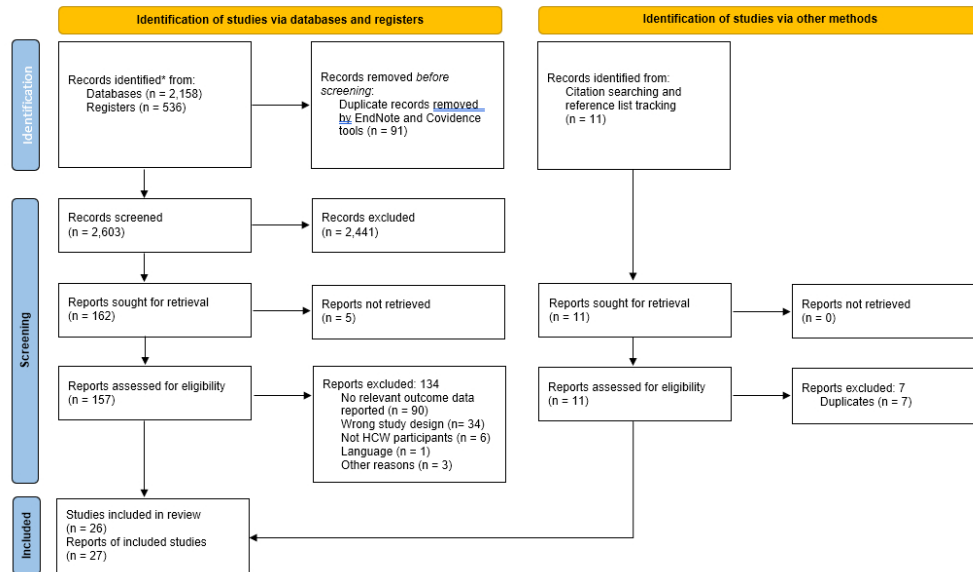
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Figure 1. Study Selection PRISMA 2020 flow diagram



\*The number of records identified from each database or register searched is shown in the Supplementary file.

Figure 1. Study Selection PRISMA 2020 flow diagram

686x446mm (38 x 38 DPI)





PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
<b>TITLE</b>			
Title	1	Identify the report as a systematic review.	P1
<b>ABSTRACT</b>			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	P2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	P5-6
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	P6
<b>METHODS</b>			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Table 2 & P9-10
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Table 1. P7
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Supplementary file 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	P9
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	P10
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	P8/9
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Table 3 Suppl Table 1 Suppl Table 2
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	n/a
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	n/a
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	P10
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	n/a
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	P9-10
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	P10
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	n/a
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	n/a





# PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	n/a
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	n/a
<b>RESULTS</b>			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Figure 1; p10
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	n/a
Study characteristics	17	Cite each included study and present its characteristics.	Table 3 Suppl Table 1 Suppl Table 2
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	n/a
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 3 Suppl Table 1 Suppl Table 2
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Table 3 and p14-22
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	n/a
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	n/a
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	n/a
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	n/a
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	n/a
<b>DISCUSSION</b>			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	P23-24
	23b	Discuss any limitations of the evidence included in the review.	P25
	23c	Discuss any limitations of the review processes used.	P25
	23d	Discuss implications of the results for practice, policy, and future research.	P25-26
<b>OTHER INFORMATION</b>			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	P28
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	P28
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	n/a
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	P1/28



PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
Competing interests	26	Declare any competing interests of review authors.	P28
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	n/a

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71  
For more information, visit: <http://www.prisma-statement.org/>

## Supplementary File 2. Literature Synthesis Search Strategies

Database: Ovid MEDLINER) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations and Daily <1946 to June 03, 2022> run on 6 June 2022:

1. exp Disease Outbreaks/
2. Epidemics/
3. Pandemics/
4. (outbreak\$ or pandemic\$ or epidemic\$).tw.
5. ebolavirus/
6. influenza, human/
7. severe acute respiratory syndrome/
8. pneumonia, viral/
9. coronavirus infections/
10. coronavirus/ or betacoronavirus/
11. exp influenzavirus a/ or exp influenzavirus b/ or influenzavirus c/
12. exp hemorrhagic fevers, viral/
13. ((avian or bird or fowl) adj5 (influenza or flu or plague)).tw.
14. (severe acute respiratory syndrome or SARS or coronavirus or Middle East respiratory syndrome or MERS-CoV).tw.
15. (coronavirus\$ or corona virus\$ or HCoV\$ or ncov\$ or covid\$ or sars-cov\$ or sarscov\$ or sars-coronavirus\$).tw.
16. ((h?emorrhagic or yellow or rift valley or lassa) adj3 fever).tw.
17. or/1-16
18. exp Stress, Psychological/
19. exp "behavior and behavior mechanisms"/
20. motivation/
21. exp Sleep Wake Disorders/
22. ((post-traumatic or posttraumatic or trauma\$) adj3 (disorder or neurosis or psychos\$)).tw.
23. (PTSD or traumati?ed or traumatic).tw.
24. (depress\$ or anxious\$ or anxiety or panic\$ or hysteria or stress\$).tw.
25. ((chronic adj2 fatigue) or suicid\$ or ((mood or mental) adj2 (disorder\$ or health\$))).tw.
26. (burnout or burn-out or cope\$ or coping or adaption or catastrophi?ing or depersonali?ation or resilience or empath\$ or hope\$ or anger or apath\$ or bereave\$ or grief or sadness or distress\$ or fear\$ or frustrat\$ or guilt or shame or hope\$ or loneliness or sadness or motivat\$ or confused or confusion or wellbeing or well-being).tw.
27. or/18-26
28. exp Health Personnel/
29. exp students, health occupations/
30. hospital volunteers/
31. ((emergency or frontline or front-line) adj5 (staff or employee\$ or personnel or professional\$ or worker\$ or workforce)).tw.
32. or/28-31
33. 17 and 27 and 32
34. ("2021" or "2022").dp.
35. ("2020 09" or 2020 10 or 2020 11 or 2020 12).dp.
36. 34 or 35
37. 33 and 36

Database: Cochrane Library (Cochrane Reviews, Cochrane Protocols, Cochrane Trials) <to June 06, 2022>

#1 [mh "Disease Outbreaks"] 771

#2 [mh ^Epidemics] 36

#3 [mh ^Pandemics] 514

#4 (outbreak\* or pandemic\* or epidemic\*):ti,ab,kw 8651

#5 [mh ^ebolavirus] 37

#6 MeSH descriptor: [Influenza, Human] explode all trees 2931

#7 [mh ^"severe acute respiratory syndrome"] 371

#8 [mh ^"pneumonia, viral"] 249

#9 [mh ^"coronavirus infections"] 685

#10 [mh ^coronavirus] OR [mh ^betacoronavirus] 131

#11 [mh "influenzavirus a"] OR [mh "influenzavirus b"] OR [mh ^"influenzavirus c"] 955

#12 [mh "hemorrhagic fevers, viral"]518

#13 ((avian:ti,ab OR bird:ti,ab OR fowl:ti,ab) NEAR/5 (influenza:ti,ab OR flu:ti,ab OR plague:ti,ab)) 184

#14 ("severe acute respiratory syndrome":ti,ab OR SARS:ti,ab OR coronavirus:ti,ab OR "Middle East respiratory syndrome":ti,ab OR MERS-CoV:ti,ab)5825

#15 (coronavirus\*:ti,ab OR ("corona" NEXT virus\*):ti,ab OR HCoV\*:ti,ab OR ncov\*:ti,ab OR covid\*:ti,ab OR sars-cov\*:ti,ab OR sarscov\*:ti,ab OR sars-coronavirus\*:ti,ab) 11343

#16 ((h?emorrhagic:ti,ab OR yellow:ti,ab OR "rift valley":ti,ab OR lassa:ti,ab) NEAR/3 fever:ti,ab) 469

#17 {or #1-#16} 19869

#18 [mh "Stress, Psychological"] 6817

#19 [mh "behavior and behavior mechanisms"] 134793

#20 [mh ^motivation] 5221

#21 [mh "Sleep Wake Disorders"] 9191

#22 (PTSD:ti,ab OR traumati?ed:ti,ab OR traumatic:ti,ab) 15571

#23 (depress\*:ti,ab OR anxious\*:ti,ab OR anxiety:ti,ab OR panic\*:ti,ab OR hysteria:ti,ab OR stress\*:ti,ab) 158774

#24 ((post-traumatic:ti,ab OR posttraumatic:ti,ab OR trauma\*:ti,ab) NEAR/3 (disorder:ti,ab OR neurosis:ti,ab OR psychos\*:ti,ab)) 4708

#25 ((chronic:ti,ab NEAR/2 fatigue:ti,ab) OR suicid\*:ti,ab OR ((mood:ti,ab OR mental:ti,ab) NEAR/2 (disorder\*:ti,ab OR health:ti,ab))) 33067

#26 (burnout:ti,ab OR burn-out:ti,ab OR cope\*:ti,ab OR coping:ti,ab OR adaption:ti,ab OR catastroph\*:ti,ab OR depersonali\*:ti,ab OR resilience:ti,ab OR empath\*:ti,ab OR hope\*:ti,ab OR anger:ti,ab OR apath\*:ti,ab OR bereave\*:ti,ab OR grief:ti,ab OR sadness:ti,ab OR distress\*:ti,ab OR fear\*:ti,ab OR frustrat\*:ti,ab OR guilt:ti,ab OR shame:ti,ab OR hope\*:ti,ab OR loneliness:ti,ab OR sadness:ti,ab OR motivat\*:ti,ab OR confused:ti,ab OR confusion:ti,ab OR wellbeing:ti,ab OR well-being:ti,ab) 94568

#27 {OR #18-#26} 332151

#28 [mh "Health Personnel"] 10379

#29 [mh "students, health occupations"] 2019

#30 [mh ^"hospital volunteers"] 3

#31 ((emergency:ti,ab OR frontline:ti,ab OR front-line:ti,ab) NEAR/5 (staff:ti,ab OR employee:ti,ab OR personnel:ti,ab OR professional:ti,ab OR worker:ti,ab OR doctor:ti,ab OR nurse:ti,ab OR workforce:ti,ab)) 696

#32 {OR #28-#31} 12834

#33 #17 AND #27 AND #32 with Cochrane Library publication date Between Sep 2020 and Jun 2022, in Cochrane Reviews, Cochrane Protocols, Trials 65

Database: Web of Science Core Collection (14 June 2022)

1. TS=((mental or psychological or psychosocial or "psycho-social" or emotional) NEAR/3 (condition\* or health or care or condition or state or status or stability or instability))
2. TS=((("post-traumatic" or posttraumatic or trauma\*) NEAR/3 (disorder or neurosis or psychos\* or syndrome)) or PTSD or traumati?ed or traumatic)
3. TS=(depress\* or anxious\* or anxiety or panic\* or hysteria or stress or (chronic NEAR/2 fatigue) or suicid\* or ((mood or mental) NEAR/2 (disorder\* or health)))
4. TS=(burnout or "burn-out" or cope or coping or adaption or catastroph?ing or depersonali?ation or resilience or exhaust\* or anger or apath\* or bereave\* or grief or sadness or distress\* or fear\* or frustrat\* or guilt or shame or loneliness or sadness or motivat\* or confusion or empathy or ((unable or difficult\*) NEAR/3 (sleep\* or focus\*)) or eagerness or enthusiasm or goodwill or hope\* or keen\* or resilie\* or toughness or volition or well-being or wellbeing or willing\* or willpower or wish\*)
5. #4 OR #3 OR #2 OR #1
6. TS=((clinical or healthcare or "health care" or (operating NEAR/3 (room or theat\* or department\*)) or hospital or laborator\* or biomedical or frontline or medical or surgical or pharmacy or social) NEAR/3 (auxilliar\* or practitioner\* or professional\* or provider\* or worker\* or personnel or dispenser\* or aides or workforce or consultant\* or technician\* or scientist\* or volunteer\*))
7. TS=(an?esthesiologist\* or an?esthetist\* or cardiologist\* or dermatologist\* or diabetologist\* or doctor\* or endocrinologist\* or epileptologist\* or gastroenterologist\* or (general NEAR/2 practitioner) or GP or geriatrician\* or gerontologist\* or gyn?ecologist\* or h?ematologist\* or (h?ematolog\* NEAR/2 specialist\*) or hepatologist\* or immunologist\* or (infectious NEAR/2 diseas\* NEAR/2 specialist\*) or intensivist\* or internist\* or medic or medics or neonatologist\* or nephrologist\* or neurologist\* or obstetrician\* or oncologist\* or ((cancer or malignancy) NEAR/2 specialist\*) or ophthalmologist\* or (orthop?edic NEAR/2 specialist\*) or orthop?edist\* or otolaryngologist\* or pathologist\* or p?ediatric\* or perinatologist\* or pharmacist\* or phlebologist\* or physiatrist\* or physician\* or podiatrist\* or psychiatrist\* or pulmonologist\* or radiologist\* or rheumatologist\* or surgeon\* or urologist\* or urogyn?ecolog\* or vaccinologist)
8. TS=((("allied health" NEAR/3 (professional\* or personnel or staff\* or worker\* or practitioner\*)) or NMAHP\* or AHP\*)
9. TS=(nurs\* or midwife\* or midwives\* or (health NEAR/2 visitor\*) or chiropodist\* or podiatrist\* or dietitian\* or dietician\* or (hearing NEAR/2 aid\* NEAR/2 dispenser\*) or ((physical or occupational) NEAR/2 therapist\*) or orthoptist\* or paramedic\* or physiotherapist\* or psychologist\* or prosthetist\* or orthotist\* or radiographer\* or ((speech NEAR/2 language NEAR/2 (therapist\* or pathologist\*)) or SLT\*))
10. TS=((key or frontline or "front-line") NEAR/3 (staff or worker\* or workforce or personnel or volunteer\* or professional\*))
11. #6 OR #7 OR #8 OR #9 OR #10
12. TS((((health\* or disease\*) NEAR/5 (disaster\* or catastrophe\* or crises or crisis)) or outbreak\* or pandemic\* or epidemic\*)
13. TS=(chikungunya or cholera or smallpox or small pox or monkeypox or plague\*)

- 14. TS= (h?emorrhagic or yellow or rift valley or lassa or ebola or ebolavirus or hendra or zika NEAR virus\*)
- 15. TS=((avian or bird or fowl) NEAR/5 (influenza or flu or plague))
- 16. TS=((bacterial NEAR/2 meningitis)
- 17. TS= ("severe acute respiratory syndrome" or SARS or coronavirus or ((atypical or influenza or viral or virus) NEAR/3 (pneumonia or bronchopneumonia or infection)))
- 18. TS=(coronavirus\* or "corona virus\*" or ncov\* or covid\* or sars-cov\* or "sars-coronavirus\*")
- 19. #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18
- 20. TS=(intervene or intervention\*)
- 21. TS=(app or apps or digital\* or ehealth or e-health or mobile or platform\*)
- 22. #20 OR #21
- 23. #19 AND #11 AND #5
- 24. #22 AND #23
- 25. #23 AND #21
- 26. #23 AND #21 and 2022 or 2021 (Publication Years)

Database: PROSPERO International prospective register of systematic reviews, run on 7 June 2022

- 1. covid-19 or coronavirus or sars or pandemic or pandemics
- 2. worker or workers or professional or professionals or front or frontline
- 3. psychological or mental
- 4. #1 AND #2 AND #3

Database: Embase Classic+Embase on Ovid 1947-2021 Week 10 (run on 14 Mar 2021):

- 1. Exp \*Coronavirus infection/
- 2. Exp health care personnel/
- 3. Exp mental stress/
- 4. 1 and 2
- 5. 3 and 4
- 6. Limit 5 to yr="2020-Current"

Database: APA PsycInfo on Ovid 1806-March Week 2, 2021 (run on 14 Mar 2021):

- 1. Exp \*coronavirus
- 2. Exp health personnel/
- 3. Exp mental disorders/
- 4. Exp \*behavior disorders/
- 5. \*behavior problems/
- 6. 1 and 2
- 7. 3 or 4 or 5
- 8. 6 and 7
- 9. Limit 8 to yr=2000-Current
- 10. Limit 9 to English language

Database: CINAHL Complete (EBSCOHost) run on 14 March 2021 – Boolean/Phrase search (unless otherwise stated):

- 1. MW health personnel
- 2. Coronavirus or covid-19 or 2019-ncov
- 3. MW mental health

4. MH mental disorders
5. SU MH "Behavioral and Mental Disorders+" (SmartText search)
6. MW Behavioral and Mental Disorders
7. MW Behavioral Disorders
8. S3 or S4 or S5 or S6 or S7
9. S1 and S2
10. S8 and S9
11. S10 limited to 20200101-20211231

For peer review only



bmjopen-2022-061317 on November 2022. Downloaded from <http://bmjopen.bmj.com/> on April 27, 2024 by guest. Protected by copyright.

Supplementary Table 1. Characteristics of studies

Author Year	Country	Pandemic	Aim	Intervention Description	Target Population	Study Design
Aiello, et al. [25]	Canada	Influenza	Describe development, implementations and results of resilience training prior to the emergency of the H1N1 influenza epidemic.	1 hour of in-person, group education session covering influenza, stress and coping. Organization-wide. Rolled out over 5 months.	1250 HCWs from 22 departments	Post evaluation.
Amsalem, et al. [32]	USA	COVID-19	Assess the impact of a brief video intervention on increasing treatment seeking intentions among HCWs.	3 minute video of a female nurse describing difficulties with coping, anxiety and depression; her false assumptions about treatment and how she overcame these assumption.	350 HCW who had evidence of anxiety, depression or PTSD.	3 arm RCT: Intervention group 1 watched video at baseline and again on day 14. Intervention group 2 watched video at baseline. Control group. Outcomes measured immediately pre-post, day 14 and day 30.
Beverly, et al. [38]	USA	COVID-19	Assess if a brief, tranquil immersive cinematic virtual reality (VR) simulation of a nature scene decreases stress in HCWs.	3 minute immersive VR involving a tranquil nature scene.	102 HCWs including direct care providers, indirect care providers, administrative/support staff.	Pre-post design
Blake, et al. [28] Blake, et al. [48]	UK	COVID-19	Survey (2020 paper) to gather healthcare workers views of	Wellbeing centres designed to be relaxing; offered opportunity for quiet time, social contact and emotional	Intervention open to all clinical, non-clinical, bank and volunteer staff at two acute	Descriptive survey. Qualitative semi-structured interviews



			wellbeing centres and support workers.  Interviews (2021 paper) explored staff and providers views of supported wellbeing centres.	support. Initially open 8am-8pm everyday, after 9 weeks open 10am-4pm weekdays. Staffed by volunteer buddies provided training in psychological first aid (hospital staff whose usual role was reduced during the pandemic)	hospital trust, Interviews with 24 wellbeing centre users and operational staff (managers and wellbeing buddies).	
Chan, et al. [41]	Singapore	COVID-19	Supporting mental well-being of obstetric and gynaecology trainees through COVID-19.	Shift to virtual continuing medical education program (vCME)	44 obstetric and gynaecology trainees	Descriptive.
Chen, et al. [27]	Taiwan	SARS	Description of anxiety, depression, and sleep quality in nurses caring for SARS patient before and after a SARS prevention program.	In-service training regarding infection prevention measures, limiting work to 8h a day, and provision of nutritional supplements. Provision of adequate PPE. Mental health clinic for HCWs.	116 nurses in a designated SARS hospital during a SARS outbreak	Pre-post design. Four time points: T1- pre-caring for SARS patients; T2- 2 weeks post intervention; T3- 1 month post intervention; T4- 1 month after hospital no longer designated SARS hospital (3 months post intervention).
Cheng, et al. [31]	China	COVID-19	Examine whether a psychological support model for HCWs can promote positive emotions, maintain team work efficiency and prevent burnout.	Mental health support program with 5 components. 1. Psychometer - daily mood index. 2. Positive self-feedback training including daily mood broadcast, promotion of	155 HCWs, including clinical and non-clinical staff, from a hospital in Shanghai who were sent to work in a hospital in Wuhan	Descriptive

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				positive self-affirmation, encouragement to face difficulties positively and information about positive happenings. 3. Peer-group psychological support and education including daily 1-hour online themed chat moderated by psychologist who posted mental health tips. 4. Weekly Balint group, run by psychiatrist, 10-12 participants able to sign up to attend. 5. Support team who responded to needs identified within the psychometer module and organised social events.	caring for COVID-19 patients for 6 weeks.	
Cole, et al. [33]	Sierra Leone	Ebola	Evaluate effectiveness of CBT to former Ebola Treatment Centre (ETC) workers with clinical depression/anxiety.	Small group CBT by facilitators with 2 weeks of CBT training. 3-hours weekly for 6 weeks, supplemented by a workbook.	Former clinical and non-clinical HC staff, with clinically significant anxiety and depression.	Descriptive with pre- and post-intervention measures. Completed 1 week prior and 2 weeks post-intervention.
De Kock, et al. [43]	UK	COVID-19	Collect preliminary evidence on use of digital psychological interventions to support HCWs psychological health during COVID-19.	Four week use of one of two digital wellbeing support apps. <b>App 1 My Possible Self (MPS):</b> NHS approved app, but not COVID-19 specific. Has modules on coping with	169 HCWs, clinical and non-clinical.	RCT three arms, two intervention arms one using MPS app and one using NHSHWBP app, and wait list control arm.

				anxiety and depression, improving sleep and happiness. <b>App 2 NHS Highland Wellbeing Project (NHSWBP)</b> Designed for NHS staff through COVID-19. Fictional nurse guided users through app. First 2 weeks focus on increasing happiness, resilience and wellbeing, second 2 weeks focus on managing low mood and anxiety. Users sent automated text to encourage engagement and includes links to 24-hr support.		Outcomes from baseline, 2 weeks (mid-point) and 4 weeks (completion).
Dincer and Inangil [45]	Turkey	COVID-19	Investigate the effectiveness of the Emotional Freedom Technique (EFT) in the prevention of stress, anxiety, and burnout in nurses caring for COVID-19 positive patients.	EFT involves tapping points on the body corresponding to acupuncture points in Traditional Chinese Medicine to send the brain either activating or deactivating signals. <b>Intervention</b> – one 20 minute online session teaching participants EFT in groups of 5. <b>Control</b> – sit in calm and tranquil environment for 15 minutes	80 hospital nurses caring for COVID positive patients	Pilot RCT two arms, intervention and control  Outcomes immediately pre-post intervention.
Fiol-DeRoque, et al. [42]	Spain	COVID-19	Evaluate effectiveness of PsyCovidApp in decreasing depression,	PsyCovidApp. Based on CBT and mindfulness. Four content areas, emotional skills, healthy	482 HCWs from any specialty or role providing care to	Two arm RCT Intervention group accessed

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			anxiety, stress, post-traumatic stress, burnout, insomnia and improving self-efficacy in HCWs during the COVID-19 pandemic.	lifestyle, work stress and burnout, and social supports. Users completed daily questionnaire with tailored information and resources offered in response to the questionnaire.	COVID-19 patients. Hospital and non-hospital HCWs included.	PsyCovidApp for 2 weeks. Control group accessed a control app that offered brief mental health information for HCWs for 2 weeks. Outcomes from pre-intervention and within 1-10 days of completing the intervention.
Giordano, et al. [51]	Italy	COVID-19	Investigate influence of music therapy (MT) and guided imagery on reducing stress and improving wellbeing in HCWs caring for COVID-19 patients.	5 week program: participants listened to a 15-20 minute long playlist in a comfortable space and sit with eyes closed focusing on an image or colour, breathing slowly. Week 1: participants given three generic playlists (breathing and energy). Following weeks (for 4 weeks): music therapists interviewed participants about listening experiences and developed personalised playlists (breathing, serenity and energy) in response to their feedback.	34 HCWs caring for COVID-19 patients.	Descriptive with pre-and post-interventions measures.
Ha, et al. [49]	Korea	COVID-19	Develop a mobile wellness program to promote physical activity	12 week mobile wellness program with participants given a Fitbit along with twice	57 nurses who worked rotating shifts in medical or surgical	Cluster randomised two arm RCT. Intervention group

			and sleep quality among nurses with rotating shifts during the COVID-19 pandemic.	weekly one hour online, live, exercises sessions 30 minute pre-recorded exercise videos that could be viewed anytime, weekly health coaching that included short-term and long-term goal setting, and motivational text messages encouraging goal setting. Weeks 1-6 participants with less than 10,000 steps/day, instructed to reach 10,000 steps/day and those at 10,000/day to maintain this. Weeks 7-12 participants instructed to increase their step count by 1,000 steps/fortnight.	wards during the COVID-19 pandemic.	received the Fitbit and the mobile wellness program, control group received only a Fitbit.  Data collect pre- and post-intervention.
Hong, et al. [30]	China	COVID-19	Supported COVID-19-related stress and immediate psychological impact among HCWs in the fever clinic.	Stress management included practical support (provision of accommodation while working and during 2-week quarantine, food, PPE, adjusted hours and infection prevention training) + psychological support hotline available 9am-9pm daily.	105 participants, 37 in first group and 68 in second, who worked for 2-3 weeks in a fever clinic during COVID-19 pandemic.	Mixed methods with interview and survey post-design.  Completed via phone during 2-week quarantine.
Kameno, et al. [29]	Japan	COVID-19	Detect individuals at high risk of mental health problems and provide them with brief,	30-60 minute individual psychotherapy sessions provided by a specialist nurse.	31 nurses caring for COVID-19 positive inpatients.	Pre-post design.

			individual, psychotherapy.			Outcomes at 3 time points: baseline, 4 weeks and 8 weeks.
Maunder, et al. [26]	Canada	Influenza	Develop pre-pandemic training to improve satisfaction with support and training, coping, pandemic-related self-efficacy and interpersonal problems. To establish the ideal course duration.	Computer assisted pre-pandemic training course, known as Pandemic Influenza Stress Vaccine, included audio and video lectures on pandemics and working outside your comfort zone as well as relaxation skills and self-assessment modules. Three course durations, 1.75hr, 3hr, 4hrs.	Open to all hospital staff. 265 enrolled.	Dose-finding using pre-post design, with participants randomised to different doses. No control group.
Nourian, et al. [47]	Iran	COVID-19	Explore effect of online mindfulness based stress reduction (MBSR) on sleep quality of nurses working on COVID-19 wards in Tehran.	7 week online MBSR program. Participants sent exercises weekly to complete. Logbooks to record experiences and meditations regarding the exercises. Program included audio meditations, videos of yoga exercises, readings about mindfulness, audio/video by experts about mindfulness.	44 nurses working on COVID-19 wards.	Two arm RCT. <b>Intervention:</b> received MBSR program; <b>Control:</b> received music files or training on caring for COVID-19 patients. Outcomes immediate pre-post intervention.
Osman, et al. [36]	Sth Africa	COVID-19	Investigate impact of brief online mindfulness based intervention (MBI) on stress, burnout and mindful awareness among HCWs and	Weekly 1hr online mindfulness sessions delivered over 4 weeks with two facilitators.	HCWs and healthcare students in Sth Africa during COVID-19. Included hospital and	Mixed methods pre - and post-intervention qualitative and quantitative data.

			trainees during the COVID-19 pandemic.		non-hospital based participants.	
Sun [39]	China	COVID-19	Provide management objective evidence to develop psychological care policy for nurses and reference the efforts made to improve medical practitioners' mental health during the epidemic.	16-week intervention. Time management training 40 minutes weekly for 8 weeks; Balint group 1 hour 1-2 times a week for 8 weeks. Time management training included setting up the correct concept of time value, improving awareness of cherishing time, discussing ideas and plans for life and exploring methods to realise dreams.	66 nurses from three Shanghai hospitals, who had previously participated in a survey of 400 nurses regarding mental health during COVID-19.	Two arm RCT <b>Intervention</b> received time management training and Balint group. <b>Control group</b> no intervention. Measured immediately pre-post intervention.
Thimmapuram, et al. [46]	USA	COVID-19	Investigate brief, virtual, heart-based audio meditation program improved sleep and loneliness in HCWs during the COVID-19 pandemic.	Heartfulness meditation practice. Intervention group listened to six-minute audio meditation sessions twice a day for 4 weeks. Morning meditation focussed on relaxation and evening on rejuvenation.	155 HCWs from four hospitals in the USA.	Two arm RCT. <b>Intervention:</b> mindfulness; <b>Control:</b> usual practice. Outcomes measured immediately pre-post intervention.
Trottier, et al. [50]	Canada	COVID-19	Assess the feasibility, acceptability, and initial efficacy of RESTORE.  RESTORE aimed to decrease: 1. social isolation and withdrawal from positive activities; 2. avoidance related to	RESTORE is an online, guided, intervention developed for COVID-19 built around CBT to support HCWs that experienced trauma or high stress. It covers 8 modules	HCWs on frontline of COVID-19 pandemic. HCWs responding to advertisement. 21 commenced the program and 12 completed to +1 month follow-up	Single group repeated measures. Outcome measures baseline; mid intervention; end-of-intervention; +1 month.

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			extremely stressful or traumatic events; 3. negative thinking about extremely stressful or traumatic events.			
Wu and Wei [34]	China	COVID-19	Understand impact of COVID-19 on psychological factors and sleep status of HCWs; assess effects of an exercise intervention on HCWs' psychological stress and sleep.	Exercise prescription. No further details regarding nature of the intervention.	60 HCWs at a designated COVID-19 hospital and 60 at a non-designated hospital.	Observation between group comparison. Unclear when questionnaires completed.
Yıldırım and Çiriş Yıldız [44]	Turkey	COVID-19	investigate effects of mindfulness based breathing and music therapy practice on stress, work related strain and psychological well-being levels among nurses caring for patients with COVID-19.	Single 30 minute online, small group session. Participants told breathing would decrease stress and calm the body and mind, after which led through a mindfulness-based breathing exercise, incorporating visualisation techniques, while listening to quiet piano music.	104 nurses caring for COVID-19 patients who had not undertaken a course or developed a practice for coping with anxiety, strain and/or stress.	Two arm RCT <b>Intervention:</b> online session; <b>Control;</b> passive relaxation for 30 minutes. Outcomes immediately pre-post intervention.
Zhan, et al. [35]	China	COVID-19	Evaluate impact of Tai Chi program on sleep quality and anxiety in HCWs.	Two week, daily, online 30 minute Tai Chi. Intervention group completed 6 pretraining sessions and an exam in the three days before the course. Control group did two week, daily 30 minute sessions of	HCWs in a designated COVID-19 hospital with direct/indirect patient contact. 50 participants, 25 in each group.	Two Arm RCT  Outcomes at baseline, day 7 and day 14.



				relaxation training and exercise.		
Zhou, et al. [40]	China	COVID-19	Develop and evaluate training program for nurses working on COVID-19 ward.	Mix of online and in-person training included information about diagnosis, infection prevention and psychological support. Psychological support included a mindfulness decompression workshop and individual psychology support.	71 nurses working on COVID-19 isolation wards.	Descriptive with pre- and post-intervention surveys.  Outcomes immediately pre-post intervention.
Zingela, et al. [37]	Sth Africa	COVID-19	Develop and evaluate psychological preparedness program for HCWs across 3 hospitals in response to the COVID-19 pandemic.	A 60-90 minute, in-person, session that covered mind care, relaxation techniques and team care. Sessions delivered by 2-3 facilitators who were Psychiatry employees.	761 HCW, out of 3,000 employees, from 3 hospitals	Descriptive  Outcomes immediately pre-post intervention.

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Supplementary Table 2. Mental Health Outcomes and Measures

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
Aiello, et al. [25]	8 question, 5 point Likert scale. Includes 1 baseline question regarding confidence in preparedness to face a pandemic and 1 question regarding feeling better able to cope in the event of a pandemic following the session.	1020 (82%) returned evaluation form; 70% worked during 2003 SARS outbreak; 70% had prior infection control training for pandemic influenza.	Confidence to deal a pandemic increased from 35% to 76% of sample.	
Amsalem, et al. [32]	3 openness to seeking help questions from Attitudes Towards Seeking Professional Psychological Help Scale (ATSPPH-SH). Mental health measures only at baseline: GAD-7; PHQ-9; Primary Care PTSD Screen.	Intervention Group 1 - 115 baseline and 93 at day 30 Intervention Group 2 - 114 baseline and 93 at day 30 Control - 121 at baseline and 94 at day 30.	<b>Baseline to day 30:</b> intervention significantly increased help-seeking intentions compared to controls. Larger impact in Group 1 than Group 2. <b>Day 14:</b> Group 1 had increased intention to seek treatment compared to immediately post-intervention, this was not the case for Group 2.	<b>ATSPPH-SH Baseline</b> Group 1 7.9 (CI 7.3-8.4) Group 2 7.9 (CI 7.9-8.8) <b>ATSPPH-SH immediately post-intervention</b> Group 1 9.2 (CI 8.7-9.7) Group 2 9.4 (CI 9.0-9.7) <b>ATSPPH-SH 30 days post</b> Group 1 9.7 (CI 9.3-10.1) Group 2 9.1 (CI 8.6-9.5)
Beverly, et al. [38]	Subjective stress visual analogue scale (VAS) range 1-10, immediately pre-post intervention. Scores $\geq 6.8$	Convenience sample of 102 participants	Significant post-intervention decrease in mean perceived stress and reduction in people reporting high stress (32.4% vs 3.5%). Those with high stress at	<b>Pre-simulation VAS</b> 5.9 SD 2.2 <b>Post-simulation VAS</b> 3.0 SD 1.8

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	correlate with high stress on the Perceived Stress Scale.		baseline had greater decrease in stress post-intervention.	
Blake, et al. [28] Blake, et al. [48]	Warwick Edinburg Mental Wellbeing Scale Utrecht Work Engagement Scale Four single item measures (Job stressfulness, Job satisfaction, Presenteeism, Turnover intentions) 12 questions about centre use. All conducted at single point in time. Semi-structured interviews	<b>Survey:</b> 819 completed - 94% aware of centres; 55.2% had accessed a centre.  <b>Interviews:</b> 24 interviews with centre users, buddies and those involved in operationalising the centres.	<b>Survey:</b> No difference in job stressfulness, job satisfaction, turnover intention and presenteeism between users and non-users. WEMWRS score and UWES score were higher in those who accessed the centre suggesting higher wellbeing and workplace engagement.  <b>Interviews:</b> Centres seen as essential support and source of pride in the NHS. They created a sense of normality and helped prevent the escalation of stress. Buddies valued being able to contribute. Challenges included opening hours, time needed to visit, staff located further away or who needed to wear PPE.	<b>UWES</b> Centre users 5.02 SD 1.14 Non-users 4.83 SD 1.15

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
Chan, et al. [41]	8 question survey; 3 wellbeing questions	28 trainees completed survey	75% of trainees agreed or strongly agreed that the vCME helped them cope with team segregation.	
Chen, et al. [27]	Zung's self-rating anxiety scale (SAS) Zung's self-rating depression scale (SDS) Pittsburgh sleep quality index (PSQI)	120 completed training and 116 returned questionnaires.	Mean anxiety decreased from moderate anxiety at T1 to m at T2 and T3 and no anxiety at T4. Mean depression decreased from moderate At T1 to mild at T2 and T3, and no depression at T4. Mean PSQI improved across the four time points, although the final report was still indicative of poor sleep.	<b>SAS</b> T1 60 SD 9.28 T2 51 SD 10.32 T3 50 SD 9.84 T4 46 SD 7.48 <b>SDS</b> T1 61 SD 12.62 T2 51 SD 11.94 T3 50 SD 10.60 T4 48 SD 10.76 <b>PSQI</b> T1 12 SD 3.83 T2 10 SD 3.43 T3 10 SD 3.77 T4 8 SD 2.75
Cheng, et al. [31]	Daily mood rating: Subjective Units of Feeling (SUF) scale (rates pleasure from 0-10); open questions	Over 6 weeks, completion of the daily mood rating ranged from 3 to 48 staff with a median of 16.	Daily mood ratings ranged from 7-9 over the 6 weeks. Daily mood index was related to the number of patients with severe	

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	about daily gain and daily challenge. Daily mood rating could be completed once every 24 hours. Follow-up survey 1 week after leaving Wuhan, while in quarantine.	124 team members completed follow-up survey, 27.4% of these had participated in a Balint group.	COVID-19 and the daily average gains. Self-reported gains increased over the study and self-reported challenges decreased.	
Cole, et al. [33]	GAD-7 PHQ9 Work and Social Adjustment Scale (WASAS)	253 former Ebola Treatment Centre staff	Significantly decreased anxiety, depression and functional impairment post-intervention. Anxiety remained in moderate range; depression moved from moderately severe to moderate; functional impairment moved from moderately severe to subclinical.	<b>GAD-7</b> T1 13.42 SD 0.49 T2 8.96 SD 0.47 <b>PHQ-9</b> T1 15.41 SD 0.66 T2 10.90 SD 0.61 <b>WASAS</b> T1 24.58 SD 0.96 T2 17.29 SD 0.89
De Kock, et al. [43]	PHQ-9 GAD-7 Warwick-England Mental Well-being Scale (WEBWBS) Secondary outcomes: Mental Toughness Index (MTI)	225 assessed for eligibility 169 randomised, 107 in final analysis 51 MPS app – 27 completed 60 NHSWBP app - 34 completed 60 control - 48 completed	Depression decreased for both MPS and NHSWBP compared to the control group; anxiety decreased in the NHSWBP decreased compared to control. Mental toughness increased in the NHSWBP and control group.	<b>GAD-7</b> MPS Baseline 7.16 SD 5.60 Midpoint 6.45 SD 5.03 Post 6.89 SD 5.71 <b>NHSWBP</b>

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	Gratitude Questionnaire (GQ)		All groups showed improvements in mental wellbeing and gratitude. Symptoms improved faster for the intervention groups compared to the control groups.	Baseline 7.77 SD 4.87 Midpoint 6.74 SD 4.69 Post 5.85 SD 3.66  <i>Control</i> Baseline 7.43 SD 5.10 Midpoint 7.35 SD 5.23 Post 6.72 SD 5.59  <b>PHQ-9</b> MCS Baseline 6.76 SD 5.04 Midpoint 5.74 SD 4.31 Post 5.18 SD 3.27  <i>MSWBP</i> Baseline 7.60 SD 4.31 Midpoint 7.23 SD 5.47 Post 5.68 SD 4.39  <i>Control</i> Baseline 7.80 SD 5.23 Midpoint 8.00 SD 5.06 Post 7.56 SD 6.25  <b>WMWBS</b> MCS

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				<p>Baseline 47.5 SD 10.2 Midpoint 50.3 SD 9.75 Post 48.7 SD 10.1</p> <p><b>NSWBP</b> Baseline 45.3 SD 8.65 Midpoint 46.9 SD 8.68 Post 48.2 SD 7.38</p> <p><b>Control</b> Baseline 44.3 SD 10.1 Midpoint 44.8 SD 10.4 Post 46.1 SD 11.1</p> <p><b>MHI</b> Baseline 40.7 SD 8.04 Midpoint 40.7 SD 9.10 Post 39.7 SD 9.80</p> <p><b>NSWBP</b> Baseline 39.3 SD 6.84 Midpoint 39.3 SD 9.55 Post 41.3 SD 8.33</p> <p><b>Control</b> Baseline 37.9 SD 9.81</p>

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				Midpoint 36.8 SD 9.20 Post 39.10 SD 20.5  GDS Mean Baseline 27.3 SD 3.46 Midpoint 27.9 SD 3.63 Post 28.2 SD 4.23  NE-SWBP Baseline 26.2 SD 3.35 Midpoint 27.1 SD 4.14 Post 27.1 SD 4.24  Control Baseline 26.7 SD 3.73 Midpoint 26.2 SD 4.30 Post 27.2 SD 3.72
Dincer and Inangil [45]	Subjective units of distress scale (SUD) State Anxiety Scale (SAS) Burnout Inventory (BAI)	80 assessed for eligibility 80 randomised, 3 withdrew and 5 did not attend session Final analysis 72 35 intervention 37 control	Intervention decreased stress, anxiety and burnout compared to controls. Decrease was clinically significant: mean SUD decreased from 7.82 to 2.58; mean anxiety decreased from 67.68 to 32.25 (a shift from moderate to mild anxiety);	<b>SUD</b> <i>Intervention</i> Pre 7.82 SD 1.33 Post 2.85 SD 1.21  <i>Control</i> Pre 7.48 SD 1.36 Post 7.40 SD 1.53



Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
			burnout decreased from 3.62 to 2.48.	<p><b>SAS</b></p> <p><i>Intervention</i> Pre 67.68 SD 9.05 Post 32.25 SD 4.67</p> <p><i>Control</i> Pre 64.7 SD 8.05 Post 64.43 SD 7.68</p> <p><b>Burnout Inventory</b></p> <p><i>Intervention</i> Pre 3.62 SD 0.76 Post 2.48 SD 1.06</p> <p><i>Control</i> Pre 3.56 SD 0.72 Post 3.43 SD 0.76</p>
Fiol-DeRoque, et al. [42]	Primary outcome total score on DASS-21. Secondary outcomes: Subscales of DASS-21 Davidson Trauma Scale (DTS) Maslach Burnout Inventory (MBI) subscales emotional exhaustion (MBI EE), personal accomplishment	248 – intervention (27 did not complete) 234 – control (19 did not complete) Analysed according to intention to treat	No difference between the intervention and control groups on outcomes. Pre-determined sub-group analysis showed that intervention group participants taking psychotropic medication and/or accessing psychotherapy had a statistically significant decrease in DASS-21, in anxiety	<p><b>Total DASS-21</b></p> <p><b>Primary outcome overall score DASS-21</b></p> <p><i>Intervention</i> Pre 5.84 SD 3.85 Post 3.83 SD 3.21</p> <p><i>Control</i> Pre 6.14 SD 3.77 Post 4.27 SD 3.47</p>

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	(MBI PA), depersonalisation (MBI D) Insomnia Severity Index (ISI) General Self-Efficacy Scale (GSE)		and stress and insomnia subscales, compared to controls. Those on psychotropic medication showed decreased post-traumatic stress.	<b>PTSD</b> <i>Intervention</i> Pre 34.57 SD 23.47 Post 24.91 SD 20.41  <i>Control</i> Pre 36.91 SD 23.18 Post 26.36 SD 21.02  <b>MBI EE</b> <i>Intervention</i> Pre 23.27 SD 12.20 Post 19.43 SD 12.25  <i>Control</i> Pre 23.57 SD 12.34 Post 19.67 SD 12.91  <b>MBI PA</b> <i>Intervention</i> Pre 39.69 SD 6.43 Post 40.33 SD 6.31  <i>Control</i> Pre 39.59 SD 6.62 Post 39.54 SD 6.93

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				<p><b>MBI D</b></p> <p><i>Intervention</i></p> <p>Pre 4.69 SD 5.08</p> <p>Post 4.51 SD 4.96</p> <p><i>Control</i></p> <p>Pre 5.24 SD 5.41</p> <p>Post 4.78 SD 5.25</p> <p><b>ISI</b></p> <p><i>Intervention</i></p> <p>Pre 9.80 SD 6.19</p> <p>Post 8.07 SD 6.18</p> <p><i>Control</i></p> <p>Pre 10.16 SD 6.53</p> <p>Post 8.44 SD 6.68</p> <p><b>GSI</b></p> <p><i>Intervention</i></p> <p>Pre 32.42 SD 4.71</p> <p>Post 33.22 SD 4.65</p> <p><i>Control</i></p> <p>Pre 32.00 SD 4.73</p> <p>Post 32.54 SD 4.88</p>

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
Giordano, et al. [51]	MusicTeamCare-Q1 Likert Scale 0-10 rate feeling of tiredness, sadness, fear and worry. Completed prior to listening to the playlist and within an hour of listening. MusicTeamCareQ2 – questions evaluating the intervention, completed at the conclusion of the study.	34 participants (5 discontinued after two weeks)	Week 1: statistically significant decrease in all four measures for generic breathing playlist and generic energy playlist. In following weeks the customised breathing and serenity playlists showed statistically significant decreases in all measures other than tiredness; energy playlist showed statistically significant decrease in all four measures.	
Ha, et al. [49]	Daily step count Pittsburgh Sleep Quality Index Self-Efficacy for Exercise scale (SEE) Behavioural Regulation in Exercise Questionnaire (BREQ-2) Multidimensional Fatigue Sale (MFS) Wellness Index for Korean Workers scale (WIKW)	60 randomised, 3 withdrew from control group. Analysis 58 participants 30 intervention 27 control	At 12 weeks intervention group showed increased daily step counts; improvement on some of the PSQI subscales, improved intrinsic motivation to exercise and improved wellness. No difference in total PTSQI score or self-rated fatigue.	<b>Total PSQI</b> <i>Intervention</i> Pre 9.23 SD 3.18 Post 7.50 SD 2.95 <i>Control</i> Pre 8.73 SD 3.02 Post 8.53 SD 2.82 <b>SEE</b> <i>Intervention</i> Pre 2.74 SD 1.62 Post 3.47 SD 1.91 <i>Control</i> Pre 3.25 SD 1.82

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				<p>Post 2.90 SD 1.73</p> <p><b>BREQ-2</b></p> <p><i>Intervention</i></p> <p>Pre 3.26 SD 0.36</p> <p>Post 3.71 SD 0.44</p> <p><i>Control</i></p> <p>Pre 3.38 SD 0.63</p> <p>Post 3.45 SD 0.48</p> <p><b>MDQ</b></p> <p><i>Intervention</i></p> <p>Pre 92.63 SD 14.61</p> <p>Post 87.37 SD 16.00</p> <p><i>Control</i></p> <p>Pre 94.83 SD 13.90</p> <p>Post 93.65 SD 19.00</p> <p><b>WIKWS</b></p> <p><i>Intervention</i></p> <p>Pre 2.89 SD 0.47</p> <p>Post 3.42 SD 0.55</p> <p><i>Control</i></p> <p>Pre 3.17 SD 0.42</p>

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				Post 3.26 SD 0.51
Hong, et al. [30]	Impact of Events Scale-Revised (IES-R) Source of distress measured with 18-item questionnaire developed during SARS. General Self-Efficacy Scale (GSES)	102 completed interview and questionnaires.	Top four sources of distress were the health of one's family/others, the virus spread, changes in work and one's own health.	IES-R median 3 (IQR 0-8). 6 participants score ≥20 GSES median 29.5 (SD 5.4). No relationship between GSES and IES-R.
Kameno, et al. [29]	Kessler Psychological Distress Scale (K6) 2 questions about sleep 1 about alcohol misuse 1 about appetite change.	31 nurses screened, 8 met cut off for high-risk and offered psychotherapy, 3 accepted. High-risk participants who received intervention were compared to high risk participants who did not.	Intervention significantly decreased psychological distress on K6; shifted from high-risk to low-risk; improved sleep and appetite. No change in alcohol misuse.	K6 Baseline K6 12 T2 (1 month later) K6 3 T3 (2 months later) K6 2
Maunder, et al. [26]	24-item Pandemic Self-Efficacy Scale (PSES) developed for the study to measure attitudes to working in a pandemic. Confidence in training and support using questionnaire developed for HCWs during SARS. Inventory of Interpersonal Problems (IIP-32)	265 enrolled, 158 commenced training, 120 completed training. Non-significant trend to higher drop-out as course duration increased.	Overall improvements in confidence in training, pandemic self-efficacy and interpersonal problems. No significant change in ways of coping.	PSES Pre 87.7 SD 12.6 Post 92.9 SD 12.9  IIP-32 Pre 31.4 SD 16.0 Post 27.6 SD 15.6  Confidence in Training Pre 32.6 SD 4.9 Post 33.8 SD 4.7

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	Ways of Coping Inventory (WCI)			<p><b>WCI problem solving</b> Pre 1.5 SD 0.5 Post 1.5 SD 0.7</p> <p><b>WCI seek support</b> Pre 1.5 SD 0.5 Post 1.4 SD 0.6</p> <p><b>WCI escape-avoidance</b> Pre 0.6 SD 0.5 Post 0.6 SD 0.5</p>
Nourian, et al. [47]	Pittsburgh Sleep Quality Index (PSQI)	44 enrolled, 41 in final analysis (2 did not complete intervention, 1 did not complete questionnaire.)	Intervention did not lead to improved PSQI total. Subscales regarding sleep quality, sleep latency and habitual sleep showed statistically significant improvements.	<p><b>PSQI</b></p> <p><i>Intervention group</i> Pre 9.90 SD 2.48 Post 9.33 SD 3.15</p> <p><i>Control group</i> Pre 9.40 SD 2.30 Post 10.60 SD 2.49</p>
Osman, et al. [36]	Mindful attention awareness scale (MAAS) Perceived stress scale (PSS)	65 enrolled 55 attended sessions 47 participants completed required assessments (46%)	Post-intervention statistically significant decrease in perceived stress (remained moderate) and in the emotional	<p><b>MAAS</b> Pre 3.5 SD 0.83 Post 3.94 SD 0.75</p>

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	Maslach Burnout Inventory (MBI) subscales emotional exhaustion (MBI EE), personal accomplishment (MBI PA), detachment (MBI D)	medical, 54% allied health) report on completers	exhaustion subscale of the MBI; significant increase in the personal accomplishment subscale.	<b>PS</b> Pr 21.1 SD 6.83 Post 15.26 SD 5.38 <b>MBI EE</b> Pr 10.3 SD 4.86 Post 8.89 SD 4.6 <b>MBI D (median and IQR)</b> Pr 2 IQR 0-4 Post 1 IQR 0-3 <b>MBI PA (median and IQR)</b> Pr 15 IQR 13-16 Post 16 IQR 14-17
Sun [39]	Symptom Checklist-90 Campbell Index of Well-being Work Stress Reaction Scale	35 – intervention 31 - control	Using paired t-test intervention group had significantly lower scores on both total and subscales of SCL-90 and the Work Stress Reaction. The Campbell Index of Well-being total score and subscale cores increased significantly. There	



Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
			was no data regarding means for these results.	
Thimmapuram, et al. [46]	University of California Los Angeles Loneliness Scale (UCLA loneliness scale) Pittsburgh Sleep Quality Index (PSQI)	77 – intervention (41 completed questionnaires) 78 – control (58 completed questionnaires) 13 intervention participants listened to audio recordings ≤ once a week 9 listened 2-3 times a week 19 listened ≥ four times a week.	Intervention group demonstrated a decrease in loneliness and improved sleep quality.	<b>UCLA loneliness score</b> <i>Intervention</i> Pre 42.1 SD 9.71 Post 39.42 SD 9.01 <i>Control</i> Pre 42.22 SD 10.75 Post 41.15 SD 12.45 <b>PSQI</b> <i>Intervention</i> Pre 10.7 SD 3.84 Post 9.1 SD 2.99 <i>Control</i> Pre 9.41 SD 2.85 Post 8.87 SD 2.77
Trottier, et al. [50]	Generalised Anxiety Disorder scale (GAD-7) Patient Health Questionnaire-depression (PHQ9)	46 entered screening 28 eligible 22 consented 21 enrolled 12 completed all measures + 1 month follow-up.	Significantly reduced anxiety, depression and PTSD severity for completers and intention to treat analysis. Effect sizes at end of intervention ranged from 0.84 to 1.05 and at	<b>Results for intention to intervene sample N=21</b> <b>GAD-7</b> Pre 11.12 SD 5.32 Mid-point 8.06 SD 4.93 Post 4.99 SD 3.59

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	Posttraumatic Stress Disorder Checklist-5 (PCL-5) Two-item suicide screen drawn from National Institute of Mental Health's Ask Suicide- Screening Questions and Beck Scale for Suicidal Ideation Feasibility and acceptability measures	Presented data for completed as well as intention to treat analysis	+1month 1.26 – 1.58. Effect sizes largest for PTSD in completers and in intention to treat.	1 month post 1.93 SD 4.05 <b>PHQ-9</b> Pre 12.53 SD 6.15 Mid-point 9.54 SD 5.54 Post 6.54 SD 4.75 1 month post 3.54 SD 4.54 <b>PCL-5</b> Pre 34.17 SD 14.39 Mid-point 24.48 SD 11.44 Post 14.78 SD 10.44 1 month post 5.08 SD 10.19
Wu and Wei [34]	Symptom Checklist 90 (SCL-90) Zung's Self-rated Anxiety Scale (SAS) Zung's Self-rated depression Scale (SDS) Pittsburgh Sleep Quality Index (PSQI) PTSD Checklist-Civilian Version (PCL-C)	Intervention group 60 - COVID-19 hospital Control 60- non-COVID hospital.	State HCWs who exercised according to the exercise prescriptions generally had better psychological stress and sleep status than those who did not (no data provided).	
Yıldırım and Çiriş Yıldız [44]	State Anxiety Index (SAI)	52 in each arm.	Intervention significantly decreased stress and work-	<b>SAI</b> Pre Intervention

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	Work Related Strain scale (WRSS) Psychological Well-Being scale (PWBS)		related strain; significantly increased psychological wellbeing, compared to control group. SAI score decreased, but remained in the moderate range.	<p><b>WRSS</b></p> <p><i>Intervention</i></p> <p>Pre 51.86 SD 15.89 Post 42.96 SD 11.75</p> <p><i>Control</i></p> <p>Pre 51.28 SD 13.38 Post 50.36 SD 14.48</p> <p><b>PWBS</b></p> <p><i>Intervention</i></p> <p>Pre 42.03 SD 9.85 Post 37.32 SD 5.62</p> <p><i>Control</i></p> <p>Pre 41.55 SD 7.46 Post 40.71 SD 7.87</p> <p><b>PWBS</b></p> <p><i>Intervention</i></p> <p>Pre 39.84 SD 8.48 Post 46.76 SD 7.22</p> <p><i>Control</i></p> <p>Pre 41.34 SD 11.08 Post 41.61 SD 12.10</p>

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
Zhan, et al. [35]	Beck Anxiety Inventory (BAI) Pittsburgh sleep quality index (PSQI)	25 intervention (4 withdrawn); 25 control (3 withdrawn).	PSQI decreased significantly at days 7 and 14 intervention group scores indicate good quality sleep. BAI decreased significantly at day 7 but was non-significant at day 14	<b>BAI</b> <i>Intervention</i> Pre 26.14 SD 7.68 Day 7 24.30 SD 5.41 Day 14 23.82 SD 3.17 <i>Control</i> Pre 26.41 SD 12.19 Day 7 29.86 SD 11.64 Day 14 33.14 SD 13.73 <b>PSQI</b> <i>Intervention</i> Pre 5.48 SD 3.46 Day 7 3.60 SD 1.96 Day 14 4.18 SD 3.62 <i>Control</i> Pre 6.00 SD 3.79 Day 7 6.00 SD 3.07 Day 14 6.33 SD 3.84
Zhou, et al. [40]	Zung's Self-Rating Anxiety scale (SAS)  Zung's Self-Rating Depression scale (SDS)	71 nurses.	Statistically significant decrease in anxiety, improved depression but not significant.	Results for change pre-post intervention. <b>SAS</b> change -3.06 SD 10.54 <b>SDS</b>

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				change -1.99 SD 16.21
Zingela, et al. [37]	26 item audit tool included questions about coping and anxiety.; reduced to 10-item due to wish not to burden participants.	192 completed pre-intervention survey 760 completed post-intervention survey.	Post-intervention participants felt increased ability to cope with and manage their reactions to the outbreak, increased ability to manage stress, increased ability to manage stress in others and increased ability to cope with anxiety.	

\*Results reported to the number of decimal places quoted by the author.

# BMJ Open

## Interventions to support the mental health and wellbeing of frontline health care workers in hospitals during pandemics: an evidence review and synthesis

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# Interventions to support the mental health and wellbeing of frontline health care workers in hospitals during pandemics: an evidence review and synthesis

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**Key words** Front line health care workers, pandemics, mental health, co-designed interventions, digital health interventions, mobile health apps, COVID-19

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**Abstract**

**Objective:** Pandemics negatively impact Health Care Workers’ (HCWs) mental health and wellbeing causing additional feelings of anxiety, depression, moral distress and post-traumatic stress. A comprehensive review and synthesis of HCW mental health and wellbeing interventions through pandemics reporting mental health outcomes was conducted addressing two questions: 1. What mental health support interventions have been reported in recent pandemics, and have they been effective in improving the mental health and wellbeing of HCWs?: And, 2. Have any mobile apps been designed and implemented to support HCWs’ mental health and wellbeing during pandemics?

**Design:** A narrative evidence synthesis was conducted using Cochrane Criteria for synthesizing and presenting findings when systematic review and pooling data for statistical analysis are not suitable due to the heterogeneity of the studies.

**Data Sources:** Evidence summary resources, bibliographic databases, grey literature sources, clinical trial registries and protocol registries were searched.

**Eligibility criteria:** Subject heading terms and keywords covering three key concepts were searched: SARS-CoV-2 coronavirus (or similar infectious diseases) epidemics, health workforce, and mental health support interventions. Searches were limited to English-language items published from 1<sup>st</sup> January 2000 to 14<sup>th</sup> June 2022. No publication-type limit was used.

**Data Extraction and synthesis:** Two authors determined eligibility and extracted data from identified manuscripts. Data was synthesised into tables and refined by co-authors.

**Results:** 2,694 studies were identified and 27 papers were included. Interventions were directed at individuals and/or organisations and most were COVID-19-focused. Interventions had positive impacts on HCW mental health and wellbeing, but variable

study quality, low sample sizes, and lack of control conditions were limitations. Two mobile apps were identified with mixed outcomes.

**Conclusion:** HCW interventions were rapidly designed and implemented with few comprehensively described or evaluated. Tailored interventions that respond to HCWs' needs for mental health and wellbeing are needed with process and outcome evaluation.

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**Article Summary**

**Strengths and limitations of this study**

- This is the most comprehensive review of interventions to support health care worker mental health and wellbeing through pandemics that has been conducted to date.
- The review explored a wide range of sources including key bibliographic databases, the EPPI-Centre's Living Systematic Map of the Evidence, preprint servers, clinical trial registers and grey literature from reputable health sources.
- The review outcomes were limited by heterogeneous designs and research outcomes that were largely descriptive, lacked appropriate outcome measures or used single group designs.
- A large number of studies were excluded as they describe mental health focused interventions for health care workers, but did not report outcomes or impact.

## Introduction

Health care workers (HCWs) experience high levels of mental distress[1] which increases through pandemics. Pandemic-related mental health and wellbeing impacts have been reported[2 3] but as increased rates of anxiety, depression, moral distress and post-traumatic stress disorders[4] and occupational stress are identified as a consequence of COVID-19, mental health and wellbeing supports for HCWs are becoming paramount.[5] Early in the pandemic, emotional distress and cumulative load was being driven by increased risk of COVID-19 infection,[6] radically altered healthcare systems and practices, and the impact of physical distancing on professional team interactions and patient relationships.[3] Now, almost three years into the pandemic, distress and burnout are driven by impacts of staff shortages and absenteeism/presenteeism, increased workload attributable to treating and preventing COVID-19, and the impact of successive waves of infection.[7 8] Morally complex decision-making in the allocation of scant health resources increased emotional distress and cumulative load and HCWs needed to evaluate risks to their own health and for loved ones.[9 10] Australian HCWs described intense stress associated with pandemic preparedness and the emotional costs of working in an environment where human contact was, and remains, restricted .[11 12] Despite these concerns, and a plethora of rapidly produced research and literature, there is a lack of clear, evidence-based HCW mental health and well-being interventions and supports, that have been evaluated and reported on even outside of the pandemic setting.[4 5]

Since 2003, pandemics have become frequent with severe acute respiratory syndrome (SARS), Middle Eastern Respiratory virus (MERS), influenza H1N1 and H7N9, Ebola, and now SARS-CoV-2, causing COVID-19, emerging. Pandemic preparedness has become a feature of healthcare system planning and several reviews published early in the pandemic examined the mental health of HCWs and potential interventions that could support HCW mental health and wellbeing.[2 13 14] While significant mental health

1 impacts on HCWs working within pandemics is recognised, there is a mismatch between  
2 the interventions offered, focusing on relieving individual symptoms, versus HCWs'  
3 expressed preferences for social support.[3] The COVID-19 pandemic has highlighted that  
4 few evidence-based interventions exist supporting the short and long-term mental health of  
5 HCWs both within and outside pandemics and are urgently required.[14-17] Reviews have  
6 indicated an increased need for technological innovation and digital interventions  
7 following the COVID-19 pandemic.[18 19] Digital mental health interventions and mobile  
8 apps are available, but there remains a paucity of evidence about HCW specific digital  
9 interventions and the uptake, acceptability and feasibility both inside and outside of  
10 pandemics.[18 20]

11 This evidence review and synthesis informed a larger project that involved the  
12 development, design, implementation and evaluation of a mobile app to support HCWs'  
13 mental health and wellbeing during COVID.[21] The project utilised experienced-based  
14 co-design (EBCD[22]) which employs narrative and story-telling approaches alongside  
15 facilitated co-design to centre the lived-experience of people who are directly impacted by  
16 a topic or issue at hand.[21] EBCD typically involves two interconnected stages (1)  
17 information/experience gathering and (2) engaging people with lived-experience as content  
18 co-creators, designers and co-developers of collaborative solutions through a co-design  
19 process[22 23].

20 We used the Cochrane approach to evidence synthesis where meta-analysis is not  
21 appropriate and applied a narrative evidence synthesis method.[24] The review addressed  
22 two questions:

- 23
- 24 1. What mental health support interventions have been reported in recent  
25 pandemics, and have they been effective in improving the mental health and wellbeing of  
26 HCWs?: And
- 27

1  
2 2. Have any mobile apps have been designed and implemented to support HCWs'  
3  
4 mental health and wellbeing during pandemics?  
5  
6

## 7 **Method**

8  
9 Following the narrative evidence synthesis method[24] the following combinations of  
10  
11 resources was searched to identify relevant publications (Table 1). A Prisma 2020  
12  
13 Checklist is included as Supplementary File 1.  
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Table 1. Databases included in search strategy

Resource type	Titles searched	Latest search date
Cochrane Library resources	Cochrane Reviews, Cochrane Protocols, Cochrane Trials	6 June 2022
Evidence summaries and guidelines	Cochrane Living Guidelines; Epistemonikos; Oxford Covid-19 Evidence; NICE Rapid guidelines on COVID-19; VA Evidence Synthesis Project COVID-19 Reviews	18 Sep 2020
Literature databases	Medline (Ovid, 1946 -)	6 June 2022
	Web of Science Core Collection	14 June 2022
	Scopus	17 Aug 2020
	PsycInfo (Ovid)	14 Mar 2021
	Embase Classic+Embase (Ovid)	14 Mar 2021
	CINAHL Complete (EBSCOhost)	14 Mar 2021
	LitCovid	17 Aug 2020
	EPPI-Centre Living Systematic Map of the Evidence	30 Jul 2020
EPPI-Centre Register	- Provided an extract of their mental health impacts references (n=468 with the last update (published 30/7)	
Preprint servers	ArXiv; MedRxiv (COVID-19 SARS-CoV-2 preprints sub-sets)	18 Aug 2020
Clinical trials registers	Australian New Zealand Clinical Trials registry COVID-19 Studies; ClinicalTrials.gov COVID-19 subset; Cochrane COVID-19 Trials register	20 Aug 2020
Systematic reviews protocols	PROSPERO International prospective register of systematic reviews	7 June 2022
Grey literature	Agency for Healthcare Research and Quality; Australian Commission on Safety and Quality in Health Care; Canadian Agency for Drugs and Technologies in Health; Health Quality Ontario; National Institute for Health and Care Excellence; World Health Organisation	18 Sep 2020

Evidence summaries and guidelines were searched using a combination of thesaurus terms (where available) and keyword searches. Database search strategies used subject heading terms and keyword searches for three key concepts: SARS-CoV-2 coronavirus (or similar

infectious diseases) epidemics, health workforce, and mental health support interventions.

Searches were limited to English-language items published from 2000. No publication-type limit was used. The detailed search strategy is included in Supplementary File 2.

Reference lists of relevant items were checked, and forward citation searches were conducted to discover related items. Grey literature sources and the websites of key health organisations were also checked. COVID-19 subsets of three clinical trials registers were examined to identify randomised controlled trials (RCTs) in progress at the time of conducting the search.

From 2,694 publications identified, comprised of reviews and single studies, 2,603 papers were screened for inclusion using the criteria shown in Table 2.



**Table 2.**

*Manuscript inclusion and exclusion criteria for literature synthesis*

Inclusion	Exclusion
Pandemic or epidemics: SARS, MERS, H1N1 H7N9, COVID-19, Ebola	Pandemics prior to 1 <sup>st</sup> of January 2000
Clinical and non-clinical health workers in hospitals	Paramedic, disaster and retrieval staff. Primary care and community healthcare workers.
Intervention that had been implemented in a hospital setting in any country at any time after the 1 <sup>st</sup> of January 2000 with the intention implemented to improve HCWs’ mental health and wellbeing in the pandemic setting	Interventions that had been proposed or recommended without having been implemented. Educational materials intended to inform the institution’s workforce
E-learning and web-based interactive programmes were included as general interventions. Only mobile apps, specifically developed to address HCWs' mental health in pandemics were included to address the second question.	Mobile app used only as a platform of communication.
Reported mental health outcomes	Did not report mental health outcomes

Two authors (KRB, CG, ML, VP) independently assessed each item to determine eligibility, using Covidence to manage this workflow.[25] Each manuscript was independently assessed by two authors (KRB, CG, ML, VP). Discrepancies were resolved

through discussion between the authors. Where required, a third author made the final determination.

Quantitative and qualitative data from eligible studies were extracted into tables. Studies that did not examine a specific intervention or include mental health outcomes were excluded. Intervention details were charted by type of intervention and mental health-related outcome data and reviewed and refined at research meetings by co-authors (KRB, CG, VP, LB, ML, AK). A formal quality appraisal tool was not applied, but the limitations of each study were considered in presenting the results.

Institutional ethics was not required as this project did not involve human or animal participants.

### **Patient and Public Involvement**

No patients involved.

**INSERT FIGURE 1 ABOUT HERE**

### **Results**

Figure 1 presents the PRISMA flow diagram of the study review and selection process. Twenty-seven papers, from 26 studies (2 papers reported aspects of the same study) met the inclusion criteria.[26-52] Heterogeneity of study designs and the outcomes reported meant that it was not possible to synthesise the effects of each outcome.

Most studies (22/26) related to the COVID-19 pandemic;[29-33 35-52] two related to influenza;[26 27] and one study to SARS[28] and one to Ebola.[34] A substantive number of interventions were premised on mitigating acute stress to prevent or minimise longer-term mental health problems. Three studies described pandemic preparedness

interventions,[26 27 38] 23 described interventions delivered during pandemics,[28-33 35-37 39-52] and one described a post-pandemic intervention.[34] These can be broadly be classified into preparedness, and responsiveness to pandemics.

Broadly, the interventions described in the literature were targeted at organisations, aiming to improve working conditions, communication, and staff support; or directed at individuals with a focus on clinical education, mental health and wellbeing, stress management and coping, or directed counselling and psychological support. Table 3 includes a summary of included studies. The aims and methods of each study presented in more detail in Supplementary Table 1, and the mental health assessments and outcomes in Supplementary Table 2.

**Table 3** *Interventions to Improve Health Care Workers' Mental Health during Pandemics*

Author Year	Pandemic	Design	Aim	Intervention	Population	Intervention impacts
Aiello, et al. [26]	Influenza	Post-evaluation	↑ resilience	Education session	HCWs	↑ coping
Amsalem, et al. [33]	COVID-19	RCT	↑ help seeking	3-minute video	HCWs with anxiety, depression or PTSD	↑ intention to seek treatment
Beverly, et al. [39]	COVID-19	Pre-post	↓ stress	3-minute virtual reality	HCWs	↓ perceived stress
Blake, et al. [29] Blake, et al. [49]	COVID-19	Post-evaluation survey ('20) Interviews ('21)	Support psychological wellbeing	Drop-in wellbeing centres	HCWs	↑ wellbeing and work place engagement/ Positive view of centres
Chan, et al. [42]	COVID-19	Post-evaluation	Support mental health	Virtual continuing medical education	Obstetric and gynaecology trainees	↑ coping
Chen, et al. [28]	SARS	Pre-post	↓ anxiety and depression, improve sleep	Multifactorial education, support, and mental health	Nurses	↓ depression, anxiety; ↑ sleep quality
Cheng, et al. [32]	COVID-19	Validation	↑ positive emotions, team work; ↓ burnout.	Mental health support	HCWs	mood 7-9/10. ↑ gains and ↓ challenges.
Cole, et al. [34]	Ebola	Pre-post	↓ anxiety and depression	Small group cognitive behavioural therapy	Past Ebola treatment staff with anxiety/depression.	↓ anxiety, depression, functional impairment
De Kock, et al. [44]	COVID-19	RCT	↑ psychological health	2 different digital apps	HCWs	Both apps: ↓ anxiety & depression; 1 app: ↑ mental toughness
Dincer and Inangil [46]	COVID-19	RCT	↓ stress, anxiety and burnout	Emotional Freedom Technique	NURSES	↓ stress, anxiety and burnout
Fiol-DeRoque, et al. [43]	COVID-19	RCT	↓ depression, anxiety, stress, PTS, burnout and insomnia, ↑ self-efficacy	Digital app	HCWs	No difference primary or secondary outcomes
Giordano, et al. [52]	COVID-19	Pre-post	↓ stress and ↑ wellbeing	Music therapy and guided imagery	HCWs	↓ tiredness, sadness, fear and worry
Ha, et al. [50]	COVID-19	Cluster RCT	↑ physical activity and sleep quality	Mobile wellness: online exercise classes, weekly health coaching	Nurses	↑ sleep quality, intrinsic motivation to exercise and wellness.

Hong, et al. [31]	COVID-19	Mixed methods	↑ stress management and psychological wellbeing	Practical support; clinical education; mental health support	HCWs	6% met cut off for high level of distress
Kameno, et al. [30]	COVID-19	Pre-post	Support high risk staff	Individual psychotherapy	Nurses	↓ psychological distress; ↑ anxiety sleep and appetite
Maunder, et al. [27]	Influenza	Pre-post	↑ support and training satisfaction, coping, pandemic-related self-efficacy; ↓ interpersonal problems.	Computer assisted clinical education and relaxation training.	HCWs	↑ pandemic perceived self-efficacy, confidence pandemic preparedness; ↓ interpersonal problems
Nourian, et al. [48]	COVID-19	RCT	↑ sleep quality	Mindfulness-based stress reduction	Nurses	No difference ↑ sleep subscales
Osman, et al. [37]	COVID-19	Mixed methods pre-post	↓ stress, burnout and mindful awareness.	Mindfulness sessions	HCWs and healthcare students	↓ stress; ↑ burnout, subscales
Sun [40]	COVID-19	RCT	↑ time management	Time management training; Balint group	Nurses	↓ Symptom Checklist Score and work stress; ↑ wellbeing
Thimmapuram, et al. [47]	COVID-19	RCT	↑ sleep and perceptions of loneliness	Heartfulness meditation practice	HCWs	↓ Loneliness; ↑ sleep quality
Trottier, et al. [51]	COVID-19	uncontrolled trial	↓ anxiety, depression, and PTSD	online guided intervention	HCWs	↓ anxiety, depression, and PTSD
Wu and Wei [35]	COVID-19	Between group Observational	↓ stress and ↑ sleep	Exercise prescription	HCWs	↑ psychological stress and sleep
Yıldırım and Çiriş Yıldız [45]	COVID-19	RCT	↓ stress, work-related strain and ↑ psychological well-being	Mindfulness based breathing and music	Nurses	↓ stress and work related strain ↑ psychological wellbeing
Zhan, et al. [36]	COVID-19	RCT	↓ anxiety and ↑ sleep	Tai Chi	HCWs	↑ sleep ↓ anxiety
Zhou, et al. [41]	COVID-19	Pre-post	↓ anxiety and depression	Mindfulness; Education; psychological support	Nurses	↓ anxiety
Zingela, et al. [38]	COVID-19	Descriptive	↑ coping, stress management.	Education on mind care; relaxation; team care	HCWs	↑ coping, stress and anxiety management.

## Preparedness: Interventions Delivered Pre-Pandemic

Three papers examined programs to prepare HCWs for pandemics. Two papers reported on elements of an organisational approach to pandemic preparedness focussed on building resilience in a Toronto based hospital based on the hospital's 2003 experience with SARS. An inter-professional Psychological Pandemic Committee developed interventions to reduce HCW stress and facilitate adaptation as a primary prevention, aiming to support staff and reduce absenteeism through future pandemics. A computer-based educational intervention, intended as a "pandemic influenza stress vaccine," delivered audio and video lectures on pandemics and working outside comfort zones as well as relaxation skills and self-assessment modules.[27] Three course durations were offered: 1.75 hours; 3 hours; and 4 hours. All course durations were reported to improve pandemic self-efficacy, confidence in training and support. There was however a non-significant trend toward higher drop-out rates for the longer course duration. In the second study, Aiello, et al. [26] reported findings from an in-person education intervention focused on coping principles and organisational and personal resilience. Post-session questionnaire data indicated that 35% of participants felt prepared to deal confidently with a pandemic before the session and this increased to 76% of participants after the session. The absence of pre-training session comparative data regarding perceived ability to cope is a notable limitation of this study.

Zingela, et al. [38] reported that a 60-90 minute in-person group education session to improve the psychological preparedness of HCWs in the COVID-19 pandemic, covering mind care, relaxation techniques and team care, improved coping and the ability to manage stress in others and their own anxiety.

It is unclear whether giving HCWs' increased confidence in their abilities improved mental health outcomes during, or following, a pandemic in the same way as could be expected of mental health focused interventions. [53-56]

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**Responsiveness: Interventions delivered in response to a pandemic**

Twenty-four studies reported mental health outcomes for interventions delivered during or after a pandemic.[28-37 39-52] Most studies (18/24) were individually directed with diverse aims that included: improving sleep, or decreasing stress, anxiety, depression, burnout and PTSD. Interventions were commonly selected based on findings from studies conducted outside the pandemic setting and with non-HCW populations. Importantly, the five studies that describe organisational level changes often incorporated interventions targeted at individuals and included additional elements.

One intervention to improve mental health treatment seeking rather than mental health outcomes was assessed in a 3 arm RCT.[33] Group one watched an intervention video twice (baseline; +14 days); Group two watched it once (baseline); and the Control Group did not watch it. The intervention increased treatment seeking intentions from pre-viewing to 30-days post in both intervention groups with group one showing an increased intention to seek treatment. No data was presented linking intention to seek treatment translated into treatment seeking.

A range of interventions to directly improve mental health outcomes were studied. Seven studies explored elements of relaxation, mindfulness and meditation.[37 39 45-48 52]. Three studies examined exercise based interventions[35 36 50], two each focused on CBT-based interventions[34 51] or mobile apps,[43 44] and three explored other interventions[29 30 40 49].

Four studies reported on mindfulness interventions with three involving multi-week interventions.[37 47 48] A seven week RCT tested an online mindfulness based stress reduction program (weekly mindfulness based exercise and mindfulness education), did not demonstrate any difference in sleep quality on the Pittsburgh Sleep Quality Index (PSQI[57]) total score, but some PSQI subscales showed improvement.[48] Osman, et al. [37] reported statistically significant improvements on the emotional exhaustion and personal accomplishment elements of the Maslach Burnout Inventory (MBI[58]) and in mean perceived stress, following four weekly, hour-long on-line mindfulness sessions. In a multisite RCT, online meditation, with participants listening to 6-minute audio meditations twice daily for 4

1 weeks, improved sleep quality on the PSQI while remaining above the threshold for poor quality sleep,  
2 and decreased loneliness on the University of California Los Angeles Loneliness Scale.[47] Yıldırım  
3 and Çiriş Yıldız [45] reported that a single 30-minute, online, mindfulness based breathing session  
4 decreased work related strain and anxiety and improved psychological wellbeing.  
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11 Beverly, et al. [39] reported decreased HCWs stress on a visual analogue scale after viewing a 3-minute  
12 immersive virtual reality nature scene using a pre-post design. Dincer and Inangil [46] showed that a  
13 20-minute online education session about the Emotional Freedom Technique, where points on the skin  
14 are tapped to send activating and deactivating signals to the brain decreased stress (Subjective units of  
15 distress scale (SUD)), anxiety (State Anxiety Scale (SAS)) and burnout (Burnout Inventory (BAI)) in a  
16 RCT.  
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26 Giordano, et al. [52] trialled a five-week music therapy intervention with three 15–20-minute playlists  
27 (breathing, tranquil and energy). In week one, participants received generic playlists and at week's end  
28 they spoke with a music therapist who tailored a playlist. This process was repeated weekly over 4  
29 weeks. The pre-post analysis showed statistically significant changes in tiredness, sadness, fear, and  
30 worry using a bespoke instrument. Participants indicated the presence of the music therapist was of  
31 greater help than the playlists however.  
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41 Three studies described exercise-based interventions.[35 36 50] Ha, et al. [50] described a 12-week  
42 fitness program aiming to increase physical activity and improve sleep quality. In this RCT the  
43 intervention group had access to online exercise classes, health coaching, and were given step count  
44 targets which significantly increased daily step counts but did not change sleep quality on the PSQI.  
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49 Wu and Wei [35] reported on an exercise prescription where the intervention group were HCWs at a  
50 COVID-19 designated hospital and the control group were HCWs at a non-COVID-19 designated  
51 hospital. The authors did not provide any details regarding the nature of the exercise prescription or  
52 numerical outcome data. They stated that those who followed the exercise prescription had better sleep  
53 and stress than those that did not, but no measurement data was presented.  
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Zhan, et al. [36] reported in their RCT that 30 minutes of online Tai Chi, daily for two weeks, significantly improved sleep on the PSQI at day 14, compared against 30 minutes of free exercise, but did not alter anxiety outcomes on the Beck Anxiety Inventory.

Two studies investigated Cognitive Behavioural Therapy (CBT) based interventions.[34 51] Cole, et al. [34]described a small group, post-pandemic, CBT based intervention that involved six, 3-hour weekly, in-person small group CBT sessions supplemented by a workbook, for former Ebola Treatment Centre (ETC) workers with evidence of anxiety, depression and/or PTSD. The intervention decreased depression on the Patient Health Questionnaire-9 (PHQ-9), functional impairment on the Work and Social Adjustment Scale (WASAS), and anxiety on the Generalised Anxiety Disorder-7 (GAD-7) in their non-randomised pre-post study. Trotter, et al. [51] reported preliminary findings from a self-directed online intervention in which participants completed eight, CBT based modules over a maximum of eight weeks. The 30-day outcomes, based on intention to intervene, showed improvements to anxiety on the GAD-7; depression on the PHQ-9; and PTSD on the PCL-5, with large pre-post effect sizes reported (0.84-1.58). The sample was small and was not randomised, and it is unclear if these findings would be observed in a larger randomised sample.

Two studies reported on the use of digital apps.[43 44] De Kock, et al. [44] described a three arm RCT comparing: an existing digital app for HCWs psychological health called My Possible Self (MPS[59]); an app designed specifically for HCWs during the pandemic, called the National Health Service Highland Wellbeing Project (NHSWBP) app; and a wait list control. In the first two weeks the NHSWBP app focused on happiness, resilience, and wellbeing, and in the final two weeks focused on low mood and anxiety. The study was not appropriately powered for efficacy and there was substantial attrition (36.7%). Nonetheless, depression, on the PHQ-9, decreased in both the MPS (M:6.76 SD:5.04 to M:5.18 SD:3.27) and NHSWBP groups (M:7.60 SD:4.31 to M:5.68 SD:4.39), anxiety, on the GAD-7, decreased in only the NHSWBP group (M:7.77 SD:4.87 to M:5.85 SD:3.66), and mental toughness on the Mental Toughness Index, improved in the NHSWBP (M:39.3 SD:6.84 to M:41.3 SD:8.33)and

control groups. All three groups showed improvements in mental wellbeing, on the Warwick-England Mental Well-Being scale, and in gratitude, on the Gratitude Questionnaire.

A RCT evaluated the impact of two weeks of access to the PsyCovidApp on depression, anxiety, stress (DASS-21[60]), PTSD (Davidson Trauma Scale[61]), burnout (MBI[58]), insomnia (Insomnia Severity Index[62]) and self-efficacy (General Self-Efficacy Scale[63]).[43] PsyCovidApp is a CBT and mindfulness-based intervention over 4 content areas (emotional skills, healthy lifestyle, work stress and burnout, and social supports). The control group accessed an app with brief information about HCW mental health during pandemics. No between group differences were observed post-intervention on primary outcomes.

Three studies utilised other interventions. One group[29 49] evaluated wellbeing centres designed to be relaxing spaces allowing quiet time and social interaction for employees, bank staff and volunteers in two UK acute hospital trusts. The centres were staffed by buddies, volunteers whose usual workload had decreased due to the pandemic, who were trained in psychological first-aid and able to provide mental health support information. The centres were evaluated via survey[29] and qualitative interviews.[49]

Using a non-randomised sample, the survey compared centre users to non-users, and of 819 respondents, 94% were aware of the centres and 55.2% had accessed a centre. Users and non-users reported similar job stressfulness, job satisfaction, turnover intention or presenteeism. Those who accessed the centres had higher wellbeing (Warwick Edinburgh Mental Wellbeing Scale M:47.04 (SD:9.49) vs M:45.11 (SD:9.35)) and higher workplace engagement (Utrecht Work Engagement Scale (M:5.02 (SD:1.14) vs M:4.83 (SD:1.15))), although it cannot be determined if this reflects the intervention impact or pre-existing characteristics. Respondents appreciated the centres and described them as having a positive impact on their wellbeing. There was a strong desire for the centres to be retained post-pandemic.

In the qualitative analysis[49] drawn from 24 interviews with centres users and operational staff, including managers and buddies, the centres were seen as an essential support and a source of pride in

1 the NHS that addressed an unmet need. Staff described pre-pandemic wellbeing initiatives as focussing  
2 on healthy lifestyle changes rather than addressing the core issues that impact staff. Buddies described  
3 their role as an opportunity to contribute to the pandemic response when their usual role had decreased.  
4 Users appreciated the information buddies offered, being able to offload their worries and talking  
5 through coping strategies.  
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13 Kameno, et al. [30] reported that individual psychotherapy for nurses who were experiencing high levels  
14 of psychological distress, decreased in distress over the following two months. Of 31 nurses screened,  
15 8 met the inclusion criteria, and 3 accepted psychotherapy. While the authors reported efficacy, the  
16 numbers were small and reasons for refusing the intervention were not specified.  
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23 A RCT reported that a 16-week time management intervention involving 1-hour Balint groups that ran  
24 1-2 times a week, and weekly 40-minute time management training over 8 weeks improved mental  
25 health, subjective wellbeing and stress response.[40] The intervention was poorly described, and the  
26 findings were presented using a paired t-test of the difference between the intervention and control  
27 group, with no data regarding the mean pre-post scores for each group.  
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36 Five studies reported interventions that included changes beyond the individual level.[28 31 32 41 42]  
37 Four of these involved multicomponent interventions. Chen, et al. [28] described an intervention for  
38 nursing staff in a Taiwanese SARS designated hospital that included an epidemic prevention plan with  
39 in-service training to minimise transmission risk when caring for SARS patients, staff allocation to  
40 ensure appropriate shift lengths and time away from work, adequate PPE supplies, and the establishment  
41 of a mental health team to provide direct staff support. Participant mental health was assessed using  
42 Zung's self-rating anxiety scale (SAS[64]) and depression scale (SDS[65]) and the PSQI[57] at four  
43 time points: pre-intervention (T1); 2 weeks post intervention (T2); 1 month post-intervention (T3); and  
44 1 month after the hospital was no longer a designated SARS hospital (T4). Of 120 nurses surveyed, 116  
45 completed questionnaires at all four time points. At T1 the mean scores on the SAS (M:60 (SD:9.28))  
46 and SDS (M:61 (SD:12.62)) indicated moderate anxiety and depression, which reduced to mild anxiety  
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and depression at T2 (SAS M:51 (SD:10.32); SDS (M:51 (SD:11.94)) and T3 (SAS M:50 (SD:9.84); SDS (M:50 (SD:10.60)), and to no anxiety or depression at T4 (SAS M:46 (SD:7.48); SDS (M:48 (SD:10.76)). Progressive improvements in sleep quality were observed at each follow-up time, but sleep quality remained above the threshold indicating poor quality sleep at all timepoints. There was no control condition making it difficult to determine the full impact of the intervention on outcomes.

Cheng, et al. [32] described a 5-module intervention including self-rate mood, positive self-feedback training, psychological peer-support, weekly psychiatry-led Balint Group, and active monitoring of wellbeing by a support team, for 155 HCWs from a Shanghai hospital who were sent to work in a COVID-19 designated hospital in Wuhan team. In the week after leaving Wuhan, while in quarantine, 125 HCWs completed follow-up questionnaires. Daily mood reports across the 6 weeks showed improvements, while daily challenges decreased. However, the number of HCWs who completed the daily self-reported mood ratings was low (Median: 16). The authors concluded that the whole team maintained a positive outlook. There was no control condition.

A multifaceted intervention to improve stress management and protect the physiological and psychological wellbeing of HCWs was delivered to 105 staff in a Beijing tertiary hospital COVID-19 fever clinic.[31 66] To address concerns regarding SARS-CoV-2 transmission to family members, HCWs were provided with accommodation during their rostered workdays at the fever clinic and quarantine period. Families were supported where necessary. PPE and training to minimise transmission risk were provided, along with adjustments to the work roster, and a telephone hotline, staffed by psychiatrists and psychologists, was available from 9am-9pm seven days a week. Feedback from the first 37 HCWs who participated was used to modify the intervention for the following 68 participants. The Impact of Events Scale-Revised (IES-R[67]) and a source of distress scale developed for use during the SARS outbreak in Hong Kong.[31] Source of distress scores were significantly higher for the first 37 HCWs (Median: 0.50 IQR:0.30–1.00 vs Median: 0.33 IQR:0.17–0.78). Decreased source of distress score for the second group may have reflected program modifications but could have related to

1 improved COVID-19 knowledge and clinic activity; without a control sample and appropriately  
2 powered study this is difficult to establish.  
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7 Zhou, et al. [41] delivered an on-line and in-person training program covering diagnosis, infection  
8 prevention and psychological support including mindfulness decompression for nurses designated to a  
9 COVID-19 ward which significantly decreased anxiety (SAS[64] M: -3.06, SD:10.54, p=.019 ) and non-  
10 significantly decreased depression (SDS[65] M:-1.99, SD:16.21, p=.306) from pre-post. The authors  
11 concluded that knowledge regarding infection prevention and psychological support decreased anxiety,  
12 but that not enough time had elapsed to decrease depression. The lack of a control condition makes it  
13 difficult to determine the observed outcomes to the intervention.  
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17 One intervention delivered virtual continuing medical education (vCME) for 44 obstetrics and  
18 gynaecology trainees in Singapore to support trainee mental health to allow trainees to continue training  
19 and maintain skills when elective surgeries were cancelled.[42] Twenty-eight trainees completed a  
20 program audit including three questions about wellbeing. The authors reported on only one question,  
21 with 75% of respondents indicating that the sessions helped them cope with the difficulties of team  
22 segregation.  
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26 Across the 26 studies, 41 mental health-focused outcome measures were reported with 30 only being  
27 used in one study each, six in two studies, two in three studies (Zung's Self-rating Anxiety Scale, Zung's  
28 Self-rating Depression Scale[64 65]), two in four studies (GAD-7, PHQ-9[68 69]) and one in five  
29 studies (PSQI[57]). Some studies used well recognised and validated instruments, whereas other studies  
30 used modified versions of existing instruments or developed their own instruments, with little  
31 presentation of how these instruments were developed or validated, if at all.  
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35 Trends can be seen in the outcomes across included studies. Six studies demonstrated improvements in  
36 sleep,[28 35 36 47 48 50] three in wellbeing,[29 40 45 49] and two in coping[38 42] and in  
37 confidence[26 27]. Seven studies demonstrated decreased anxiety,[28 34 36 41 44 46 51] five decreased  
38 stress,[35 37 39 45 46] four decreased depression,[28 34 44 51] two decreased burnout,[37 46] and one  
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each decreased PTSD[51] and functional impairment[34]. The conclusions that can be drawn from these findings are limited however by the wide range of instruments used, variability in interventions and approaches, contextual factors, frequent lack of control data, and the limited or incomplete data reported within papers.

For peer review only

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**Discussion**

The COVID-19 pandemic has impacted all HCWs across the world, and this was most acutely experienced in hospital settings with the pandemic exacerbating the existing known wellbeing and mental health challenges facing HCWs during their pre-pandemic work-lives. As successive waves of COVID-19 continue, it is essential that research evidence be rapidly distilled and updated to effectively support HCWs’ mental health and wellbeing as the pandemic evolves and the challenges to HCWs mental health and wellbeing shift. Early pandemic wellbeing challenges were driven by the lack of information regarding infection prevention and effective treatment pathways, PPE availability, no vaccines, infection risk, and rapidly changing guidelines and protocols. HCWs experienced uncertainty regarding how to protect themselves and their loved ones, while caring for patients. Two and half years later, vaccination has significantly decreased the risk of severe disease and evidence regarding infection prevention and treatment is increasing. HCWs wellbeing and mental health remain increasingly challenged on pre-pandemic conditions as they are still required to navigate uncertainty and the challenges of contested knowledge, against a background of high workloads, ongoing waves of COVID-19 infections and staffing shortages to due COVID-19 exposure and staff leaving the profession. This has all occurred in the context of high rates of pre-pandemic mental health challenges and high rates of burnout. [1 70]

This evidence review and synthesis has reported on a wide range of HCW mental health and wellbeing interventions. It is encouraging that there is such a focus on supporting HCW mental health, and most studies reported some positive impact of their interventions. The full impact on the psychological health and wellbeing of HCWs, and promising approaches however are difficult to determine from the included studies as many were limited by pre-post study designs, small samples, a highly localised context, and presented limited baseline or comparative data. Most interventions focused on individual behaviour and psychological change by fostering resilience to increase coping skills and offering additional support to those in crisis, rather than addressing the factors HCWs identified as important such as adequate PPE,



family and social supports and clear communication.[2 14] While some of the interventions have been developed by staff and colleagues, we did not observe any that had been co-developed with HCWs.

The evidence synthesis draws attention to two interconnected problems regarding work in this area: the gap between what HCWs want and the supports that are offered; and, the variable quality of the reported research. Literature reviews on the mental health impacts of pandemics have concluded that social and practical support are important mechanisms for alleviating psychological distress and may be preferred to professional psychological support.[2 3] This was reported early in the pandemic by Chen, et al. [71] who interviewed HCWs and found that the psychological support intervention they offered did not address HCWs' self-identified concerns. Interviews with HCWs and social care workers in the United Kingdom found they valued practical support from their organisations during the COVID-19 pandemic including the provision of food, flexibility around work, clear communications and being consulted regarding their needs.[7] Direct psychological support was valued but was one element in what was needed to support their mental health. Most included interventions focused on individual behaviour, fostering resilience to increase coping skills or offering support to those in crisis.

This misalignment likely reflects complexity, and time and cost constraints organisations face especially if interventions require cultural change or reorganisation of existing systems. COVID-19 forced healthcare systems to make rapid large-scale systemic and environmental changes including increased use of telehealth, social distancing measures, the wearing of PPE, and the cancellation of elective procedures. It is conceivable that systems, and people within these systems, would have struggled to accommodate further complex reorganisation at that time to fully respond to mental health needs. Second, many mental health and wellbeing intervention were locally driven by departments, groups, and individuals within hospitals that the pandemic impacted and were developed with limited resourcing and with a sense of urgency. Many of the implemented interventions were developed pre-pandemic and had existing gaps in the reported development, uptake, acceptability and efficacy.



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2 Generating evidence within pandemics is understandably complex[17] as interventions are rapidly  
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4 developed and deployed, participants are already burdened, and the system is under strain. Our review  
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6 excluded many papers describing interventions that did not present efficacy data. The included studies  
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8 had variable design quality. Most studies had small samples and no indication of power, and only 10/26  
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10 studies included control data. Long-term follow-up was infrequent. There was significant heterogeneity  
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12 in the interventions, reported outcomes, dosage description, and rigour of the evaluations. The use of  
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14 proxy outcome measurements was common such that confidence was used as a proxy for resilience[26  
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16 27] and sleep quality as a proxy for mental health and wellbeing.[48 50]  
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21 Our search identified two HCW mobile mental health app studies designed specifically in response to  
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23 the COVID-19.[43 44] Despite a good retention rate and being adequately powered, Fiol-DeRoque, et  
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25 al. [43] demonstrated no difference in any of the primary or secondary outcomes aside from pre-  
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27 specified sub-group analysis. Given that participants only had access to the app for two weeks and no  
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29 data was reported on app usage, the lack of impact could reflect low dosage both in terms of engagement  
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31 and usage, and time to see a change. De Kock, et al. [44] showed their COVID-19 specific app was of  
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33 greater benefit than a non-specific mental health app, however there was a high attrition rate (36.7%)  
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35 and the study was not powered for efficacy. Sample attrition is a concern in pandemic situations where  
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37 high demands on HCWs are understandably likely to impact on research participation. These mixed  
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39 findings indicate that there is some potential for HCW focused mental health mobile applications to be  
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41 developed and implemented though pandemics, however, the app design needs to centre HCWs needs  
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43 and use-case to overcome pre-existing reluctance to access mental health and wellbeing supports[1] and  
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45 time limitations in pandemic conditions. Methods such as experience-based co-design become highly  
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47 relevant and central to the development of support interventions.[22 23]  
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54 The strength of this evidence synthesis is the breadth of search terms and the focus on studies only  
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56 reporting HCWs mental health outcomes. Existing reviews of interventions (e.g.[2 7 13 18]) cited useful  
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58 studies, and we acknowledge lessons learned from their work. The use of digital techniques in  
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60 responding to the COVID-19 pandemic provided an additional focus for the current review, as it aligned

with the wider research being undertaken by our team.[21] We were also able to extend the date range for the literature search through to June 2022, to capture the range of initiatives applied in light of accrued knowledge about the virus, vaccine efficacy, and HCWs' support preferences. Unlike previous reviews, the search extended to other pandemics apart from COVID-19 pandemic[3 18] and was solely focused on HCWs mental health.[14] A wide range of sources were searched including the EPPI-Centre's Living Systematic Map of the Evidence,[72] preprint servers, clinical trial registers and grey literature from reputable health sources. Outcomes were limited by the heterogeneity of and quality of the evidence, and we elected not to use a formal quality appraisal tool.

Reviews of interventions to improve HCW resilience[4] and decrease occupational stress[5] outside pandemics reported limited evidence with many studies lacking adequate numbers and longitudinal data which is mirrored in this review. In future, researchers should better report population and intervention details, ensure the studies are adequately powered and have a control condition. Our findings reflect concerns regarding waste in research and, particularly, COVID-19 research which have been raised elsewhere.[73 74] While large scale randomised controlled trials of HCW mental health support interventions may be unfeasible in a pandemic context, other study designs, such as the adaptive trial design utilised by Chen, et al. [28] would offer valuable information. In addition, real time data collection methods and monitoring using remote methods should be further evaluated for application in pandemics.

## Conclusion

HCW mental health support needs are clearly of increased prominence with 22 of the included studies conducted through COVID-19 and health organisations taking steps to address this challenge internationally. The next step is to develop proactive organisational responses that better align with HCWs' self-identified preferences for support. While individually focused supports are intuitively valuable, it can be counterintuitive to ignore potential systemic factors in HCW wellbeing, and place

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increased responsibility for mental health and wellbeing on an already burdened individual, with the unintended consequence of blame for a failure to maintain wellbeing. HCWs are highly time-pressured, facing huge workloads and could struggle to incorporate activities such as exercise or mindfulness. In this context, the importance of experience-based co-design methods to support HCW mental health and wellbeing must be emphasised as it seeks to understand the needs of end-users and co-produce methods and modalities to best address identified needs. Through deep engagement with HCWs we can gain an understanding of the work and life challenges they face through the pandemic and beyond in their lives; the challenges to their mental health and wellbeing; and the best ways that mental health and wellbeing can be supported.

peer review only

**Figure Legend:** Figure 1. Study Selection PRISMA 2020 flow diagram

For peer review only

**Contributors Statement**

VP and LB conceptualised the evidence review and synthesis. VP, LB, KRB and CG (health librarian) developed the search criteria, KRB and CG performed the searches. CG performed the updated search and wrote the Literature Synthesis Search Strategies. KRB, CG, VP and ML screened abstracts and manuscripts and extracted the data. JP supported data extraction. KRB analysed the data, with input from CG, VP, LB, ML, and AK. KRB drafted the manuscript with input from CG, VP, LB, ML, AK, JP, MO and CJ. All authors (KRB, CG, VP, LB, ML, AK, JP, MO and CJ) read and revised the whole manuscript.

**Declaration of Interests**

No interests to declare.

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**Registration:**

The review was not registered and no protocol is available.

**Supplementary Material**

- Supplementary File 1: PRISMA 2020 checklist
- Supplementary File 2: Literature Synthesis Search Strategies.
- Supplementary Table 1: Characteristics of Studies.
- Supplementary Table 2: Mental Health Outcomes and Measures

## Data Sharing Statement

No additional data available.

## Ethics statements

### Participant consent

There were no participants. This is not applicable.

### Ethics approval

Institutional ethics was not required as this project does not involve human or animal participants.

For peer review only

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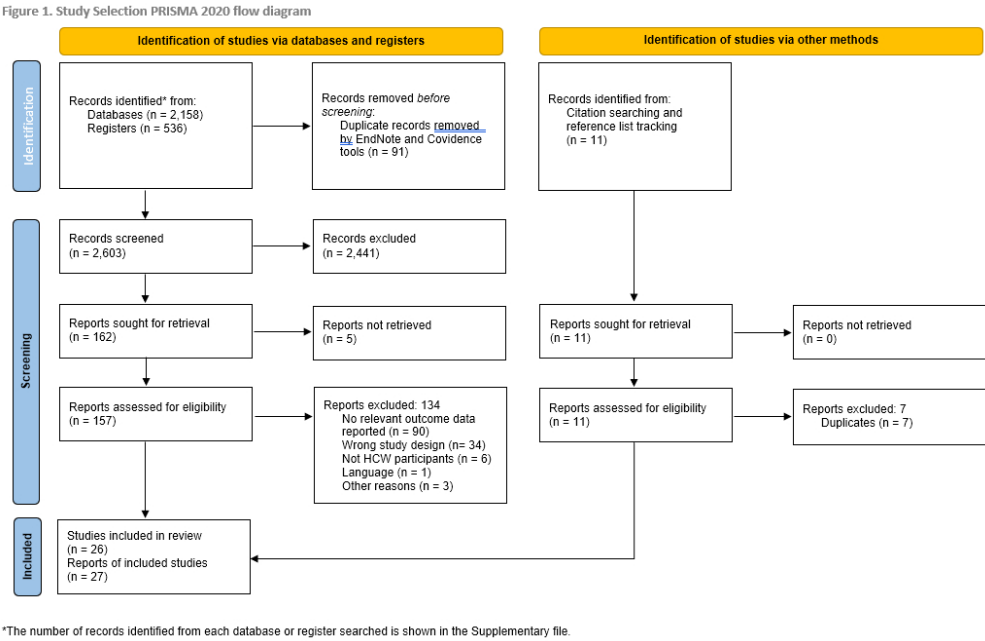


Figure 1. Study Selection PRISMA 2020 flow diagram

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# PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
<b>TITLE</b>			
Title	1	Identify the report as a systematic review.	P1
<b>ABSTRACT</b>			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	P2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	P5-6
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	P6
<b>METHODS</b>			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Table 2 & P9-10
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Table 1. P7
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Supplementary file 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	P9
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	P10
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	P8/9
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Table 3 Suppl Table 1 Suppl Table 2
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	n/a
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	n/a
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	P10
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	n/a
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	P9-10
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	P10
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	n/a
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	n/a





PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	n/a
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	n/a
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Figure 1; p10
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	n/a
Study characteristics	17	Cite each included study and present its characteristics.	Table 3 Suppl Table 1 Suppl Table 2
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	n/a
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Table 3 Suppl Table 1 Suppl Table 2
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Table 3 and p14-22
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	n/a
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	n/a
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	n/a
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	n/a
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	n/a
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	P23-24
	23b	Discuss any limitations of the evidence included in the review.	P25
	23c	Discuss any limitations of the review processes used.	P25
	23d	Discuss implications of the results for practice, policy, and future research.	P25-26
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	P28
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	P28
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	n/a
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	P1/28



## PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
Competing interests	26	Declare any competing interests of review authors.	P28
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	n/a

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71  
For more information, visit: <http://www.prisma-statement.org/>

Supplementary File 2. Literature Synthesis Search Strategies

Database: Ovid MEDLINER) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations and Daily <1946 to June 03, 2022> run on 6 June 2022:

1. exp Disease Outbreaks/
2. Epidemics/
3. Pandemics/
4. (outbreak\$ or pandemic\$ or epidemic\$).tw.
5. ebolavirus/
6. influenza, human/
7. severe acute respiratory syndrome/
8. pneumonia, viral/
9. coronavirus infections/
10. coronavirus/ or betacoronavirus/
11. exp influenzavirus a/ or exp influenzavirus b/ or influenzavirus c/
12. exp hemorrhagic fevers, viral/
13. ((avian or bird or fowl) adj5 (influenza or flu or plague)).tw.
14. (severe acute respiratory syndrome or SARS or coronavirus or Middle East respiratory syndrome or MERS-CoV).tw.
15. (coronavirus\$ or corona virus\$ or HCoV\$ or ncov\$ or covid\$ or sars-cov\$ or sarscov\$ or sars-coronavirus\$).tw.
16. ((h?emorrhagic or yellow or rift valley or lassa) adj3 fever).tw.
17. or/1-16
18. exp Stress, Psychological/
19. exp "behavior and behavior mechanisms"/
20. motivation/
21. exp Sleep Wake Disorders/
22. ((post-traumatic or posttraumatic or trauma\$) adj3 (disorder or neurosis or psychos\$)).tw.
23. (PTSD or traumati?ed or traumatic).tw.
24. (depress\$ or anxious\$ or anxiety or panic\$ or hysteria or stress\$).tw.
25. ((chronic adj2 fatigue) or suicid\$ or ((mood or mental) adj2 (disorder\$ or health))).tw.
26. (burnout or burn-out or cope\$ or coping or adaption or catastrophi?ing or depersonali?ation or resilience or empath\$ or hope\$ or anger or apath\$ or bereave\$ or grief or sadness or distress\$ or fear\$ or frustrat\$ or guilt or shame or hope\$ or loneliness or sadness or motivat\$ or confused or confusion or wellbeing or well-being).tw.
27. or/18-26
28. exp Health Personnel/
29. exp students, health occupations/
30. hospital volunteers/
31. ((emergency or frontline or front-line) adj5 (staff or employee\$ or personnel or professional\$ or worker\$ or workforce)).tw.
32. or/28-31
33. 17 and 27 and 32
34. ("2021" or "2022").dp.
35. ("2020 09" or 2020 10 or 2020 11 or 2020 12).dp.
36. 34 or 35
37. 33 and 36

Database: Cochrane Library (Cochrane Reviews, Cochrane Protocols, Cochrane Trials) <to June 06, 2022>

- #1 [mh "Disease Outbreaks"] 771
- #2 [mh ^Epidemics] 36
- #3 [mh ^Pandemics] 514
- #4 (outbreak\* or pandemic\* or epidemic\*):ti,ab,kw 8651
- #5 [mh ^ebolavirus] 37
- #6 MeSH descriptor: [Influenza, Human] explode all trees 2931
- #7 [mh ^"severe acute respiratory syndrome"] 371
- #8 [mh ^"pneumonia, viral"] 249
- #9 [mh ^"coronavirus infections"] 685
- #10 [mh ^coronavirus] OR [mh ^betacoronavirus] 131
- #11 [mh "influenzavirus a"] OR [mh "influenzavirus b"] OR [mh ^"influenzavirus c"] 955
- #12 [mh "hemorrhagic fevers, viral"] 518
- #13 ((avian:ti,ab OR bird:ti,ab OR fowl:ti,ab) NEAR/5 (influenza:ti,ab OR flu:ti,ab OR plague:ti,ab)) 184
- #14 ("severe acute respiratory syndrome":ti,ab OR SARS:ti,ab OR coronavirus:ti,ab OR "Middle East respiratory syndrome":ti,ab OR MERS-CoV:ti,ab) 5825
- #15 (coronavirus\*:ti,ab OR ("corona" NEXT virus\*):ti,ab OR HCoV\*:ti,ab OR ncov\*:ti,ab OR covid\*:ti,ab OR sars-cov\*:ti,ab OR sarscov\*:ti,ab OR sars-coronavirus\*:ti,ab) 11343
- #16 ((h?emorrhagic:ti,ab OR yellow:ti,ab OR "rift valley":ti,ab OR lassa:ti,ab) NEAR/3 fever:ti,ab) 469
- #17 {or #1-#16} 19869
- #18 [mh "Stress, Psychological"] 6817
- #19 [mh "behavior and behavior mechanisms"] 134793
- #20 [mh ^motivation] 5221
- #21 [mh "Sleep Wake Disorders"] 9191
- #22 (PTSD:ti,ab OR traumati?ed:ti,ab OR traumatic:ti,ab) 15571
- #23 (depress\*:ti,ab OR anxious\*:ti,ab OR anxiety:ti,ab OR panic\*:ti,ab OR hysteria:ti,ab OR stress\*:ti,ab) 158774
- #24 ((post-traumatic:ti,ab OR posttraumatic:ti,ab OR trauma\*:ti,ab) NEAR/3 (disorder:ti,ab OR neurosis:ti,ab OR psychos\*:ti,ab)) 4708
- #25 ((chronic:ti,ab NEAR/2 fatigue:ti,ab) OR suicid\*:ti,ab OR ((mood:ti,ab OR mental:ti,ab) NEAR/2 (disorder\*:ti,ab OR health:ti,ab))) 33067
- #26 (burnout:ti,ab OR burn-out:ti,ab OR cope\*:ti,ab OR coping:ti,ab OR adaption:ti,ab OR catastroph\*:ti,ab OR depersonali\*:ti,ab OR resilience:ti,ab OR empath\*:ti,ab OR hope\*:ti,ab OR anger:ti,ab OR apath\*:ti,ab OR bereave\*:ti,ab OR grief:ti,ab OR sadness:ti,ab OR distress\*:ti,ab OR fear\*:ti,ab OR frustrat\*:ti,ab OR guilt:ti,ab OR shame:ti,ab OR hope\*:ti,ab OR loneliness:ti,ab OR sadness:ti,ab OR motivat\*:ti,ab OR confused:ti,ab OR confusion:ti,ab OR wellbeing:ti,ab OR well-being:ti,ab) 94568
- #27 {OR #18-#26} 332151
- #28 [mh "Health Personnel"] 10379
- #29 [mh "students, health occupations"] 2019
- #30 [mh ^"hospital volunteers"] 3
- #31 ((emergency:ti,ab OR frontline:ti,ab OR front-line:ti,ab) NEAR/5 (staff:ti,ab OR employee:ti,ab OR personnel:ti,ab OR professional:ti,ab OR worker:ti,ab OR doctor:ti,ab OR nurse:ti,ab OR workforce:ti,ab)) 696

#32 {OR #28-#31} 12834  
#33 #17 AND #27 AND #32 with Cochrane Library publication date Between Sep 2020 and Jun 2022, in Cochrane Reviews, Cochrane Protocols, Trials 65

Database: Web of Science Core Collection (14 June 2022)

1. TS=((mental or psychological or psychosocial or “psycho-social” or emotional) NEAR/3 (condition\* or health or care or condition or state or status or stability or instability))
2. TS=(((“post-traumatic” or posttraumatic or trauma\*) NEAR/3 (disorder or neurosis or psychos\* or syndrome)) or PTSD or traumati?ed or traumatic)
3. TS=(depress\* or anxious\* or anxiety or panic\* or hysteria or stress or (chronic NEAR/2 fatigue) or suicid\* or ((mood or mental) NEAR/2 (disorder\* or health)))
4. TS=(burnout or “burn-out” or cope or coping or adaption or catastroph?ing or depersonali?ation or resilience or exhaust\* or anger or apath\* or bereave\* or grief or sadness or distress\* or fear\* or frustrat\* or guilt or shame or loneliness or sadness or motivat\* or confusion or empathy or ((unable or difficult\*) NEAR/3 (sleep\* or focus\*)) or eagerness or enthusiasm or goodwill or hope\* or keen\* or resilie\* or toughness or volition or well-being or wellbeing or willing\* or willpower or wish\*)
5. #4 OR #3 OR #2 OR #1
6. TS=((clinical or healthcare or “health care” or (operating NEAR/3 (room or theat\* or department\*)) or hospital or laborator\* or biomedical or frontline or medical or surgical or pharmacy or social) NEAR/3 (auxilliar\* or practitioner\* or professional\* or provider\* or worker\* or personnel or dispenser\* or aides or workforce or consultant\* or technician\* or scientist\* or volunteer\*))
7. TS=(an?esthesiologist\* or an?esthetist\* or cardiologist\* or dermatologist\* or diabetologist\* or doctor\* or endocrinologist\* or epileptologist\* or gastroenterologist\* or (general NEAR/2 practitioner) or GP or geriatrician\* or gerontologist\* or gyn?ecologist\* or h?ematologist\* or (h?ematolog\* NEAR/2 specialist\*) or hepatologist\* or immunologist\* or (infectious NEAR/2 diseas\* NEAR/2 specialist\*) or intensivist\* or internist\* or medic or medics or neonatologist\* or nephrologist\* or neurologist\* or obstetrician\* or oncologist\* or ((cancer or malignancy) NEAR/2 specialist\*) or ophthalmologist\* or (orthop?edic NEAR/2 specialist\*) or orthop?edist\* or otolaryngologist\* or pathologist\* or p?ediatric\* or perinatologist\* or pharmacist\* or phlebologist\* or physiatrist\* or physician\* or podiatrist\* or psychiatrist\* or pulmonologist\* or radiologist\* or rheumatologist\* or surgeon\* or urologist\* or urogyn?ecolog\* or vaccinologist)
8. TS=(((“allied health” NEAR/3 (professional\* or personnel or staff\* or worker\* or practitioner\*)) or NMAHP\* or AHP\*)
9. TS=(nurs\* or midwife\* or midwives\* or (health NEAR/2 visitor\*) or chiropodist\* or podiatrist\* or dietitian\* or dietician\* or (hearing NEAR/2 aid\* NEAR/2 dispenser\*) or ((physical or occupational) NEAR/2 therapist\*) or orthoptist\* or paramedic\* or physiotherapist\* or psychologist\* or prosthetist\* or orthotist\* or radiographer\* or ((speech NEAR/2 language NEAR/2 (therapist\* or pathologist\*)) or SLT\*))
10. TS=((key or frontline or “front-line”) NEAR/3 (staff or worker\* or workforce or personnel or volunteer\* or professional\*))
11. #6 OR #7 OR #8 OR #9 OR #10
12. TS=(((health\* or disease\*) NEAR/5 (disaster\* or catastrophe\* or crises or crisis)) or outbreak\* or pandemic\* or epidemic\*)
13. TS=(chikungunya or cholera or smallpox or small pox or monkeypox or plague\*)

14. TS= (h?emorrhagic or yellow or rift valley or lassa or ebola or ebolavirus or hendra or zika NEAR virus\*)
15. TS=((avian or bird or fowl) NEAR/5 (influenza or flu or plague))
16. TS=((bacterial NEAR/2 meningitis)
17. TS= ("severe acute respiratory syndrome" or SARS or coronavirus or ((atypical or influenza or viral or virus) NEAR/3 (pneumonia or bronchopneumonia or infection)))
18. TS=(coronavirus\* or "corona virus\*" or ncov\* or covid\* or sars-cov\* or "sars-coronavirus\*")
19. #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18
20. TS=(intervene or intervention\*)
21. TS=(app or apps or digital\* or ehealth or e-health or mobile or platform\*)
22. #20 OR #21
23. #19 AND #11 AND #5
24. #22 AND #23
25. #23 AND #21
26. #23 AND #21 and 2022 or 2021 (Publication Years)

Database: PROSPERO International prospective register of systematic reviews, run on 7 June 2022

1. covid-19 or coronavirus or sars or pandemic or pandemics
2. worker or workers or professional or professionals or front or frontline
3. psychological or mental
4. #1 AND #2 AND #3

Database: Embase Classic+Embase on Ovid 1947-2021 Week 10 (run on 14 Mar 2021):

1. Exp \*Coronavirus infection/
2. Exp health care personnel/
3. Exp mental stress/
4. 1 and 2
5. 3 and 4
6. Limit 5 to yr="2020-Current"

Database: APA PsycInfo on Ovid 1806-March Week 2, 2021 (run on 14 Mar 2021):

1. Exp \*coronavirus
2. Exp health personnel/
3. Exp mental disorders/
4. Exp \*behavior disorders/
5. \*behavior problems/
6. 1 and 2
7. 3 or 4 or 5
8. 6 and 7
9. Limit 8 to yr=2000-Current
10. Limit 9 to English language

Database: CINAHL Complete (EBSCOHost) run on 14 March 2021 – Boolean/Phrase search (unless otherwise stated):

1. MW health personnel
2. Coronavirus or covid-19 or 2019-ncov
3. MW mental health

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- 4. MH mental disorders
- 5. SU MH “Behavioral and Mental Disorders+” (SmartText search)
- 6. MW Behavioral and Mental Disorders
- 7. MW Behavioral Disorders
- 8. S3 or S4 or S5 or S6 or S7
- 9. S1 and S2
- 10. S8 and S9
- 11. S10 limited to 20200101-20211231

For peer review only



Supplementary Table 1. Characteristics of studies

Author Year	Country	Pandemic	Aim	Intervention Description	Target Population	Study Design
Aiello, et al. [26]	Canada	Influenza	Describe development, implementations and results of resilience training prior to the emergency of the H1N1 influenza epidemic.	1 hour of in-person, group education session covering influenza, stress and coping. Organization-wide. Rolled out over 5 months.	1250 HCWs from 22 departments.	Post evaluation.
Amsalem, et al. [33]	USA	COVID-19	Assess the impact of a brief video intervention on increasing treatment seeking intentions among HCWs.	3 minute video of a female nurse describing difficulties with coping, anxiety and depression; her false assumptions about treatment and how she overcame these assumption.	350 HCWs who had evidence of anxiety, depression or PTSD.	3 arm RCT: Intervention group 1 watched video at baseline and again on day 14. Intervention group 2 watched video at baseline. Control group. Outcomes measured immediately pre-post, day 14 and day 30.
Beverly, et al. [39]	USA	COVID-19	Assess if a brief, tranquil immersive cinematic virtual reality (VR) simulation of a nature scene decreases stress in HCWs.	3 minute immersive VR involving a tranquil nature scene.	102 HCWs including direct care providers, indirect care providers, administrative/support staff.	Pre-post design
Blake, et al. [29] Blake, et al. [49]	UK	COVID-19	Survey (2020 paper) to gather healthcare workers views of wellbeing centres and support workers.	Wellbeing centres designed to be relaxing; offered opportunity for quiet time, social contact and emotional support. Initially open 8am-8pm everyday, after 9 weeks	Intervention open to all clinical, non-clinical, bank and volunteer staff at two acute hospital trusts, Interviews with 24	Descriptive survey. Qualitative semi-structured interviews



			Interviews (2021 paper) explored staff and providers views of supported wellbeing centres.	open 10am-4pm weekdays. Staffed by volunteer buddies provided training in psychological first aid (hospital staff whose usual role was reduced during the pandemic)	wellbeing centre users and operational staff (managers and wellbeing buddies).	
Chan, et al. [42]	Singapore	COVID-19	Supporting mental well-being of obstetric and gynaecology trainees through COVID-19.	Shift to virtual continuing medical education program (vCME)	44 obstetric and gynaecology trainees	Descriptive.
Chen, et al. [28]	Taiwan	SARS	Description of anxiety, depression, and sleep quality in nurses caring for SARS patient before and after a SARS prevention program.	In-service training regarding infection prevention measures, limiting work to 8h a day, and provision of nutritional supplements. Provision of adequate PPE. Mental health clinic for HCWs.	116 nurses in a designated SARS hospital during a SARS outbreak	Pre-post design. Four time points: T1- pre-caring for SARS patients; T2- 2 weeks post intervention; T3- 1 month post intervention; T4- 1 month after hospital no longer designated SARS hospital (3 months post intervention).
Cheng, et al. [32]	China	COVID-19	Examine whether a psychological support model for HCWs can promote positive emotions, maintain team work efficiency and prevent burnout.	Mental health support program with 5 components. 1. Psychometer - daily mood index. 2. Positive self-feedback training including daily mood broadcast, promotion of positive self-affirmation, encouragement to face difficulties positively and	155 HCWs including clinical and non-clinical staff, from a hospital in Shanghai who were sent to work in a hospital in Wuhan caring for COVID-19 patients for 6 weeks.	Descriptive

				<p>information about positive happenings.</p> <p>3. Peer-group psychological support and education including daily 1-hour online themed chat moderated by psychologist who posted mental health tips.</p> <p>4. Weekly Balint group, run by psychiatrist, 10-12 participants able to sign up to attend.</p> <p>5. Support team who responded to needs identified within the psychometer module and organised social events.</p>		
Cole, et al. [34]	Sierra Leone	Ebola	Evaluate effectiveness of CBT to former Ebola Treatment Centre (ETC) workers with clinical depression/anxiety.	Small group CBT by facilitators with 2 weeks of CBT training. 3-hours weekly for 6 weeks, supplemented by a workbook.	Former clinical and non-clinical ETC staff, with clinically significant anxiety and depression.	Descriptive with pre- and post-intervention measures. Completed 1 week prior and 2 weeks post-intervention.
De Kock, et al. [44]	UK	COVID-19	Collect preliminary evidence on use of digital psychological interventions to support HCWs psychological health during COVID-19.	Four week use of one of two digital wellbeing support apps. <b>App 1 My Possible Self (MPS):</b> NHS approved app, but not COVID-19 specific. Has modules on coping with anxiety and depression, improving sleep and happiness.	169 HCWs, clinical and non-clinical.	RCT three arms, two intervention arms one using MPS app and one using NHSHWBP app, and wait list control arm. Outcomes from baseline, 2 weeks (mid-point) and 4 weeks (completion).

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				<b>App 2 NHS Highland Wellbeing Project (NHSWBP)</b> Designed for NHS staff through COVID-19. Fictional nurse guided users through app. First 2 weeks focus on increasing happiness, resilience and wellbeing, second 2 weeks focus on managing low mood and anxiety. Users sent automated text to encourage engagement and includes links to 24-hr support.		
Dincer and Inangil [46]	Turkey	COVID-19	Investigate the effectiveness of the Emotional Freedom Technique (EFT) in the prevention of stress, anxiety, and burnout in nurses caring for COVID-19 positive patients.	EFT involves tapping points on the body corresponding to acupuncture points in Traditional Chinese Medicine to send the brain either activating or deactivating signals. <b>Intervention</b> – one 20 minute online session teaching participants EFT in groups of 5. <b>Control</b> – sit in calm and tranquil environment for 15 minutes	80 hospital nurses caring for COVID positive patients	Pilot RCT two arms, intervention and control  Outcomes immediately pre-post intervention.
Fiol-DeRoque, et al. [43]	Spain	COVID-19	Evaluate effectiveness of PsyCovidApp in decreasing depression, anxiety, stress, post-traumatic stress, burnout, insomnia and improving self-efficacy in HCWs	PsyCovidApp. Based on CBT and mindfulness. Four content areas, emotional skills, healthy lifestyle, work stress and burnout, and social supports. Users completed daily questionnaire with tailored	482 HCWs from any specialty or role providing care to COVID-19 patients. Hospital and non-hospital HCWs included.	Two arm RCT Intervention group accessed PsyCovidApp for 2 weeks. Control group accessed a control

			during the COVID-19 pandemic.	information and resources offered in response to the questionnaire.		app that offered brief mental health information for HCWs for 2 weeks. Outcomes from pre-intervention and within 1-10 days of completing the intervention.
Giordano, et al. [52]	Italy	COVID-19	Investigate influence of music therapy (MT) and guided imagery on reducing reduce stress and improving wellbeing in HCWs caring for COVID-19 patients.	5 week program: participants listened to a 15-20 minute long playlist in a comfortable space and sit with eyes closed focusing on an image or colour, breathing slowly. Week 1: participants given three generic playlists (breathing and energy). Following weeks (for 4 weeks): music therapists interviewed participants about listening experiences and developed personalised playlists (breathing, serenity and energy) in response to their feedback.	34 HCWs caring for COVID-19 patients.	Descriptive with pre- and post-interventions measures.
Ha, et al. [50]	Korea	COVID-19	Develop a mobile wellness program to promote physical activity and sleep quality among nurses with rotating shifts during the COVID-19 pandemic.	12 week mobile wellness program with participants given a Fitbit along with twice weekly one hour online, live, exercises sessions 30 minute pre-recorded exercise videos that could be viewed anytime, weekly health coaching that	57 nurses who worked rotating shifts in medical or surgical wards during the COVID-19 pandemic.	Cluster randomised two arm RCT. Intervention group received the Fitbit and the mobile wellness program, control group received only a Fitbit.

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				included short-term and long-term goal setting, and motivational text messages encouraging goal setting. Weeks 1-6 participants with less than 10,000 steps/day, instructed to reach 10,000 steps/day and those at 10,000/day to maintain this. Weeks 7-12 participants instructed to increase their step count by 1,000 steps/fortnight.		Data collect pre- and post-intervention.
Hong, et al. [31]	China	COVID-19	Supported COVID-19-related stress and immediate psychological impact among HCWs in the fever clinic.	Stress management included practical support (provision of accommodation while working and during 2-week quarantine, food, PPE, adjusted hours and infection prevention training) + psychological support hotline available 9am-9pm daily.	105 participants, 37 in first group and 68 in second, who worked for 2-3 weeks in a fever clinic during COVID-19 pandemic.	Mixed methods with interview and survey post-design.  Completed via phone during 2-week quarantine.
Kameno, et al. [30]	Japan	COVID-19	Detect individuals at high risk of mental health problems and provide them with brief, individual, psychotherapy.	30-60 minute individual psychotherapy sessions provided by a specialist nurse.	31 nurses caring for COVID-19 positive inpatients.	Pre-post design.  Outcomes at 3 time points: baseline, 4 weeks and 8 weeks.
Maunder, et al. [27]	Canada	Influenza	Develop pre-pandemic training to improve satisfaction with support and training, coping,	Computer assisted pre-pandemic training course, known as Pandemic Influenza Stress Vaccine, included audio	Open to all hospital staff. 265 enrolled.	Dose-finding using pre-post design, with participants randomised to

			pandemic-related self-efficacy and interpersonal problems. To establish the ideal course duration.	and video lectures on pandemics and working outside your comfort zone as well as relaxation skills and self-assessment modules. Three course durations, 1.75hr, 3hr, 4hrs.		different doses. No control group.
Nourian, et al. [48]	Iran	COVID-19	Explore effect of online mindfulness based stress reduction (MBSR) on sleep quality of nurses working on COVID-19 wards in Tehran.	7 week online MBSR program. Participants sent exercises weekly to complete. Logbooks to record experiences and meditations regarding the exercises. Program included audio meditations, videos of yoga exercises, readings about mindfulness, audio/video by experts about mindfulness.	44 nurses working on COVID-19 wards.	Two arm RCT. <b>Intervention:</b> received MBSR program; <b>Control:</b> received music files or training on caring for COVID-19 patients. Outcomes immediate pre-post intervention.
Osman, et al. [37]	Sth Africa	COVID-19	Investigate impact of brief online mindfulness based intervention (MBI) on stress, burnout and mindful awareness among HCWs and trainees during the COVID-19 pandemic.	Weekly 1hr online mindfulness sessions delivered over 4 weeks with two facilitators.	HCWs and healthcare students in Sth Africa during COVID-19. Included hospital and non-hospital based participants.	Mixed methods pre - and post-intervention qualitative and quantitative data.
Sun [40]	China	COVID-19	Provide management objective evidence to develop psychological care policy for nurses and reference the efforts made to improve medical practitioners' mental	16-week intervention. Time management training 40 minutes weekly for 8 weeks; Balint group 1 hour 1-2 times a week for 8 weeks. Time management training included setting up the correct concept	66 nurses from three Shanghai hospitals, who had previously participated in a survey of 500 nurses regarding mental	Two arm RCT <b>Intervention</b> received time management training and Balint group.

			health during the epidemic.	of time value, improving awareness of cherishing time, discussing ideas and plans for life and exploring methods to realise dreams.	health during COVID-19.	<b>Control group</b> no intervention. Measured immediately pre-post intervention.
Thimmapuram, et al. [47]	USA	COVID-19	Investigate brief, virtual, heart-based audio meditation program improved sleep and loneliness in HCWs during the COVID-19 pandemic.	Heartfulness meditation practice. Intervention group listened to six-minute audio meditation sessions twice a day for 4 weeks. Morning meditation focussed on relaxation and evening on rejuvenation.	155 HCWs from four hospitals in the USA.	Two arm RCT. <b>Intervention:</b> mindfulness; <b>Control:</b> usual practice. Outcomes measured immediately pre-post intervention.
Trottier, et al. [51]	Canada	COVID-19	Assess the feasibility, acceptability, and initial efficacy of RESTORE.  RESTORE aimed to decrease: 1. social isolation and withdrawal from positive activities; 2. avoidance related to extremely stressful or traumatic events; 3. negative thinking about extremely stressful or traumatic events.	RESTORE is an online, guided, intervention developed for COVID-19 built around CBT to support HCWs that experienced trauma or high stress. It covers 8 modules	HCWs on frontline of COVID-19 pandemic. HCWs responding to advertisement. 21 commenced the program and 12 completed to +1month follow-up	Single group repeated measures. Outcome measures baseline; mid intervention; end-of-intervention; +1 month.
Wu and Wei [35]	China	COVID-19	Understand impact of COVID-19 on psychological factors and sleep status of HCWs; assess effects of an exercise intervention on	Exercise prescription. No further details regarding nature of the intervention.	60 HCWs at a designated COVID-19 hospital and 60 at a non-designated hospital.	Observation between group comparison. Unclear when questionnaires completed.

			HCWs' psychological stress and sleep.			
Yıldırım and Çiriş Yıldız [45]	Turkey	COVID-19	investigate effects of mindfulness based breathing and music therapy practice on stress, work related strain and psychological well-being levels among nurses caring for patients with COVID-19.	Single 30 minute online, small group session. Participants told breathing would decrease stress and calm the body and mind, after which led through a mindfulness-based breathing exercise, incorporating visualisation techniques, while listening to quiet piano music.	104 nurses caring for COVID-19 patients who had not undertaken a course or developed a practice for coping with anxiety, strain and/or stress.	Two arm RCT <b>Intervention:</b> online session; <b>Control;</b> passive relaxation for 30 minutes. Outcomes immediately pre-post intervention.
Zhan, et al. [36]	China	COVID-19	Evaluate impact of Tai Chi program on sleep quality and anxiety in HCWs.	Two week, daily, online 30 minute Tai Chi. Intervention group completed 6 pretraining sessions and an exam in the three days before the course. Control group did two week, daily 30 minute sessions of relaxation training and exercise.	HCWs in designated COVID-19 hospital with direct/indirect patient contact. 50 participants, 25 in each group.	Two Arm RCT  Outcomes at baseline, day 7 and day 14.
Zhou, et al. [41]	China	COVID-19	Develop and evaluate training program for nurses working on COVID-19 ward.	Mix of online and in-person training included information about diagnosis, infection prevention and psychological support. Psychological support included a mindfulness decompression workshop and individual psychology support.	71 nurses working on COVID-19 isolation wards.	Descriptive with pre- and post-intervention surveys.  Outcomes immediately pre-post intervention.



Zingela, et al. [38]	Sth Africa	COVID-19	Develop and evaluate psychological preparedness program for HCWs across 3 hospitals in response to the COVID-19 pandemic.	A 60-90 minute, in-person, session that covered mind care, relaxation techniques and team care. Sessions delivered by 2-3 facilitators who were Psychiatry employees.	761 HCWs out of 3,000 employees, from 3 hospitals	Descriptive Outcomes immediately pre-post intervention.
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Supplementary Table 2. Mental Health Outcomes and Measures

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
Aiello, et al. [26]	8 question, 5 point Likert scale. Includes 1 baseline question regarding confidence in preparedness to face a pandemic and 1 question regarding feeling better able to cope in the event of a pandemic following the session.	1020 (82%) returned evaluation form; 70% worked during 2003 SARS outbreak; 70% had prior infection control training for pandemic influenza.	Confidence to deal a pandemic increased from 35% to 76% of sample.	
Amsalem, et al. [33]	3 openness to seeking help questions from Attitudes Towards Seeking Professional Psychological Help Scale (ATSPPH-SH). Mental health measures only at baseline: GAD-7; PHQ-9; Primary Care PTSD Screen.	Intervention Group 1 - 115 baseline and 93 at day 30 Intervention Group 2 - 114 baseline and 93 at day 30 Control - 121 at baseline and 94 at day 30.	<b>Baseline to day 30:</b> intervention significantly increased help-seeking intentions compared to controls. Larger impact in Group 1 than Group 2. <b>Day 14:</b> Group 1 had increased intention to seek treatment compared to immediately post-intervention, this was not the case for Group 2.	<b>ATSPPH-SH Baseline</b> Group 1 7.9 (CI 7.3-8.4) Group 2 7.9 (CI 7.9-8.8) <b>ATSPPH-SH immediately post-intervention</b> Group 1 9.2 (CI 8.7-9.7) Group 2 9.4 (CI 9.0-9.7) <b>ATSPPH-SH 30 days post</b> Group 1 9.7 (CI 9.3-10.1) Group 2 9.1 (CI 8.6-9.5)
Beverly, et al. [39]	Subjective stress visual analogue scale (VAS) range 1-10, immediately pre-post intervention. Scores $\geq 6.8$	Convenience sample of 102 participants	Significant post-intervention decrease in mean perceived stress and reduction in people reporting high stress (32.4% vs 3.5%). Those with high stress at	<b>Pre-simulation VAS</b> 5.9 SD 2.2 <b>Post-simulation VAS</b> 3.0 SD 1.8

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	correlate with high stress on the Perceived Stress Scale.		baseline had greater decrease in stress post-intervention.	
Blake, et al. [29] Blake, et al. [49]	Warwick Edinburg Mental Wellbeing Scale Utrecht Work Engagement Scale Four single item measures (Job stressfulness, Job satisfaction, Presenteeism, Turnover intentions) 12 questions about centre use. All conducted at single point in time. Semi-structured interviews	<b>Survey:</b> 819 completed - 94% aware of centres; 55.2% had accessed a centre.  <b>Interviews:</b> 24 interviews with centre users, buddies and those involved in operationalising the centres.	<b>Survey:</b> No difference in job stressfulness, job satisfaction, turnover intention and presenteeism between users and non-users. WEMWRS score and UWES score were higher in those who accessed the centre suggesting higher wellbeing and workplace engagement.  <b>Interviews:</b> Centres seen as essential support and source of pride in the NHS. They created a sense of normality and helped prevent the escalation of stress. Buddies valued being able to contribute. Challenges included opening hours, time needed to visit, staff located further away or who needed to wear PPE.	<b>UWES</b> Centre users 5.02 SD 1.14 Non-users 4.83 SD 1.15

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
Chan, et al. [42]	8 question survey; 3 wellbeing questions	28 trainees completed survey	75% of trainees agreed or strongly agreed that the vCME helped them cope with team segregation.	
Chen, et al. [28]	Zung's self-rating anxiety scale (SAS) Zung's self-rating depression scale (SDS) Pittsburgh sleep quality index (PSQI)	120 completed training and 116 returned questionnaires.	Mean anxiety decreased from moderate anxiety at T1 to m at T2 and T3 and no anxiety at T4. Mean depression decreased from moderate At T1 to mild at T2 and T3, and no depression at T4. Mean PSQI improved across the four time points, although the final report was still indicative of poor sleep.	<b>SAS</b> T1 60 SD 9.28 T2 51 SD 10.32 T3 50 SD 9.84 T4 46 SD 7.48 <b>SDS</b> T1 61 SD 12.62 T2 51 SD 11.94 T3 50 SD 10.60 T4 48 SD 10.76 <b>PSQI</b> T1 12 SD 3.83 T2 10 SD 3.43 T3 10 SD 3.77 T4 8 SD 2.75
Cheng, et al. [32]	Daily mood rating: Subjective Units of Feeling (SUF) scale (rates pleasure from 0-10); open questions	Over 6 weeks, completion of the daily mood rating ranged from 3 to 48 staff with a median of 16.	Daily mood ratings ranged from 7-9 over the 6 weeks. Daily mood index was related to the number of patients with severe	

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	about daily gain and daily challenge. Daily mood rating could be completed once every 24 hours. Follow-up survey 1 week after leaving Wuhan, while in quarantine.	124 team members completed follow-up survey, 27.4% of these had participated in a Balint group.	COVID-19 and the daily average gains. Self-reported gains increased over the study and self-reported challenges decreased.	
Cole, et al. [34]	GAD-7 PHQ9 Work and Social Adjustment Scale (WASAS)	253 former Ebola Treatment Centre staff	Significantly decreased anxiety, depression and functional impairment post-intervention. Anxiety remained in moderate range; depression moved from moderately severe to moderate; functional impairment moved from moderately severe to subclinical.	<b>GAD-7</b> T1 13.42 SD 0.49 T2 8.96 SD 0.47 <b>PHQ-9</b> T1 15.41 SD 0.66 T2 10.90 SD 0.61 <b>WASAS</b> T1 24.58 SD 0.96 T2 17.29 SD 0.89
De Kock, et al. [44]	PHQ-9 GAD-7 Warwick-England Mental Well-being Scale (WEBWBS) Secondary outcomes: Mental Toughness Index (MTI)	225 assessed for eligibility 169 randomised, 107 in final analysis 51 MPS app – 27 completed 60 NHSWBP app - 34 completed 60 control - 48 completed	Depression decreased for both MPS and NHSWBP compared to the control group; anxiety decreased in the NHSWBP decreased compared to control. Mental toughness increased in the NHSWBP and control group.	<b>GAD-7</b> MPS Baseline 7.16 SD 5.60 Midpoint 6.45 SD 5.03 Post 6.89 SD 5.71 <b>NHSWBP</b>

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	Gratitude Questionnaire (GQ)		All groups showed improvements in mental wellbeing and gratitude. Symptoms improved faster for the intervention groups compared to the control groups.	Baseline 7.77 SD 4.87 Midpoint 6.74 SD 4.69 Post 5.85 SD 3.66  <i>Control</i> Baseline 7.43 SD 5.10 Midpoint 7.35 SD 5.23 Post 6.72 SD 5.59  <b>PHQ-9</b> MCS Baseline 6.76 SD 5.04 Midpoint 5.74 SD 4.31 Post 5.18 SD 3.27  <i>NSWBP</i> Baseline 7.60 SD 4.31 Midpoint 7.23 SD 5.47 Post 5.68 SD 4.39  <i>Control</i> Baseline 7.80 SD 5.23 Midpoint 8.00 SD 5.06 Post 7.56 SD 6.25  <b>WMWBS</b> MCS

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				<p>Baseline 47.5 SD 10.2 Midpoint 50.3 SD 9.75 Post 48.7 SD 10.1</p> <p><b>NSWBP</b> Baseline 45.3 SD 8.65 Midpoint 46.9 SD 8.68 Post 48.2 SD 7.38</p> <p><b>Control</b> Baseline 44.3 SD 10.1 Midpoint 44.8 SD 10.4 Post 46.1 SD 11.1</p> <p><b>MHI</b> Baseline 40.7 SD 8.04 Midpoint 40.7 SD 9.10 Post 39.7 SD 9.80</p> <p><b>NSWBP</b> Baseline 39.3 SD 6.84 Midpoint 39.3 SD 9.55 Post 41.3 SD 8.33</p> <p><b>Control</b> Baseline 37.9 SD 9.81</p>



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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				Midpoint 36.8 SD 9.20 Post 39.10 SD 20.5  <b>GDS</b> Mean Baseline 27.3 SD 3.46 Midpoint 27.9 SD 3.63 Post 28.2 SD 4.23  <b>PHQ-9</b> Baseline 26.2 SD 3.35 Midpoint 27.1 SD 4.14 Post 27.1 SD 4.24  Control Baseline 26.7 SD 3.73 Midpoint 26.2 SD 4.30 Post 27.2 SD 3.72
Dincer and Inangil [46]	Subjective units of distress scale (SUD) State Anxiety Scale (SAS) Burnout Inventory (BAI)	80 assessed for eligibility 80 randomised, 3 withdrew and 5 did not attend session Final analysis 72 35 intervention 37 control	Intervention decreased stress, anxiety and burnout compared to controls. Decrease was clinically significant: mean SUD decreased from 7.82 to 2.58; mean anxiety decreased from 67.68 to 32.25 (a shift from moderate to mild anxiety);	<b>SUD</b> <i>Intervention</i> Pre 7.82 SD 1.33 Post 2.85 SD 1.21  <i>Control</i> Pre 7.48 SD 1.36 Post 7.40 SD 1.53

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
			burnout decreased from 3.62 to 2.48.	<p><b>SAS</b></p> <p><i>Intervention</i> Pre 67.68 SD 9.05 Post 32.25 SD 4.67</p> <p><i>Control</i> Pre 64.7 SD 8.05 Post 64.43 SD 7.68</p> <p><b>Burnout Inventory</b></p> <p><i>Intervention</i> Pre 3.62 SD 0.76 Post 2.48 SD 1.06</p> <p><i>Control</i> Pre 3.56 SD 0.72 Post 3.43 SD 0.76</p>
Fiol-DeRoque, et al. [43]	Primary outcome total score on DASS-21. Secondary outcomes: Subscales of DASS-21 Davidson Trauma Scale (DTS) Maslach Burnout Inventory (MBI) subscales emotional exhaustion (MBI EE), personal accomplishment	248 – intervention (27 did not complete) 234 – control (19 did not complete) Analysed according to intention to treat	No difference between the intervention and control groups on outcomes. Pre-determined sub-group analysis showed that intervention group participants taking psychotropic medication and/or accessing psychotherapy had a statistically significant decrease in DASS-21, in anxiety	<p><b>Total DASS-21</b></p> <p><b>Primary outcome overall score DASS-21</b></p> <p><i>Intervention</i> Pre 5.84 SD 3.85 Post 3.83 SD 3.21</p> <p><i>Control</i> Pre 6.14 SD 3.77 Post 4.27 SD 3.47</p>

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	(MBI PA), depersonalisation (MBI D) Insomnia Severity Index (ISI) General Self-Efficacy Scale (GSE)		and stress and insomnia subscales, compared to controls. Those on psychotropic medication showed decreased post-traumatic stress.	<b>PTSD</b> <i>Intervention</i> Pre 34.57 SD 23.47 Post 24.91 SD 20.41  <i>Control</i> Pre 36.91 SD 23.18 Post 26.36 SD 21.02  <b>MBI EE</b> <i>Intervention</i> Pre 23.27 SD 12.20 Post 19.43 SD 12.25  <i>Control</i> Pre 23.57 SD 12.34 Post 19.67 SD 12.91  <b>MBI PA</b> <i>Intervention</i> Pre 39.69 SD 6.43 Post 40.33 SD 6.31  <i>Control</i> Pre 39.59 SD 6.62 Post 39.54 SD 6.93

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				<p><b>MBI D</b></p> <p><i>Intervention</i></p> <p>Pre 4.69 SD 5.08</p> <p>Post 4.51 SD 4.96</p> <p><i>Control</i></p> <p>Pre 5.24 SD 5.41</p> <p>Post 4.78 SD 5.25</p> <p><b>ISI</b></p> <p><i>Intervention</i></p> <p>Pre 9.80 SD 6.19</p> <p>Post 8.07 SD 6.18</p> <p><i>Control</i></p> <p>Pre 10.16 SD 6.53</p> <p>Post 8.44 SD 6.68</p> <p><b>GSI</b></p> <p><i>Intervention</i></p> <p>Pre 32.42 SD 4.71</p> <p>Post 33.22 SD 4.65</p> <p><i>Control</i></p> <p>Pre 32.00 SD 4.73</p> <p>Post 32.54 SD 4.88</p>

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
Giordano, et al. [52]	MusicTeamCare-Q1 Likert Scale 0-10 rate feeling of tiredness, sadness, fear and worry. Completed prior to listening to the playlist and within an hour of listening. MusicTeamCareQ2 – questions evaluating the intervention, completed at the conclusion of the study.	34 participants (5 discontinued after two weeks)	Week 1: statistically significant decrease in all four measures for generic breathing playlist and generic energy playlist. In following weeks the customised breathing and serenity playlists showed statistically significant decreases in all measures other than tiredness; energy playlist showed statistically significant decrease in all four measures.	
Ha, et al. [50]	Daily step count Pittsburgh Sleep Quality Index Self-Efficacy for Exercise scale (SEE) Behavioural Regulation in Exercise Questionnaire (BREQ-2) Multidimensional Fatigue Sale (MFS) Wellness Index for Korean Workers scale (WIKW)	60 randomised, 3 withdrew from control group. Analysis 58 participants 30 intervention 27 control	At 12 weeks intervention group showed increased daily step counts; improvement on some of the PSQI subscales, improved intrinsic motivation to exercise and improved wellness. No difference in total PTSQI score or self-rated fatigue.	<b>Total PSQI</b> <i>Intervention</i> Pre 9.23 SD 3.18 Post 7.50 SD 2.95 <i>Control</i> Pre 8.73 SD 3.02 Post 8.53 SD 2.82 <b>SEE</b> <i>Intervention</i> Pre 2.74 SD 1.62 Post 3.47 SD 1.91 <i>Control</i> Pre 3.25 SD 1.82

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				<p>Post 2.90 SD 1.73</p> <p><b>BREQ-2</b></p> <p><i>Intervention</i></p> <p>Pre 3.26 SD 0.36</p> <p>Post 3.71 SD 0.44</p> <p><i>Control</i></p> <p>Pre 3.38 SD 0.63</p> <p>Post 3.45 SD 0.48</p> <p><b>MDI</b></p> <p><i>Intervention</i></p> <p>Pre 92.63 SD 14.61</p> <p>Post 87.37 SD 16.00</p> <p><i>Control</i></p> <p>Pre 94.83 SD 13.90</p> <p>Post 93.65 SD 19.00</p> <p><b>WIKWS</b></p> <p><i>Intervention</i></p> <p>Pre 2.89 SD 0.47</p> <p>Post 3.42 SD 0.55</p> <p><i>Control</i></p> <p>Pre 3.17 SD 0.42</p>

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				Post 3.26 SD 0.51
Hong, et al. [31]	Impact of Events Scale-Revised (IES-R) Source of distress measured with 18-item questionnaire developed during SARS. General Self-Efficacy Scale (GSES)	102 completed interview and questionnaires.	Top four sources of distress were the health of one's family/others, the virus spread, changes in work and one's own health.	IES-R median 3 (IQR 0-8). 6 participants score ≥20 GSES median 29.5 (SD 5.4). No relationship between GSES and IES-R.
Kameno, et al. [30]	Kessler Psychological Distress Scale (K6) 2 questions about sleep 1 about alcohol misuse 1 about appetite change.	31 nurses screened, 8 met cut off for high-risk and offered psychotherapy, 3 accepted. High-risk participants who received intervention were compared to high risk participants who did not.	Intervention significantly decreased psychological distress on K6; shifted from high-risk to low-risk; improved sleep and appetite. No change in alcohol misuse.	K6 Baseline K6 12 T2 (1 month later) K6 3 T3 (2 months later) K6 2
Maunder, et al. [27]	24-item Pandemic Self-Efficacy Scale (PSES) developed for the study to measure attitudes to working in a pandemic. Confidence in training and support using questionnaire developed for HCWs during SARS. Inventory of Interpersonal Problems (IIP-32)	265 enrolled, 158 commenced training, 120 completed training. Non-significant trend to higher drop-out as course duration increased.	Overall improvements in confidence in training, pandemic self-efficacy and interpersonal problems. No significant change in ways of coping.	PSES Pre 87.7 SD 12.6 Post 92.9 SD 12.9 IIP-32 Pre 31.4 SD 16.0 Post 27.6 SD 15.6  Confidence in Training Pre 32.6 SD 4.9 Post 33.8 SD 4.7

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	Ways of Coping Inventory (WCI)			<p><b>WCI problem solving</b> Pre 1.5 SD 0.5 Post 1.5 SD 0.7</p> <p><b>WCI seek support</b> Pre 1.5 SD 0.5 Post 1.4 SD 0.6</p> <p><b>WCI escape-avoidance</b> Pre 0.6 SD 0.5 Post 0.6 SD 0.5</p>
Nourian, et al. [48]	Pittsburgh Sleep Quality Index (PSQI)	44 enrolled, 41 in final analysis (2 did not complete intervention, 1 did not complete questionnaire.)	Intervention did not lead to improved PSQI total. Subscales regarding sleep quality, sleep latency and habitual sleep showed statistically significant improvements.	<p><b>PSQI</b></p> <p><i>Intervention group</i> Pre 9.90 SD 2.48 Post 9.33 SD 3.15</p> <p><i>Control group</i> Pre 9.40 SD 2.30 Post 10.60 SD 2.49</p>
Osman, et al. [37]	Mindful attention awareness scale (MAAS) Perceived stress scale (PSS)	65 enrolled 55 attended sessions 47 participants completed required assessments (46%	Post-intervention statistically significant decrease in perceived stress (remained moderate) and in the emotional	<p><b>MAAS</b> Pre 3.5 SD 0.83 Post 3.94 SD 0.75</p>



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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	Maslach Burnout Inventory (MBI) subscales emotional exhaustion (MBI EE), personal accomplishment (MBI PA), detachment (MBI D)	medical, 54% allied health) report on completers	exhaustion subscale of the MBI; significant increase in the personal accomplishment subscale.	<b>PS</b> Pr 21.1 SD 6.83 Post 15.26 SD 5.38 <b>MBI EE</b> Pr 10.3 SD 4.86 Post 8.89 SD 4.6 <b>MBI D (median and IQR)</b> Pr 2 IQR 0-4 Post 1 IQR 0-3 <b>MBI PA (median and IQR)</b> Pr 15 IQR 13-16 Post 16 IQR 14-17
Sun [40]	Symptom Checklist-90 Campbell Index of Well-being Work Stress Reaction Scale	35 – intervention 31 - control	Using paired t-test intervention group had significantly lower scores on both total and subscales of SCL-90 and the Work Stress Reaction. The Campbell Index of Well-being total score and subscale cores increased significantly. There	

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
			was no data regarding means for these results.	
Thimmapuram, et al. [47]	University of California Los Angeles Loneliness Scale (UCLA loneliness scale) Pittsburgh Sleep Quality Index (PSQI)	77 – intervention (41 completed questionnaires) 78 – control (58 completed questionnaires) 13 intervention participants listened to audio recordings ≤ once a week 9 listened 2-3 times a week 19 listened ≥ four times a week.	Intervention group demonstrated a decrease in loneliness and improved sleep quality.	<b>UCLA loneliness score</b> <i>Intervention</i> Pre 42.1 SD 9.71 Post 39.42 SD 9.01 <i>Control</i> Pre 42.22 SD 10.75 Post 41.15 SD 12.45 <b>PSQI</b> <i>Intervention</i> Pre 10.7 SD 3.84 Post 9.1 SD 2.99 <i>Control</i> Pre 9.41 SD 2.85 Post 8.87 SD 2.77
Trottier, et al. [51]	Generalised Anxiety Disorder scale (GAD-7) Patient Health Questionnaire-depression (PHQ9)	46 entered screening 28 eligible 22 consented 21 enrolled 12 completed all measures + 1 month follow-up.	Significantly reduced anxiety, depression and PTSD severity for completers and intention to treat analysis. Effect sizes at end of intervention ranged from 0.84 to 1.05 and at	<b>Results for intention to intervene sample N=21</b> <b>GAD-7</b> Pre 11.12 SD 5.32 Mid-point 8.06 SD 4.93 Post 4.99 SD 3.59

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	Posttraumatic Stress Disorder Checklist-5 (PCL-5) Two-item suicide screen drawn from National Institute of Mental Health's Ask Suicide- Screening Questions and Beck Scale for Suicidal Ideation Feasibility and acceptability measures	Presented data for completed as well as intention to treat analysis	+1month 1.26 – 1.58. Effect sizes largest for PTSD in completers and in intention to treat.	1 month post 1.93 SD 4.05  <b>PHQ-9</b> Pre 12.53 SD 6.15 Mid-point 9.54 SD 5.54 Post 6.54 SD 4.75 1 month post 3.54 SD 4.54  <b>PCL-5</b> Pre 34.17 SD 14.39 Mid-point 24.48 SD 11.44 Post 14.78 SD 10.44 1 month post 5.08 SD 10.19
Wu and Wei [35]	Symptom Checklist 90 (SCL-90) Zung's Self-rated Anxiety Scale (SAS) Zung's Self-rated depression Scale (SDS) Pittsburgh Sleep Quality Index (PSQI) PTSD Checklist-Civilian Version (PCL-C)	Intervention group 60 - COVID-19 hospital Control 60- non-COVID hospital.	State HCWs who exercised according to the exercise prescriptions generally had better psychological stress and sleep status than those who did not (no data provided).	
Yıldırım and Çiriş Yıldız [45]	State Anxiety Index (SAI)	52 in each arm.	Intervention significantly decreased stress and work-	<b>SAI</b> <i>Intervention</i>

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
	Work Related Strain scale (WRSS) Psychological Well-Being scale (PWBS)		related strain; significantly increased psychological wellbeing, compared to control group. SAI score decreased, but remained in the moderate range.	<p><b>WRSS</b></p> <p><i>Intervention</i></p> <p>Pre 51.86 SD 15.89 Post 42.96 SD 11.75</p> <p><i>Control</i></p> <p>Pre 51.28 SD 13.38 Post 50.36 SD 14.48</p> <p><b>PWBS</b></p> <p><i>Intervention</i></p> <p>Pre 42.03 SD 9.85 Post 37.32 SD 5.62</p> <p><i>Control</i></p> <p>Pre 41.55 SD 7.46 Post 40.71 SD 7.87</p> <p><b>PWBS</b></p> <p><i>Intervention</i></p> <p>Pre 39.84 SD 8.48 Post 46.76 SD 7.22</p> <p><i>Control</i></p> <p>Pre 41.34 SD 11.08 Post 41.61 SD 12.10</p>

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Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
Zhan, et al. [36]	Beck Anxiety Inventory (BAI) Pittsburgh sleep quality index (PSQI)	25 intervention (4 withdrawn); 25 control (3 withdrawn).	PSQI decreased significantly at days 7 and 14 intervention group scores indicate good quality sleep. BAI decreased significantly at day 7 but was non-significant at day 14	<b>BAI</b> <i>Intervention</i> Pre 26.14 SD 7.68 Day 7 24.30 SD 5.41 Day 14 23.82 SD 3.17 <i>Control</i> Pre 26.41 SD 12.19 Day 7 29.86 SD 11.64 Day 14 33.14 SD 13.73 <b>PSQI</b> <i>Intervention</i> Pre 5.48 SD 3.46 Day 7 3.60 SD 1.96 Day 14 4.18 SD 3.62 <i>Control</i> Pre 6.00 SD 3.79 Day 7 6.00 SD 3.07 Day 14 6.33 SD 3.84
Zhou, et al. [41]	Zung's Self-Rating Anxiety scale (SAS)  Zung's Self-Rating Depression scale (SDS)	71 nurses.	Statistically significant decrease in anxiety, improved depression but not significant.	Results for change pre-post intervention. <b>SAS</b> change -3.06 SD 10.54 <b>SDS</b>

Author Year	Outcome Measure/s	Participant numbers/retention	Mental health related results	Post Intervention Outcome Measures (mean and SD unless otherwise specified)*
				change -1.99 SD 16.21
Zingela, et al. [38]	26 item audit tool included questions about coping and anxiety.; reduced to 10-item due to wish not to burden participants.	192 completed pre-intervention survey 760 completed post-intervention survey.	Post-intervention participants felt increased ability to cope with and manage their reactions to the outbreak, increased ability to manage stress, increased ability to manage stress in others and increased ability to cope with anxiety.	

\*Results reported to the number of decimal places quoted by the author.