BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (http://bmjopen.bmj.com).

If you have any questions on BMJ Open's open peer review process please email info.bmjopen@bmj.com

BMJ Open

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

SCHOLARONE™
Manuscripts

BMJ

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1   **Interventions to support the mental health and wellbeing of frontline health care workers**

2   **in hospitals during pandemics: an evidence review and synthesis**

3   Authors: Kate Robins-Browne[1], Luke Burchill[2,3], Cecily Gilbert[4], Matthew Lewis[1,5], Caroline

4   Johnson[1,5], Meaghan L O'Donnell[6], Aneta Kotevski[2], Jasmine Poonian[7], Victoria J Palmer[1,5].

5   1. Primary Care Mental Health Research Program, Department of General Practice, Melbourne Medical
6   School, The University of Melbourne, Melbourne, Australia

7   2. Department of Medicine, The University of Melbourne, Parkville, Australia

8   3. Department of Cardiology, Royal Melbourne Hospital, Parkville, Australia

9   4. Centre for Digital Transformation of Health, The University of Melbourne, Melbourne, Australia

10   5. ALIVE National Centre for Mental Health Research Translation, Department of General Practice,
11   Melbourne Medical School, The University of Melbourne, Melbourne, Australia

12   6. Phoenix Australia, Department of Psychiatry, The University of Melbourne, Melbourne, Australia

13   7. Emergency Department, The Royal Melbourne Hospital, Melbourne, Victoria, Australia

14

15   **Corresponding Author:**

16   Professor Victoria Palmer

17   ALIVE National Centre for Mental Health Research Translation

18   Department of General Practice, Melbourne Medical School

19   The University of Melbourne,

20   780 Elizabeth St, Melbourne VIC, Australia 3010

21   Email: v.palmer@unimelb.edu.au

22

29

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

31

Abstract

Objective: Pandemics impact negatively on Health Care Workers' (HCWs) mental health and wellbeing causing additional anxiety, depression, moral distress and post-traumatic stress. A comprehensive review and synthesis of interventions to support HCW mental health and wellbeing through pandemics and their reported effectiveness was conducted. The use of digital components in the reported interventions was recorded. Data was extracted and synthesised.

Design: A narrative evidence synthesis was conducted using the Cochrane Criteria for synthesizing and presenting findings using other methods.

Data Sources: The Cochrane Library; key bibliographic databases; preprint sources; clinical trial registries; grey literature sources; and the EPPI-Centre Living Systematic Map of the Evidence were included in the search.

Eligibility criteria: Subject heading terms and keyword searches for 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 January 1st 2000 to March 11th 2021. No publication-type limit was used.

Data Extraction and synthesis: Manuscripts were assessed by two authors to determine eligibility and extract data. Data were extracted into tables that were refined by co-authors.

Results: 1,007 studies were identified and 31 met inclusion criteria. Included interventions were directed at the individual and/or organisational level and a large number responded to the COVID-19 pandemic. Many interventions included a digital component but mostly to deliver online training and support. Only one purposively designed mobile app was identified. Heterogeneity between studies meant that a systematic review as not possible.

2

1
2 54   **Conclusion:** Interventions are rapidly designed and implemented and few are comprehensively
3
4 55   evaluated. Tailored interventions are needed with process and outcome evaluation data reported to
5
6 56   identify effective supports for HCWs' mental health and wellbeing in pandemic settings.
7
8
9
10 57   **Abstract word count**: 282
11
12
...
60

For peer review only

1
2 58   **Article Summary**
3
4
5 59   **Strengths and limitations of this study**
6
7
8 60   - This is the most comprehensive review of interventions to support health care worker mental
9
10 61   health and wellbeing through pandemics that has been conducted to date.
11
12
13 62   - The review explored and a wide range of sources including key bibliographic databases, the
14
15 63   EPPI-Centre's Living Systematic Map of the Evidence 21, preprint servers, clinical trial registers
16
17
18 64   and grey literature from reputable health sources.
19
20
21 65   - The review outcomes were limited by heterogeneous research outcomes that were largely
22
23 66   descriptive, lacked appropriate outcome measures or used single group designs.
24
25
26 67
27

4

Introduction

Health care workers (HCWs) experience a high burden of mental distress[1] which increases through pandemics. 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, support for HCWs' mental health and wellbeing are becoming paramount.[5] Increased mental distress is 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] 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.[7 8] Australian HCWs have described intense stress associated with pandemic preparedness and the emotional costs of working in an environment where human contact is restricted.[9] [10] 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.[2 11 12] 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.[3] Evidence-based interventions supporting the short and long-term mental health of HCWs in pandemics are required.[12-15] Reviews have indicated an increased need for technological innovation and digital interventions following the COVID-19 pandemic.[16 17] 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.[16 18]

93 To address the need for HCW support during pandemics, we used an experience based co-design

94 method to develop, implement and evaluate a mobile app for Australian HCWs' working in the COVID-

95 19 pandemic.[19] This review of the published literature on mental health and wellbeing interventions

96 delivered for HCWs was conducted as part of the development and implementation process. We used

97 the Cochrane approach to evidence synthesis where meta-analysis is not appropriate and applied a

98 narrative evidence synthesis method.[20] The review addressed two questions: 1. What interventions have

99 been reported in recent pandemics, and have they been effective in improving the mental health and

100 wellbeing of HCWs?: And, 2. What mobile apps have been designed and implemented to support

101 HCWs' mental health and wellbeing during pandemics with performance, acceptability, and outcomes

102 reported?

103

104 **Method**

105 Heterogeneity in the study designs and a lack of common outcome measurements prohibited meta-

106 analysis. Following the narrative evidence synthesis method[20] the following combinations of resources

107 was searched to identify relevant publications (Table 1). A Prisma 2020 Checklist is included as

108 Supplementary File 1.

109 **Table 1.**

110 *Databases included in search strategy*

Resource type	Titles searched	Latest search date
Evidence summaries and guidelines	Cochrane Library;	11 Mar 2021
	Epistemonikos; Oxford COVID-19 Evidence;	18 Sep 2020
	NICE Rapid guidelines on COVID-19;	
	National COVID-19 Living Guidelines; VA	

6

	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

111

112 Evidence summaries and guidelines were searched using a combination of thesaurus terms (where

113 available) and keyword searches. Database search strategies used subject heading terms and keyword

114 searches for three key concepts: SARS-CoV-2 coronavirus (or similar infectious diseases) epidemics,

115 health workforce, and mental health support interventions. Searches were limited to English-language

7

116 items published from 2000. No publication-type limit was used. The detailed search strategy is included

117 in Supplementary File 2.

118 Reference lists of relevant items were checked, and forward citation searches were conducted to

119 discover related items. Grey literature sources and the websites of key health organisations were also

120 checked. The EPPI-Centre directly provided 468 citations assigned to the Mental Health Impacts

121 category from its Living Systematic Map of the Evidence[21]. COVID-19 subsets of three clinical trials

122 registers were examined to identify randomised controlled trials in progress at the time of conducting

123 the search. Specific study characteristics, such as type of intervention, length of follow-up and outcome

124 measures, were not used as criteria for initial selection.

125 From 1,007 publications identified, comprised of reviews and single studies, 327 items were screened

126 for inclusion using the criteria shown in Table 2.

127

128 **Table 2.**

129 *Manuscript inclusion and exclusion criteria for literature synthesis*

Inclusion	Exclusion
Pandemic or epidemics: SARS, MERS, H1N1 H7N9, COVID-19, Ebola	Pandemics prior to 1st 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 1st of January 2020 with the intention to	Interventions that had been proposed or recommended without having been implemented.

| improve HCWs' mental health and wellbeing in the pandemic setting | 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. |

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

1
2 145
3
4
5 146
6
7 147
8
9
10 148
11
12 149
13
14 150
15
16
17 151
18
19 152
20
21 153
22
23 154
24
25
26 155
27
28 156
29
30
31 157
32
33 158
34
35
36 159
37
38 160
39
40 161
41
42 162
43
44
45 163
46
47
48 164
49
50
51
52
53
54
55
56
57
58
59
60

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.[22-30] 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.[31-50] 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 quantitiatve 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.

10

165 **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**		
Pre-pandemic Interventions for Prevention and Preparedness								
Aiello, et al. [22]	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. [29]	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 (32.6 to 33.8), total inventory of interpersonal problems (IIPP-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		
During any contemporary pandemic with a primary focus on mental health related outcomes								
Chen, et al. [25]	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 T!: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. [27]	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 ≥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		

11

166	Wu and Wei [30]	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	Empirical report	No mobile app		
	Kameno, et al. [28]	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.	Hospital – 31 nurses	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	T1:+7-16 days; T2:+ 33-49 days; T3:+70-86 days post COVID-19 admission	Letter	No		
	During pandemic with a primary focus on uptake related outcomes								
	Blake, et al. [23]	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. [24]	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. [26]	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.

167

168 Two papers examined the development of an organisational approach to pandemic preparedness in a

169 Toronto based hospital based on their 2003 experience with SARS.[22] [29] An inter-professional

170 Psychological Pandemic Committee was formed to develop interventions to reduce HCW stress and

171 facilitate adaptation as a primary prevention. The aim was to support staff and to reduce absenteeism

172 through future pandemics. As a part of this program a computer-based educational intervention was

173 used as a "pandemic influenza stress vaccine" to deliver audio and video lectures on pandemics and

174 working outside your comfort zone as well as relaxation skills and self-assessment modules.[29] Several

175 course durations were offered and all led to improved Pandemic self-efficacy, confidence in training

176 and support but completion rates were higher with the shorter training programs. An additional face to

177 face education intervention was offered[22] focusing on coping principles and organisational and personal

178 resilience to increase confidence with results indicating a 41% increase in participants' confidence to

179 cope with pandemic induced situations. The absence of pre-training session data regarding perceived

180 ability to cope is a significant limitation of this study, and despite the proposition that HCWs who have

181 received specialised training are at lower risk of mental health problems during a pandemic[51-54] it was

182 not clear whether increasing HCWs' confidence in their ability to improved mental health outcomes

183 during or following a pandemic.

184

Interventions delivered during a pandemic

185

186 Five papers reported mental health outcomes following intervention delivery through a pandemic and

187 report positive impacts on mental health outcomes. However the reported data is limited or incomplete,

188 there are few studies with control groups and baseline data is not adequately reported to determine the

189 magnitude of any pre-post changes.

190 Chen et al.[25] described an intervention in a Taiwanese SARS designated hospital for nursing staff that

191 included an epidemic prevention plan with in-service training to minimise the risk of transmission when

13

192 caring for SARS patients, staff allocation to ensure appropriate shift lengths and time away from work,

193 adequate PPE supplies, and the establishment of a mental health team to provide direct staff support.

194 Participant mental health was assessed using Zung's self-rating anxiety scale (SAS[55]), Zung's self-

195 rating depression scale (SDS[56]) and the Pittsburgh sleep quality index (PSQI[57]) at four time points (see

196 Table 3). Of 120 nurses surveyed, 116 completed questionnaires at all four time points showing

197 decreased scores for mean anxiety (60 at T1; 46 at T4) and depression (61 at T1; 48 at T2) after the

198 implementation of the prevention programme. At baseline (T1) the mean scores on the SAS and SDS

199 indicated moderate anxiety and depression, which reduced to mild anxiety and depression at two weeks

200 (T2) and one month (T3) after the intervention, with no anxiety or depression at the final assessment

201 (T4). Progressive improvements in sleep quality were observed at each follow-up time, but sleep quality

202 remained poor on the PSQI. No control group was included making it difficult to determine whether

203 outcomes were affected by uncontrolled factors.

204 Two papers reported a multifaceted intervention delivered to HCWs in a COVID-19 fever clinic in a

205 Beijing tertiary hospital.[27] [58] The intervention aimed to improve stress management and protect the

206 physiological and psychological wellbeing of HCWs (including doctors, nurses and laboratory

207 technicians). To address concerns regarding SARS-CoV-2 transmission to family members, HCWs

208 were provided with accommodation during their rostered work days at the fever clinic and quarantine

209 period. Support was provided to family members where necessary. PPE and training to minimise

210 transmission risk were provided, along with adjustments to the work roster, and a telephone hotline,

211 staffed by psychiatrists and psychologists, was available from 9am-9pm seven days a week. The first

212 36 participants in the study completed the Patient Health Questionaire-9 (PHQ-9[59]) and the Maslach

213 Burn-out Inventory (MBI[60]) at the completion of their two weeks rostered onto the clinic.[58] Seven

214 HCWs met the PHQ-9 depression criteria 9 and 13 of 32 HCWs who completed the MBI, 13 met criteria

215 for burn-out (one - emotional, four - depersonalisation, and eight - professional burnout). The authors

216 suggested that these scores were lower than expected and therefore the intervention was effective. The

217 Impact of Events Scale-Revised (IES-R [61]) and a source of distress scale developed for use during the

14

218 SARS outbreak in Hong Kong[27] were completed by 102 HCWs in two batches with three HCWs from

219 each batch showing positive scores on the IES-R. The source of distress score was higher for the first

220 batch. Qualitative outcomes from the first batch were used to make improvements to the intervention,

221 and this may have coincided with improvements to COVID-19 knowledge and clinic activity. Both

222 papers did not report baseline or any control data making it difficult to interpret the true impact of the

223 intervention. The authors acknowledge that multiple factors impacted on HCW stress and that there

224 were no infections among participants during the study period, and that findings may not be

225 generalizable to other settings given clinic specific factors.[27 58]

226 One study reported that an exercise intervention improved stress and sleep quality in HCWs,[30] but

227 presented no data to support this. Their sample consisted of an "intervention" group of 60 frontline

228 HCWs from a designated COVID-19 hospital with a "control" group of 60 frontline HCWs drawn from

229 a non-COVID-19 designated hospital. Outcomes included the symptom check-list (SCL-90[62]), SAS,

230 SDS, PSQI and the PTSD Checklist Civilian Version.[63] A description of the intervention was not

231 provided and adherence to the exercise program or its impact was not described or included in the

232 analysis making it impossible to assess the efficacy of the intervention.

233 Kameno, et al. [28] reported on the delivery of a brief psychotherapy intervention (30-60 minutes long) to

234 31 ward nurses. Using the Six-Item Kessler Psychological Distress Scale,[64] eight participants were

235 identified as high risk and eligible for the intervention. Despite reporting a positive outcome, only three

236 of the eight who were invited to the intervention participated.

237

Uptake of interventions delivered during a pandemic

239 Intervention uptake was used as the key outcome of three larger scale studies who did not report mental

240 health outcomes.[23 24 26] Blake, et al. [23] reported the only mobile app based mental health support

241 intervention in this synthesis. The app was made available to all HCWs in the United Kingdom and

242 included content on the psychological impact of pandemics, psychologically supportive teams,

15

communication, social support, self-care and managing emotions. Fifty-five participants (49 employees and six students) completed a fidelity assessment one week after the intervention launched. Within the first week the package was accessed 17,633 times with over 50,000 exposures on social media. Over 80% of participants indicated they had used the information in their daily life and 100% believed they would continue to use it. Acceptability of app content was 100% and 100% of users said they would recommend it to others. None of the users said that time, technical or financial challenges impacted on their use of the app.

Geoffroy, et al. [26] developed a psychological support telephone hotline for clinical and non-clinical staff employed across 39 hospitals in France. The hotline was staffed by certified, volunteer psychologists who received brief (30 minute) training on crisis intervention who could on-refer when needed. In the first 26 days of operation there had been 149 calls (average 5.75/day) with an average call duration of 18 minutes. Eighty-six percent of callers were female and 19% were nurses. Most calls were from HCWs in frontline departments including the emergency department, intensive care unit, infectious diseases unit, COVID-19 units and the nursing school across 44 different departments. The most common reason for calling was anxiety which accounted for just under half the calls. Other reasons included being worried about COVID-19, exhaustion, trauma reactivation, insomnia, anger and depression.

Chen, et al. [24] presented an intervention involving a psychological intervention team who offered online courses in dealing with common psychological problems, a psychological assistance hotline, and group activities to reduce stress in a Chinese hospital. HCWs were reluctant to utilise the service, and 13 HCWs were interviewed to better understand needs. The interviews revealed that staff were not worried about their own infection risk, but had greater concerns for family infection and burden. Staff lacked confidence when dealing with uncooperative patients, were concerned about a lack of PPE, and felt incapable when caring for critically ill patients. HCWs described needing a place to rest, access to PPE, and to develop skills in dealing with patient psychological distress. The intervention was subsequently modified to provide staff with a place where they could rest, with guaranteed food and daily living

16

269 support. Work and daily life routines were videoed for their families, and pre-job training included skills

270 in dealing with psychological distress in patients. Security staff were made available to assist with

271 uncooperative patients, detailed PPE guidelines were developed, leisure activities provided, and

272 counsellors were available to staff. The authors indicated that HCWs were more engaged with the

273 modified intervention, however quantitative data was not reported.

274

Discussion

276 The COVID-19 pandemic has impacted all HCWs across the world, particularly those in hospital

277 settings. As successive waves of COVID-19 continue, it is essential that research evidence be rapidly

278 distilled to effectively support HCWs' mental health and wellbeing. The findings of this evidence

279 synthesis suggest that HCWs impacted by all contemporary pandemics value interventions that support

280 their practical needs (access to PPE, food and sleep) and those which ameliorate acute stressors

281 (infection risk and being separated from family). This is also reflected in recent reviews,[2][12] which

282 recommended and reviewed a range of individual, service, and societal strategies for reducing

283 psychological distress but emphasised a pressing need to determine their effectiveness. It has been

284 difficult to determine the true impact on the psychological health and wellbeing of HCWs from the

285 studies included in this evidence synthesis as studies were limited by pre-post study designs, small

286 samples and presented little to no baseline data to allow impact to be determined. Many interventions

287 have focused on individual behaviour and psychological change by fostering resilience to increase

288 coping skills and offering additional support to those in crisis, rather than addressing the factors HCWs

289 identify as important such as adequate PPE, family and social supports and clear communication.

290 The negative impact of pandemics on HCWs' mental health and wellbeing is indeed now well

291 established[2][3][65] and it is positive that interventions are being implemented to sustain the mental health

292 and wellbeing of HCWs. However, it is unclear how best to provide supports to HCWs in the hospital

293 setting. A preference has been identified for socially oriented interventions over psychotherapeutic

17

294 approaches.[3] Some interventions delivered at organisational levels have ensured adequate PPE supply

295 and clear communication, and offered psychological education, peer support programmes and

296 embedding mental health workers within a team or unit to support individuals.[24] Although mental health

297 interventions have been delivered to HCWs, few studies included outcome data and, where outcomes

298 are reported, they were often of low quality.

299 Generating evidence in pandemic settings is understandably complex[15] with interventions rapidly

300 implemented to support HCWs' mental health within the pandemic. This synthesis illustrates that

301 descriptions of these interventions often focus on their practical and operational characteristics which

302 can inform other institutions to develop their own pandemic response plans. In this process the reporting

303 of outcome data is limited which means that the effectiveness of interventions implemented to support

304 the mental health and wellbeing of HCWs remains unknown.

305 Two papers included outcome data on pre-pandemic interventions that were designed to improve HCW

306 resilience to decrease stress and mental health during a pandemic.[22 29] The observed positive outcomes

307 carry over to real world pandemic situations. Interestingly, the intervention with the strongest evidence

308 focused on organisational changes and staff education around minimisation of the risk of transmission,

309 rather than specific mental health focussed interventions.[25] This fits with conclusions reached by Muller,

310 et al. [3] that primary concerns for HCWs are PPE and the management of workload rather than individual

311 professional psychological support. There is a risk that through emphasising individual responsibility

312 for mental health, larger system and organisational level impacts are not regarded. Nonetheless, Blake,

313 et al. [23] and Geoffroy, et al. [26] indicated that HCWs will engage with individually directed supportive

314 interventions, but limited evidence exists regarding the effectiveness of these interventions for

315 improving mental health outcomes.

316 Digital components featured in many of the included studies with resources made available online or

317 through delivery of remote education and tele-health support. Some mobile apps were used for

318 communication purposes. Only one mobile app was identified in our searches designed specifically in

18

319 response to the COVID-19 pandemic aside from our study protocol.[23] Mobile apps can provide safe

320 intervention delivery during a pandemic where social/physical distancing can make in-person

321 interventions challenging, and app-based interventions can be scalable to the work force. A mobile app

322 may also reach those with severe symptoms of mental illness and those with subsyndromal responses.

323 Additionally, people who may feel stigmatised accessing helplines or professional services can receive

324 support in the privacy of own home or elsewhere. A mobile app could be designed to identify those who

325 are at higher risk of psychological distress and provide matched intervention options and could allow

326 individuals to retain their own mental health data and track their wellbeing over time. However, in the

327 design and development of mobile apps, personalised and tailored content will be essential to facilitate

328 greater engagement and uptake and engagement with the services or interventions provided within it.

329 Hence, this makes methods such as experience-based co-design highly relevant and central to the

330 development and implementation of such interventions.

331 The strength of this evidence synthesis is the breadth of search terms and studies included. Unlike

332 previous reviews, the search was not limited to studies conducted during the COVID-19 pandemic [3 16]

333 and was solely focused on health care worker focused interventions rather than also including wider

334 populations.[12] In addition to bibliographic databases, a wide range of sources were searched including

335 the EPPI-Centre's Living Systematic Map of the Evidence,[21] preprint servers, clinical trial registers and

336 grey literature from reputable health sources. The synthesis was limited by the descriptive nature of

337 many included studies and study designs that lacked comparator groups or adequate baseline and post-

338 intervention measures. Work is underway to address these shortcomings. The Battle Buddies

339 programme includes measures of burnout out and mental health syndromes at multiple time points,

340 including prior to the intervention.[66] Fukuti, et al. [67] are using mental health questionnaires at multiple

341 time points to determine risk and deliver targeted interventions. Mobile apps have significant potential

342 in this space, however effectiveness studies will be essential. Evidence regarding the effectiveness of

343 mobile apps for HCWs' mental health outside of the pandemic setting, such as the SHIFT app study,[68]

19

344   may also advance the field of research further. This synthesis should be updated once these studies are

345   completed.

346   Reviews of studies intended to improve HCW resilience[4] and decrease occupational stress[5] outside

347   pandemics demonstrated a lack of evidence with many studies lacking adequate numbers and

348   longitudinal data which is amplified in pandemic settings. Authors and publishers of future studies could

349   better report population and intervention details. Concerns regarding waste in all research and in

350   particular in COVID-19 research have been raised elsewhere.[69 70] Our findings reflect these concerns.

351   While randomised controlled trials of HCW mental health support interventions may be unfeasible in a

352   pandemic context, other study designs, such as the adaptive trial design utilised by Chen et al [25] would

353   offer valuable information. In addition, real time data collection methods and monitoring using mobile

354   methods should be further evaluated for application in pandemics.

355   This evidence synthesis has shown that the efficacy of existing interventions to support the mental health

356   and wellbeing of HCWs is unable to be determined. Descriptive studies and single group designs are

357   common, and while it is heartening that efforts are being made to support HCW wellbeing, efficacy

358   cannot be determined from these study designs. In this context the importance of experience-based co-

359   design methods to develop interventions to support HCW mental health and wellbeing must be

360   emphasised as it becomes vital that the needs of end-users and the best methods and modalities to meet

361   these needs are understood. Through deep engagement with HCWs we can gain an understanding of

362   the work and life challenges they face through the pandemic; the challenges to their mental health and

363   wellbeing; and the best ways that mental health and wellbeing can be supported.

364   Despite recognition of the impact pandemics have on HCWs' mental health relatively few attempts have

365   been possible to develop evidence-based interventions to address this problem. Many interventions

366   focus on individuals and increasing individual coping skills and offering additional support to those in

367   crisis, rather than addressing the factors HCWs identify as important such as adequate PPE, family and

368   social supports and clear communication. Future studies should offer interventions that reflect HCWs'

20

1
2 369 self-identified needs and preferences, and the effectiveness of these should be measured using pre-
3
4 370 specified outcomes.
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

21

1
2 371
3
4
5 372   **Figure Legend:** Figure 1. PRISMA 2020 flow diagram for new reviews which included searches of
6
7 373   databases, registers and other sources
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

22

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 me 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.

Funding source

This research was funded by a grant from the Australian Government Department of Health, the Peter Doherty Philanthropic Trust Fund, the Royal Melbourne Hospital, and the University of Melbourne. The funding bodies had no role in study design, data collection, data analysis, data interpretation, or writing of the manuscript. The corresponding author has full access to all the data in the study and had final responsibility for the decision to submit for publication.

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.

23

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.

24

References

407

408 1. Petrie K, Crawford J, Baker STE, et al. Interventions to reduce symptoms of common mental
409 disorders and suicidal ideation in physicians: a systematic review and meta-analysis. The Lancet
410 Psychiatry 2019;6(3):225-34. doi: https://doi.org/10.1016/S2215-0366(18)30509-1

411 2. Kisely S, Warren N, McMahon L, et al. Occurrence, prevention, and management of the
412 psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-
413 analysis. BMJ 2020;369:m1642. doi: 10.1136/bmj.m1642 [published Online First: 2020/05/07]

414 3. Muller AE, Hafstad EV, Himmels JPW, et al. The mental health impact of the covid-19 pandemic
415 on healthcare workers, and interventions to help them: A rapid systematic review. Psychiatry
416 Research 2020;293:113-441. doi: https://doi.org/10.1016/j.psychres.2020.113441

417 4. Kunzler AM, Helmreich I, Chmitorz A, et al. Psychological interventions to foster resilience in
418 healthcare professionals. Cochrane Database of Systematic Reviews 2020(7) doi:
419 10.1002/14551858.CD012527.pub2

420 5. Ruotsalainen JH, Verbeek JH, Marine A, et al. Preventing occupational stress in healthcare
421 workers. Cochrane Database of Systematic Reviews 2015(4) doi: 10.1002/14651858.CD002892.pub5

422 6. Albert CM, Andreotti G, Bala B, et al. Risk of COVID-19 among front-line health-care workers
423 and the general community: a prospective cohort study. The Lancet Public Health 2020;5(9):e475-
424 e83. doi: 10.1016/S2468-2667(20)30164-X

425 7. Greenberg N, Docherty M, Gnanapragasam S, et al. Managing mental health challenges faced by
426 healthcare workers during covid-19 pandemic. BMJ 2020;368:m1211. doi: 10.1136/bmj.m1211 %J
427 BMJ

428 8. Jack T, Bryan D-W, Gary L. Psychosocial Support for Healthcare Workers During the COVID-19
429 Pandemic. Frontiers in Psychology 2020;11 doi: 10.3389/fpsyg.2020.01960

430 9. Lokuge A. A Doctor Asks: Is Covid Scaring Us Away From Our Humanity? [Letter]. New York:
431 Sulzberger, Arthur Greeg; 2020 [updated 28th August 2020. Available from:
432 https://www.nytimes.com/2020/08/28/world/australia/melbourne-covid-
433 doctor.html?searchResultPosition=3 accessed 1st November 2020.

434 10. Lokuge A. Racing Against the Virus from Inside Australia's Healthcare System [Letter]. New
435 York: Sulzberger, Arthur Gregg; 2020 [updated 1st May 2020. Available from:

25

436 https://www.nytimes.com/2020/05/01/world/australia/hospitals-coronavirus-response.html accessed

437 1st November 2020.

438 11. Pollock A, Campbell P, Cheyne J, et al. Interventions to support the resilience and mental health

439 of frontline health and social care professionals during and after a disease outbreak, epidemic or

440 pandemic: a mixed methods systematic review. Cochrane Database of Systematic Reviews 2020(11)

441 doi: 10.1002/14651858.CD013779

442 12. Yue J-L, Yan W, Sun Y-K, et al. Mental health services for infectious disease outbreaks including

443 COVID-19: a rapid systematic review. Psychological Medicine 2020;50(15):2498-513. doi:

444 10.1017/S0033291720003888 [published Online First: 2020/11/05]

445 13. American Medical Association. Caring for our caregivers during COVID-19 2020 [updated 17th

446 June. Available from: https://www.ama-assn.org/delivering-care/public-health/caring-our-caregivers-

447 during-covid-19 accessed 3rd November 2020.

448 14. World Health Orgnization. Mental health and psychosocial considerations during the COVID-19

449 outbreak. 2020 [updated 18 March. Available from: https://www.who.int/docs/default-

450 source/coronavirus/mental-health-considerations.pdf?sfvrsn=6d3578af_2 accessed 3rd November

451 2020.

452 15. Yang L, Yin J, Wang D, et al. Urgent need to develop evidence-based self-help interventions for

453 mental health of healthcare workers in COVID-19 pandemic. Psychological Medicine

454 2021;51(10):1775-76. doi: 10.1017/S0033291720001385 [published Online First: 2020/04/28]

455 16. Drissi N, Ouhbi S, Marques G, et al. A Systematic Literature Review on e-Mental Health

456 Solutions to Assist Health Care Workers During COVID-19. Telemedicine journal and e-health : the

457 official journal of the American Telemedicine Association 2021 (epub 2020);27(6):594-602. doi:

458 10.1089/tmj.2020.0287 [published Online First: 2020/09/25]

459 17. Moreno C, Wykes T, Galderisi S, et al. How mental health care should change as a consequence

460 of the COVID-19 pandemic. The Lancet Psychiatry 2020;7(9):813-24. doi: 10.1016/S2215-

461 0366(20)30307-2

462 18. Chang BP, Kessler RC, Pincus HA, et al. Digital approaches for mental health in the age of

463 COVID-19. British Medical Journal 2020;369:m2541.

464 19. Lewis M, Palmer VJ, Kotevski A, et al. Rapid Design and Delivery of an Experience-Based Co-

465 designed Mobile App to Support the Mental Health Needs of Health Care Workers Affected by the

26

466   COVID-19 Pandemic: Impact Evaluation Protocol. JMIR Res Protoc 2021;10(3):e26168. doi:

467   10.2196/26168

468   20. McKenzie J, Brennan S. Chapter 12: Synthesizing and presenting findings using other methods.

469   In: Higgins J, Thomas J, Chandler J, et al., eds. Cochrane Handbook for Systematic Reviews of

470   Interventions Version 6-2 (updated February 2021): Cochrane, 2021.

471   21. EPPI Centre. COVID-19: a living systematic map of the evidence United Kingdom: EPPI Centre;

472   2020 [Available from:

473   http://eppi.ioe.ac.uk/cms/Projects/DepartmentofHealthandSocialCare/Publishedreviews/COVID-

474   19Livingsystematicmapoftheevidence/tabid/3765/Default.aspx accessed 18th September 2020.

475   22. Aiello A, Khayeri MY, Raja S, et al. Resilience training for hospital workers in anticipation of an

476   influenza pandemic. Journal of Continuing Education in the Health Professions 2011;31(1):15-20.

477   23. Blake H, Bermingham F, Johnson G, et al. Mitigating the Psychological Impact of COVID-19 on

478   Healthcare Workers: A Digital Learning Package. International Journal of Environmental Research &

479   Public Health [Electronic Resource] 2020;17(9):26.

480   24. Chen Q, Liang M, Li Y, et al. Mental health care for medical staff in China during the COVID-19

481   outbreak. The Lancet Psychiatry 2020;7(4):e15-e16. doi: 10.1016/s2215-0366(20)30078-x

482   25. Chen R, Chou K-R, Huang Y-J, et al. Effects of a SARS prevention programme in Taiwan on

483   nursing staff's anxiety, depression and sleep quality: A longitudinal survey. International Journal of

484   Nursing Studies 2006;43(2):215-25. doi: 10.1016/j.ijnurstu.2005.03.006

485   26. Geoffroy PA, Le Goanvic V, Sabbagh O, et al. Psychological Support System for Hospital

486   Workers During the Covid-19 Outbreak: Rapid Design and Implementation of the Covid-Psy Hotline.

487   2020;11(511) doi: 10.3389/fpsyt.2020.00511

488   27. Hong X, Cao J, Wei J, et al. The Stress and Psychological Impact of the COVID-19 Outbreak on

489   Medical Workers at the Fever Clinic of a Tertiary General Hospital in Beijing: A Cross-Sectional

490   Study. BJPsych Open 2021 (available online 2020);7(3):e76. doi: doi:10.1192/bjo.2021.32

491   28. Kameno Y, Hanada A, Asai D, et al. Individual psychotherapy using psychological first aid for

492   frontline nurses at high risk of psychological distress during the COVID-19 pandemic. 2021;75(1):25-

493   27. doi: https://doi.org/10.1111/pcn.13170

27

29. Maunder RG, Lancee WJ, Mae R, et al. Computer-assisted resilience training to prepare healthcare workers for pandemic influenza: a randomized trial of the optimal dose of training. BMC Health Services Research 2010;10:72.

30. Wu K, Wei X. Analysis of Psychological and Sleep Status and Exercise Rehabilitation of Front-Line Clinical Staff in the Fight Against COVID-19 in China. Medical science monitor basic research 2020;26:e924085. doi: 10.12659/msmbr.924085 [published Online First: 2020/05/12]

31. Arango C. Lessons Learned From the Coronavirus Health Crisis in Madrid, Spain: How COVID-19 Has Changed Our Lives in the Last 2 Weeks. Biol Psychiatry 2020;88(7):e33-e34. doi: 10.1016/j.biopsych.2020.04.003 [published Online First: 2020/04/08]

32. Bridson TL, Jenkins K, Allen KG, et al. PPE for your mind: a peer support initiative for health care workers. Medical Journal of Australia 2021;214:8-11.e1. doi: https://doi.org/10.5694/mja2.50886

33. Cao di San Marco E, Menichetti J, Vegni E. COVID-19 emergency in the hospital: How the clinical psychology unit is responding. Psychological Trauma: Theory, Research, Practice, and Policy 2020;12(S1):S43-S44. doi: 10.1037/tra0000684

34. Cartwright J, Thompson A. Introducing psychological strategies for healthcare professionals during Covid-19: an overview of the face Covid intervention. Dermatological Nursing 2020;19 (2):18-21.

35. Cheng P, Xia G, Pang P, et al. COVID-19 Epidemic Peer Support and Crisis Intervention Via Social Media. Community Mental Health Journal 2020;56(5):786-92. doi: 10.1007/s10597-020-00624-5

36. Gujral H, Rushton Cynda H, Rosa William E. Action Steps Toward a Culture of Moral Resilience in the Face of COVID-19. Journal of Psychosocial Nursing and Mental Health Services 2020;58(7):2-4. doi: 10.3928/02793695-20200617-01

37. Jiang X, Deng L, Zhu Y, et al. Psychological crisis intervention during the outbreak period of new coronavirus pneumonia from experience in Shanghai. Psychiatry Res 2020;286:112903. doi: 10.1016/j.psychres.2020.112903 [published Online First: 2020/03/09]

38. Kang L, Li Y, Hu S, et al. The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. The lancet Psychiatry 2020;7(3):e14. doi: 10.1016/s2215-0366(20)30047-x [published Online First: 2020/02/09]

28

39. Khee KS, Lee LB, Chai OT, et al. The Psychological impact of SARS on health care providers. Critical Care & Shock 2004;7:99-106.

40. Klomp RW, Jones L, Watanabe E, et al. CDC's Multiple Approaches to Safeguard the Health, Safety, and Resilience of Ebola Responders. Prehospital and Disaster Medicine 2020;35(1):69-75. doi: 10.1017/S1049023X19005144 [published Online First: 2019/12/10]

41. Krystal JH. Responding to the hidden pandemic for healthcare workers: stress. Nature Medicine 2020;26(5):639-39. doi: 10.1038/s41591-020-0878-4

42. Lissoni B, Del Negro S, Brioschi P, et al. Promoting resilience in the acute phase of the COVID-19 pandemic: Psychological interventions for intensive care unit (ICU) clinicians and family members. Psychological Trauma: Theory, Research, Practice, and Policy 2020;12(S1):S105-S07. doi: 10.1037/tra0000802

43. Makino M, Kanie A, Nakajima A, et al. Mental health crisis of Japanese health care workers under COVID-19. Psychological Trauma: Theory, Research, Practice, and Policy 2020;12(S1):S136-S37. doi: 10.1037/tra0000819

44. Miotto K, Sanford J, Brymer MJ, et al. Implementing an emotional support and mental health response plan for healthcare workers during the COVID-19 pandemic. Psychological Trauma: Theory, Research, Practice, and Policy 2020;12(S1):S165-S67. doi: 10.1037/tra0000918

45. Ping NPT, Shoesmith WD, James S, et al. Ultra Brief Psychological Interventions for COVID-19 Pandemic: Introduction of a Locally-Adapted Brief Intervention for Mental Health and Psychosocial Support Service. The Malaysian journal of medical sciences : MJMS 2020;27(2):51-56. doi: 10.21315/mjms2020.27.2.6 [published Online First: 2020/08/14]

46. Poonian J, Walsham N, Kilner T, et al. Managing healthcare worker well-being in an Australian emergency department during the COVID-19 pandemic. 2020;32(4):700-02. doi: https://doi.org/10.1111/1742-6723.13547

47. Rentrop V, Schneider JS, Bäuerle A, et al. Psychosocial emergency care in times of COVID-19: the Essen University Hospital concept for corona-infected patients, their relatives, and medical staff. International archives of occupational and environmental health 2021;94(2):347-50. doi: 10.1007/s00420-020-01580-z [published Online First: 2020/09/24]

48. Ripp J, Peccoralo L, Charney D. Attending to the Emotional Well-Being of the Health Care Workforce in a New York City Health System During the COVID-19 Pandemic. Academic medicine :

29

553 journal of the Association of American Medical Colleges 2020;95(8):1136-39. doi:

554 10.1097/acm.0000000000003414 [published Online First: 2020/04/14]

555 49. Schreiber M, Cates DS, Formanski S, et al. Maximizing the Resilience of Healthcare Workers in

556 Multi-hazard Events: Lessons from the 2014-2015 Ebola Response in Africa. Military medicine

557 2019;184(Suppl 1):114-20. doi: 10.1093/milmed/usy400 [published Online First: 2019/03/23]

558 50. Zhang J, Wu W, Zhao X, et al. Recommended psychological crisis intervention response to the

559 2019 novel coronavirus pneumonia outbreak in China: a model of West China Hospital. Precision

560 Clinical Medicine 2020;3(1):3-8. doi: 10.1093/pcmedi/pbaa006

561 51. Brooks SK, Dunn R, Amlôt R, et al. A Systematic, Thematic Review of Social and Occupational

562 Factors Associated With Psychological Outcomes in Healthcare Employees During an Infectious

563 Disease Outbreak. Journal of Occupational & Environmental Medicine 2018;60(3):248-57. doi:

564 10.1097/JOM.0000000000001235

565 52. De Brier N, Stroobants S, Vandeerckhove P, et al. Factors affecting mental health of health care

566 workers during the coronavirus disease outbreaks: a rapid systematic review. PLoS One (PsychRxiv

567 [Preprint]) 2020;15(12):e0244052. doi: Preprint: 10.31234/osf.io/w9uxs Article::

568 10.1371/journal.pone.0244052

569 53. Preti E, Di M, Perego G, et al. The Psychological Impact of Epidemic and Pandemic Outbreaks on

570 Healthcare Workers: Rapid Review of the Evidence. Current Psychiatry Reports 2020;22:43. doi:

571 https://dx.doi.org/10.1007/s11920-020-01166-z

572 54. Serrano-Ripoll MJ, Meneses-Echavez JF, Ricci-Cabello I, et al. Impact of viral epidemic

573 outbreaks on mental health of healthcare workers: a rapid systematic review and meta-analysis.

574 Journal of Affective Disorders 2020;277:347-57. doi: 10.1016/j.jad.2020.08.034

575 55. Zung WW. A rating instrument for anxiety disorders. Psychosomatics 1971;12(6):371-9. doi:

576 10.1016/s0033-3182(71)71479-0 [published Online First: 1971/11/01]

577 56. Zung WW. A SELF-RATING DEPRESSION SCALE. Archives of general psychiatry

578 1965;12:63-70. doi: 10.1001/archpsyc.1965.01720310065008 [published Online First: 1965/01/01]

579 57. Buysse DJ, Reynolds CF, 3rd, Monk TH, et al. The Pittsburgh Sleep Quality Index: a new

580 instrument for psychiatric practice and research. Psychiatry Res 1989;28(2):193-213. doi:

581 10.1016/0165-1781(89)90047-4 [published Online First: 1989/05/01]

582 58. Cao J, Wei J, Zhu H, et al. A Study of basic needs and psychological wellbeing of medical
583 workers in the fever clinic of a tertiary general hospital in Beijing during the COVID-19 outbreak.
584 Psychotherapy and Psychosomatics 2020;89(4):252-54. doi: 10.1159/000507453

585 59. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure.
586 J Gen Intern Med 2001;16(9):606-13. doi: 10.1046/j.1525-1497.2001.016009606.x

587 60. Maslach C, Jackson SE. The measurement of experienced burnout. 1981;2(2):99-113. doi:
588 https://doi.org/10.1002/job.4030020205

589 61. Weiss DS, Marmar CR. The Impact of Event Scale-Revised. In: Wilson JP, Keane TM, eds.
590 Assessing Psychological Trauma and PTSD: A Practitioner's Handbook. New York: Guilford Press
591 1997:399-411.

592 62. Derogatis LR, Lipman RS, Covi L. SCL-90: an outpatient psychiatric rating scale--preliminary
593 report. Psychopharmacology bulletin 1973;9(1):13-28. [published Online First: 1973/01/01]

594 63. Ruggiero KJ, Ben KD, Scotti JR, et al. Psychometric Properties of the PTSD Checklist—Civilian
595 Version. Journal of Traumatic Stress 2003;16(5):495-502. doi: 10.1023/A:1025714729117

596 64. Kessler RC, Andrews G, Colpe LJ, et al. Short screening scales to monitor population prevalences
597 and trends in non-specific psychological distress. Psychological Medicine 2002;32(6):959-76. doi:
598 10.1017/S0033291702006074 [published Online First: 2002/09/26]

599 65. García-Fernández L, Romero-Ferreiro V, López-Roldán PD, et al. Mental health impact of
600 COVID-19 pandemic on Spanish healthcare workers. Psychological Medicine 2020:1-3. doi:
601 10.1017/S0033291720002019 [published Online First: 2020/05/27]

602 66. Albott CS, Wozniak JR, McGlinch BP, et al. Battle Buddies: Rapid Deployment of a
603 Psychological Resilience Intervention for Health Care Workers During the COVID-19 Pandemic.
604 Anesthesia & Analgesia 2020;131(1):43-54.

605 67. Fukuti P, Uchôa CLM, Mazzoco MF, et al. How Institutions Can Protect the Mental Health and
606 Psychosocial Well-Being of Their Healthcare Workers in the Current COVID-19 Pandemic. Clinics
607 (Sao Paulo, Brazil) 2020;75:e1963. doi: 10.6061/clinics/2020/e1963 [published Online First:
608 2020/06/11]

609 68. Australian and New Zealand Clinical Trials Registry [Internet]. Evaluation of Shift, a smartphone
610 application for New South Wales Junior Medical Officers, on depression and anxiety during the

31

611 COVID-19 epidemic. [Clinical trial]. Sydney (NSW): NHMRC Clinical Trials Centre, University of

612 Sydney (Australia); 2020 [updated 15th May. 15th May:[Available from:

613 https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=379737&isReview=true accessed

614 2nd November 2020.

615 69. Glasziou PP, Sanders S, Hoffmann T. Waste in covid-19 research. BMJ (Clinical research ed)

616 2020;369:m1847. doi: 10.1136/bmj.m1847

617 70. Janiaud P, Axfors C, van't Hooft J, et al. The worldwide clinical trial research response to the

618 COVID-19 pandemic - the first 100 days [version 1; peer review: 2 approved]. F1000Research 2020;9

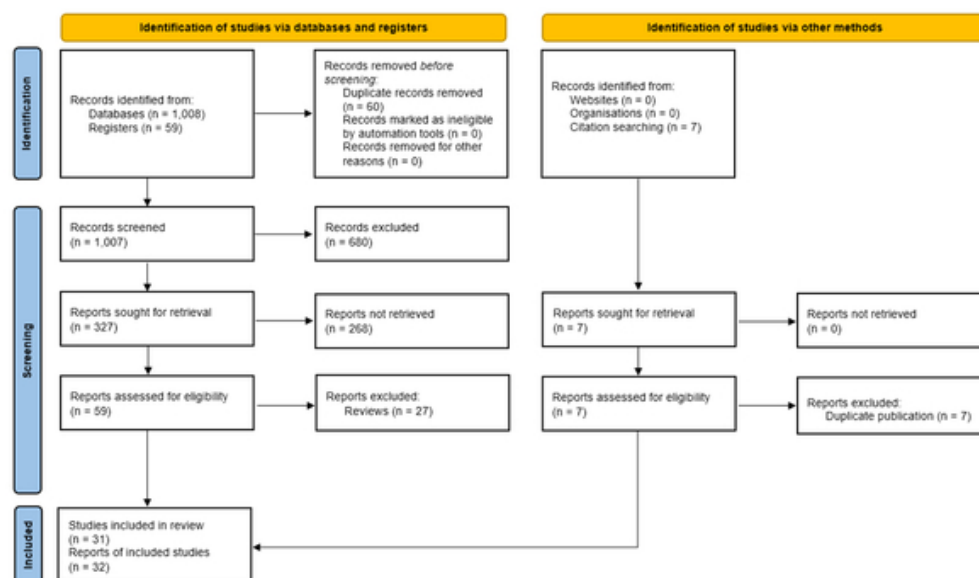619 doi: 10.12688/f1000research.26707.1

620

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

49x29mm (300 x 300 DPI)

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

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			
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; 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
DISCUSSION			
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
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.	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	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/

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	42,902
	2. limit 1 to (english language and yr="2000 -Current")	32,850
	3. stress, psychological/ or burnout, psychological/ or burnout, professional/ or occupational stress/ or compassion fatigue/	131,163
	4. limit 3 to (english language and yr="2000 -Current")	85,339
	5. exp Pandemics/	18,898
	6. limit 5 to (english language and yr="2000 -Current")	17,497
	7. 2 and 4 and 6	43
PubMed, 10 Jul 2020	1. emergency OR frontline OR front-line	989,055
	2. corona* OR covid*[All fields]	594,736
	3. mental OR psychology*[All fields]	2,086,916
	4. 2 AND 3	18,835
	5. 1 AND 4	1,457
CINAHL EBSCOhost, 8 Aug 2020	1. MW Health Personnel	102,550
	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	40, 943
	3. MW mental health or MH 'Behavioral and Mental Disorders+'	867,676
	4. 1 AND 2 AND 3, published 20100101-20201231, English language	183
	5. MH 'Mobile Applications' or TI 'mobile app*' or AB 'mobile app*' or TI 'smartphone*' or AB 'smartphone*'	14,337
	6. 4 AND 5	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/	375,853
	2. limit 1 to (english language and yr="2000 -Current")	276,454

	3. exp Pandemics/	757
	4. limit 3 to (english language and yr="2000 -Current")	726
	5. exp Mental Health/	66,671
	6. 2 and 4 and 5	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	1,472
	2. 1 AND (mental OR stress)	11

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

During pandemic with multi-level approaches (organisational, individual)								
Albott, et al. [66]	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. [67]	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		
During pandemic - no evaluation components that include outcome data								
Arango [31]	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	Corresponden ce / Letter	No		
Bridson, et al. [32]	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	No		
Cao di San Marco, et al. [33]	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	descriptive	No	No	No

1

				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		
Cartwright and Thompson [34]	UK	COVID-19	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	No		No
				Individual	Not applicable	Descriptive paper on intervention components	No		
Cheng, et al. [35]	China	COVID-19	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	No data presented. Early information suggests people found intervention useful		No
				Individual	Approx. 300 people participated in counselling groups	Descriptive paper of the intervention	No – part of program used WeChat		
Gujral, et al. [36]	USA	COVID-19	To offer workplace excellence strategies for concrete practices and recommendations to promote staff wellbeing and moral resilience.	Hospital staff	Descriptive	Yes	No		No
				Individual	Not applicable	Editorial	No		
Jiang, et al. [37]	China	COVID-19	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	No		No
				Individual	Not described	Short Communication	No		
Kang, et al. [38]	China	COVID-19	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	Descriptive paper	No	No. Authors write there is a good response and service offering is widening to other service. No data provided.		No
				Organisation wide	Hundreds of HCWs are receiving these interventions	Correspondence	No		

2

Author	Country	Disease	Aim	Setting	Study type	Evaluation (col 1)	Evaluation (col 2)	Outcomes reported	Measures
Khee, et al. [39]	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.
			Hospital wide	188 HCWs in a SARS designated hospital from multiple units	Empirical report	No			
Klomp, et al. [40]	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
			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			
Krystal [41]	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
			Individual	Not described	Viewpoint	No – mobile phone based tools are mentioned.			
Lissoni, et al. [42]	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
			Individual	Not described	Descriptive paper of intervention	No			
Makino, et al. [43]	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
			Individual	Not applicable	Short report	No			
Miotto, et al. [44]	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

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46

3

			Individual	Not described	Commentary	No		
Ping, et al. [45]	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.
			Individually reported	Initially 25 nurses in contact with patients with COVID-19.	Empirical Paper	No		
Poonian, et al. [46]	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
			Organisation wide.	Not described	Perspective Descriptive paper	No		
Rentrop, et al. [47]	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		Yes –delivered via telehealth/ teleconference and online COPE IT intervention embedded within	Not reported	Not reported.
			Individual.	Medical staff and extended to patients with COVID-19 and families	Corresponden ce / commentary	No		
Ripp, et al. [48]	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
			Organisation-wide.	Not described	Commentary	Yes but used existing apps		
Schreiber, et al. [49]	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. 20% below PTSD cut-off on PsySTART-R	Not reported
			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)		

4

Zhang, et al. [50]	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;

5

BMJ Open

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

SCHOLARONE™
Manuscripts

BMJ

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

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

Authors: Kate Robins-Browne[1], Matthew Lewis[1,5], Luke Burchill[2,3], Cecily Gilbert[4], Caroline Johnson[1,5], Meaghan L O'Donnell[6], Aneta Kotevski[2], Jasmine Poonian[7], Victoria J Palmer[1,5].

1. Primary Care Mental Health Research Program, Department of General Practice, Melbourne Medical School, The University of Melbourne, Melbourne, Australia

2. Department of Medicine, The University of Melbourne, Parkville, Australia

3. Department of Cardiology, Royal Melbourne Hospital, Parkville, Australia

4. Centre for Digital Transformation of Health, The University of Melbourne, Melbourne, Australia

5. ALIVE National Centre for Mental Health Research Translation, Department of General Practice, Melbourne Medical School, The University of Melbourne, Melbourne, Australia

6. Phoenix Australia, Department of Psychiatry, The University of Melbourne, Melbourne, Australia

7. Emergency Department, The Royal Melbourne Hospital, Melbourne, Victoria, Australia

Corresponding Author:

Professor Victoria Palmer

ALIVE National Centre for Mental Health Research Translation

Department of General Practice, Melbourne Medical School

The University of Melbourne,

780 Elizabeth St, Melbourne VIC, Australia 3010

Email: v.palmer@unimelb.edu.au

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

Word Count: 4800 (including in-text citations)

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 1st January 2000 to 14th 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

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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.

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 1st 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 1st of January 2000 with the intention 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]

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.

1   **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.

13

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.

2

14

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]

15

Interventions delivered during a pandemic

27

28 Twenty-four studies reported mental health outcomes for interventions delivered during or after a

29 pandemic.[27-36 38-51] Most studies (18/24) were individually directed with diverse aims, including

30 improving sleep, or decreasing stress, anxiety, depression, burnout and PTSD. Interventions were

31 commonly selected based on findings from studies conducted outside the pandemic setting and with

32 non-HCW populations. The five studies that describe organisational level changes often incorporated

33 interventions targeted at individuals and included additional elements.

34 An intervention to improve mental health treatment seeking rather than mental health outcomes was

35 assessed in a 3 arm RCT.[32] Group one watched an intervention video twice (baseline; +14 days);

36 Group two watched it once (baseline); and the Control Group did not watch it. The intervention

37 increased treatment seeking intentions from pre-viewing to 30-days post in both intervention groups

38 with group one showing an increased intention to seek treatment. No data was presented linking

39 intention to seek treatment translated into treatment seeking.

40 A range of interventions were studied. Seven studies explored elements of relaxation, mindfulness and

41 meditation.[36 38 44-47 51]. Three studies examined exercise based interventions[34 35 49], two each

42 focused on CBT-based interventions[33 50] or mobile apps,[42 43] and three explored other

43 interventions[28 29 39 48].

44 Four studies reported on mindfulness interventions with three involving multi-week interventions.[36

45 46 47] A seven week online mindfulness based stress reduction program (weekly mindfulness based

46 exercise and mindfulness education), did not demonstrate any difference in sleep quality on the

47 Pittsburgh Sleep Quality Index (PSQI[56]) total score, but some PSQI subscales showed

48 improvement.[47] Osman, et al. [36] reported statistically significant improvements on the emotional

49 exhaustion and personal accomplishment elements of the Maslach Burnout Inventory (MBI[57]) and in

50 mean perceived stress, following four weekly, hour-long on-line mindfulness sessions. Online

51 meditation, with participants listening to 6-minute audio meditations twice daily for 4 weeks, improved

16

52   sleep quality on the PSQI while remaining above the threshold for poor quality sleep, and decreased

53   loneliness on the University of California Los Angeles Loneliness Scale.[46] Yıldırım and Çiriş Yıldız

54   [44] reported that a single 30-minute, online, mindfulness based breathing session decreased work

55   related strain and anxiety and improved psychological wellbeing.

56   Beverly, et al. [38] reported decreased HCWs stress on a visual analogue scale after viewing a 3-minute

57   immersive virtual reality nature scene. Dincer and Inangil [45] showed that a 20-minute online

58   education session about the Emotional Freedom Technique, where points on the skin are tapped to send

59   activating and deactivating signals to the brain decreased stress, anxiety and burnout.

60   Giordano, et al. [51] trialled a five-week music therapy intervention with three 15–20-minute playlists

61   (breathing, tranquil and energy). In week one, participants received generic playlists and at week's end

62   they spoke with a music therapist who tailored a playlist. This process was repeated weekly over 4

63   weeks. The authors observed statistically significant changes in tiredness, sadness, fear, and worry using

64   a bespoke instrument. Participants indicated the presence of the music therapist was of greater help than

65   the playlists.

66   Three studies described exercise-based interventions.[34 35 49] Ha, et al. [49] described a 12-week

67   fitness program aiming to increase physical activity and improve sleep quality. The intervention group

68   had access to online exercise classes, health coaching, and were given step count targets which

69   significantly increased daily step counts but did not change sleep quality on the PSQI. Wu and Wei

70   [34] reported on an exercise prescription where the intervention group were HCWs at a COVID-19

71   designated hospital and the control group were HCWs at a non-COVID-19 designated hospital. The

72   authors did not provide any details regarding the nature of the exercise prescription or numerical

73   outcome data. They stated that those who followed the exercise prescription had better sleep and stress

74   than those that did not, but no data was presented.

17

75 Zhan, et al. [35] reported that 30 minutes of online Tai Chi, daily for two weeks, significantly improved

76 sleep on the PSQI at day 14, compared against 30 minutes of free exercise, but did not alter anxiety

77 outcomes on the Beck Anxiety Inventory.

78 Two studies investigated CBT-based interventions.[33 50] Cole, et al. [33]described a small group,

79 post-pandemic, CBT based intervention that involved six, 3-hour weekly, in-person small group CBT

80 sessions supplemented by a workbook, for former Ebola Treatment Centre (ETC) workers with

81 evidence of anxiety, depression and/or PTSD. The intervention decreased depression on the Patient

82 Health Questionnaire-9 (PHQ-9), functional impairment on the Work and Social Adjustment Scale

83 (WASAS), and anxiety on the Generalised Anxiety Disoder-7 (GAD-7). Trottier, et al. [50] reported

84 preliminary findings from a self-directed online intervention in which participants completed eight,

85 CBT based modules over a maximum of 8 weeks. The 30-day outcomes, based on intention to intervene,

86 showed improvements to anxiety on the GAD-7; depression on the PHQ-9; and PTSD on the PCL-5,

87 with large, reported effect sizes.

88 Two studies reported on the use of digital apps.[42 43] De Kock, et al. [43] described a three arm RCT

89 comparing: an existing digital app for HCWs psychological health called My Possible Self (MPS[58]);

90 an app designed specifically for HCWs during the pandemic, called the National Health Service

91 Highland Wellbeing Project (NHSWBP) app; and a wait list control. In the first two weeks the

92 NHSWBP app focused on happiness, resilience and wellbeing, and in the final two weeks focused on

93 low mood and anxiety. The study was not appropriately powered for efficacy and there was high attrition

94 (36.7%). Nonetheless, depression, on the PHQ-9, decreased in both the MPS and NHSWBP groups,

95 anxiety, on the GAD-7, decreased in only the NHSWBP group, and mental toughness on the Mental

96 Toughness Index, improved in the NHSWBP and control groups. All three groups showed

97 improvements in mental wellbeing, on the Warwick-England Mental Well-Being scale, and in gratitude,

98 on the Gratitude Questionnaire.

18

99 A RCT evaluated the impact of two weeks of access to the PsyCovidApp on depression, anxiety, stress

100 (DASS-21[59]), PTSD (Davidson Trauma Scale[60]), burnout (MBI[57]), insomnia (Insomnia Severity

101 Index[61]) and self-efficacy (General Self-Efficacy Scale[62]). [42] PsyCovidApp is a CBT and

102 mindfulness-based intervention over 4 content areas (emotional skills, healthy lifestyle, work stress and

103 burnout, and social supports). The control group accessed an app with brief information about HCW

104 mental health during pandemics. No between group differences were observed post-intervention on

105 primary outcomes.

106 Three studies utilised other interventions. One group[28 48] evaluated wellbeing centres designed to

107 be relaxing spaces allowing quiet time and social interaction for employees, bank staff and volunteers

108 in two UK acute hospital trusts. The centres were staffed by buddies, volunteers whose usual workload

109 had decreased due to the pandemic, who were trained in psychological first-aid and able to provide

110 mental health support information. The centres were evaluated via survey[28] and qualitative

111 interviews.[48]

112 The survey compared centre users to non-users, and of 819 respondents, 94% were aware of the centres

113 and 55.2% had accessed a centre. Users and non-users reported similar job stressfulness, job

114 satisfaction, turnover intention or presenteeism. Those who accessed the centres had higher wellbeing

115 (Warwick Edinburgh Mental Wellbeing Scale) and higher workplace engagement (Utrecht Work

116 Engagement Scale). Respondents appreciated the centres and described them as having a positive

117 impact on their wellbeing. There was a strong desire for the centres to be retained post-pandemic.

118 In their qualitative analysis[48] drawn from 24 interviews with centres users and operational staff,

119 including managers and buddies, the centres were seen as an essential support and a source of pride in

120 the NHS that addressed an unmet need. Staff described pre-pandemic wellbeing initiatives as focussing

121 on healthy lifestyle changes rather than addressing the core issues that impact staff. Buddies described

122 their role as an opportunity to contribute to the pandemic response when their usual role had decreased.

123 Users appreciated the information buddies offered, being able to offload their worries and talking

124 through coping strategies.

125 Kameno, et al. [29] reported that individual psychotherapy for nurses experiencing high levels of

126 psychological distress decreased distress over the following two months. Of 31 nurses screened, 8 met

127 the inclusion criteria, and 3 accepted psychotherapy. While the authors reported efficacy, the numbers

128 were small and reasons for refusing the intervention were not specified.

129 A RCT reported that a 16-week time management intervention involving 1-hour Balint groups that ran

130 1-2 times a week, and weekly 40-minute time management training over 8 weeks improved mental

131 health, subjective wellbeing and stress response.[39] The intervention is poorly described, and the

132 findings are presented using a paired t-test of the difference between the intervention and control group,

133 with no data regarding the mean pre-post scores for each group.

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

135 Four of these involved multicomponent interventions. Chen, et al. [27] described an intervention for

136 nursing staff in a Taiwanese SARS designated hospital that included an epidemic prevention plan with

137 in-service training to minimise transmission risk when caring for SARS patients, staff allocation to

138 ensure appropriate shift lengths and time away from work, adequate PPE supplies, and the establishment

139 of a mental health team to provide direct staff support. Participant mental health was assessed using

140 Zung's self-rating anxiety scale (SAS[63]) and depression scale (SDS[64]) and the PSQI[56] at four

141 time points: pre-intervention (T1); 2 weeks post intervention (T2); 1 month post-intervention (T3); and

142 1 month after the hospital was no longer a designated SARS hospital (T4). Of 120 nurses surveyed, 116

143 completed questionnaires at all four time points. At T1 the mean scores on the SAS and SDS indicated

144 moderate anxiety and depression, which reduced to mild anxiety and depression at T2 and T3, and to

145 no anxiety or depression at T4. Progressive improvements in sleep quality were observed at each follow-

146 up time, but sleep quality remained above the threshold indicating poor quality sleep at all timepoints.

20

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

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

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

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

21

depression (SDS[64]). The authors concluded that knowledge regarding infection prevention and psychological support decreased anxiety, but that not enough time had elapsed to decrease depression.

One intervention delivered virtual continuing medical education (vCME) for 44 obstetrics and gynaecology trainees in Singapore to support trainee mental health to allow trainees to continue training and maintain skills when elective surgeries were cancelled.[41] Twenty-eight trainees completed a program audit including three questions about wellbeing. The authors reported on only one question, with 75% of respondents indicating that the sessions helped them cope with the difficulties of team segregation.

Across the 26 studies, 41 mental health-focused outcome measures were reported with 30 only being used in one study each, six in two studies, two in three studies (Zung's Self-rating Anxiety Scale, Zung's Self-rating Depression Scale[63 64]), two in four studies (GAD-7, PHQ-9[67 68]) and one in five studies (PSQI[56]). Some studies used well recognised and validated instruments, whereas other studies used modified versions of existing instruments or developed their own instruments, with little presentation of how these instruments were developed or validated, if at all.

Data trends across included studies are evident. Six studies demonstrated improvements in sleep,[27 34 35 46 47 49] three in wellbeing,[28 39 44 48] and two in coping[37 41] and in confidence[25 26]. Seven studies demonstrated decreased anxiety,[27 33 35 40 43 45 50] five in stress,[34 36 38 44 45] four in depression,[27 33 43 50] two in burnout,[36 45] and one each in PTSD[50] and functional impairment[33]. The conclusions that can be drawn from these findings are limited by the wide range of instruments used, variability in interventions and approaches, frequent lack of control data, and the limited or incomplete data reported within papers.

22

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]

23

219   The evidence synthesis draws attention to two interconnected problems regarding work in this area: the

220   gap between what HCWs want and the supports that are offered; and, the variable quality of the reported

221   research. Literature reviews on the mental health impacts of pandemics suggest that social and practical

222   support are important mechanisms for alleviating psychological distress and may be preferred to

223   professional psychological support.[2 3] This was reported early in the pandemic by Chen, et al. [70]

224   who interviewed HCWs and found that the psychological support intervention they offered did not

225   address HCWs' self-identified concerns. Interviews with UK HCWs and social care workers found

226   they valued practical support from their organisations during the COVID-19 pandemic including the

227   provision of food, flexibility around work, clear communications and being consulted regarding their

228   needs.[7] Direct psychological support was valued but was one element in what was needed to support

229   their mental health. Most included interventions focused on individual behaviour, fostering resilience

230   to increase coping skills or offering support to those in crisis.

231   This misalignment likely reflects complexity, and time and costs constraints organisations face

232   especially if interventions require cultural change or reorganisation of existing systems. COVID-19

233   forced healthcare systems to make rapid large-scale systemic and environmental changes including

234   increased use of telehealth, social distancing measures, the wearing of PPE, and the cancellation of

235   elective procedures. It is conceivable that systems, and people within these systems, would have

236   struggled to accommodate further complex reorganisation at that time. Second, many mental health and

237   wellbeing intervention were locally driven by departments, groups, and individuals within hospitals that

238   the pandemic impacted and were developed with limited resourcing and with a sense of urgency.

239   Generating evidence within pandemics is understandably complex[17] as interventions are rapidly

240   developed and deployed, participants are already burdened, and the system is under strain. Our review

241   excluded many papers describing interventions that did not present efficacy data. The included studies

242   had variable design quality. Most studies had small samples and no indication of power, and only 10/26

243   studies included control data. Long-term follow-up was infrequent. There was significant heterogeneity

244   in the interventions, reported outcomes, dosage description, and rigour of the evaluations. The use of

24

245 proxy outcome measurements was common such that confidence was used as a proxy for resilience[25

246 26] and sleep quality as a proxy for mental health and wellbeing.[47 49]

247 Our search identified two HCW mobile mental health app studies designed specifically in response to

248 the COVID-19.[42 43] Despite a good retention rate and being adequately powered, Fiol-DeRoque, et

249 al. [42] demonstrated no difference in any of the primary or secondary outcomes aside from pre-

250 specified sub-group analysis. Given that participants only had access to the app for two weeks and no

251 data was reported on app usage, the lack of impact could reflect low dosage both in term of usage and

252 time to see a change. De Kock, et al. [43] showed their COVID-19 specific app was of greater benefit

253 that a non-specific mental health app, however they showed a high attrition rate (36.7%) and the study

254 was not powered for efficacy. Sample attrition is a concern in pandemic situations where high demands

255 on HCWs are likely to impact on research participation. These findings provide preliminary support

256 that HCW focused mental health mobile applications have some promise through pandemics, however,

257 the app design needs to centre HCWs needs and use-case to overcome pre-existing reluctance to access

258 mental health and wellbeing supports[1] and time limitations in pandemic conditions. Methods such as

259 experience-based co-design become highly relevant and central to the development of support

260 interventions.[22 23]

261 The strength of this evidence synthesis is the breadth of search terms and the focus on studies only

262 reporting HCWs mental health outcomes. Unlike previous reviews, the search extended to other

263 pandemics apart from COVID-19 pandemic[3 18] and was solely focused on HCWs mental health. [14]

264 A wide range of sources were searched including the EPPI-Centre's Living Systematic Map of the

265 Evidence,[71] preprint servers, clinical trial registers and grey literature from reputable health sources.

266 Outcomes were limited by the heterogeneity of and quality of the evidence, and we elected not to use a

267 formal quality appraisal tool.

268 Reviews of interventions to improve HCW resilience[4] and decrease occupational stress[5] outside

269 pandemics reported limited evidence with many studies lacking adequate numbers and longitudinal data

25

270   which is mirrored in this review. In future, researchers should better report population and intervention

271   details, ensure the studies are adequately powered and have a control condition. Our findings reflect

272   concerns regarding waste in research and, particularly, COVID-19 research which have been raised

273   elsewhere.[72 73]   While large scale randomised controlled trials of HCW mental health support

274   interventions may be unfeasible in a pandemic context, other study designs, such as the adaptive trial

275   design utilised byChen, et al. [27] would offer valuable information. In addition, real time data

276   collection methods and monitoring using remote methods should be further evaluated for application in

277   pandemics.

278

Conclusion

280   HCW mental health support needs are clearly of increased prominence with 22 of the included studies

281   conducted through COVID-19 and health organisations taking steps to address this challenge. The next

282   step is to develop proactive organisational responses that better align with HCWs' self-identified

283   preferences for support. While individually focused supports are intuitively valuable, it can be

284   counterintuitive to ignore potential systemic factors in HCW wellbeing, and place increased

285   responsibility for mental health and wellbeing on an already burdened individual, with the unintended

286   consequence of blame for a failure to maintain wellbeing. HCWs are highly time-pressured, facing

287   huge workloads and could struggle to incorporate activities such as exercise or mindfulness. In this

288   context the importance of experience-based co-design methods to support HCW mental health and

289   wellbeing must be emphasised as it seeks to understand the needs of end-users and co-produce methods

290   and modalities to best address identified needs. Through deep engagement with HCWs we can gain an

291   understanding of the work and life challenges they face through the pandemic; the challenges to their

292   mental health and wellbeing; and the best ways that mental health and wellbeing can be supported.

26

1
2 293
3
4
5 294   **Figure Legend:** Figure 1. Study Selection PRISMA 2020 flow diagram
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

27

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.

Funding source

This research was funded by a grant from the Australian Government Department of Health, the Peter Doherty Philanthropic Trust Fund, the Royal Melbourne Hospital, and the University of Melbourne. The funding bodies had no role in study design, data collection, data analysis, data interpretation, or writing of the manuscript. The corresponding author has full access to all the data in the study and had final responsibility for the decision to submit for publication.

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

1
2 319 **Data Sharing Statement**
3
4 320 No additional data available.
5
6 321
7
8 322 **Ethics statements**
9
10 323 Participant consent
11
12 324 There were no participants. This is not applicable.
13
14 325
15
16 326 Ethics approval
17
18 327 Institutional ethics was not required as this project does not involve human or animal participants.
19
20 328
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

29

References

1. Petrie K, Crawford J, Baker STE, et al. Interventions to reduce symptoms of common
   mental disorders and suicidal ideation in physicians: a systematic review and meta-
   analysis. *The Lancet Psychiatry* 2019;6(3):225-34. doi:
   https://doi.org/10.1016/S2215-0366(18)30509-1

2. Kisely S, Warren N, McMahon L, et al. Occurrence, prevention, and management of the
   psychological effects of emerging virus outbreaks on healthcare workers: rapid review
   and meta-analysis. *BMJ* 2020;369:m1642. doi: 10.1136/bmj.m1642 [published Online
   First: 2020/05/07]

3. Muller A, Hafstad E, Himmels JPW, et al. The mental health impact of the covid-19
   pandemic on healthcare workers, and interventions to help them: A rapid systematic
   review. *Psychiatry Research* 2020;293:113441.

4. Kunzler AM, Helmreich I, Chmitorz A, et al. Psychological interventions to foster
   resilience in healthcare professionals. *Cochrane Database of Systematic Reviews* 2020
   2020 Jul 5.
   https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=edswsc&A
   N=000568666400016&site=eds-live&scope=site&custid=s2775460 (accessed 2020
   Aug 5).

5. Ruotsalainen JH, Verbeek JH, Marine A, et al. Preventing occupational stress in healthcare
   workers. *Cochrane Database of Systematic Reviews* 2015 2015 Apr 7; 4.
   https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=edswsc&A
   N=000209933000008&site=eds-live&scope=site&custid=s2775460 (accessed 2020
   Aug 15).

6. Albert CM, Andreotti G, Bala B, et al. Risk of COVID-19 among front-line health-care
   workers and the general community: a prospective cohort study. *The Lancet Public
   Health* 2020;5(9):e475-e83. doi: 10.1016/S2468-2667(20)30164-X

7. Billings J, Ching BCF, Gkofa V, et al. Experiences of frontline healthcare workers and
   their views about support during COVID-19 and previous pandemics: a systematic

review and qualitative meta-synthesis. *BMC Health Services Research* 2021;21(1):923. doi: 10.1186/s12913-021-06917-z

8. Sharifi M, Asadi-Pooya AA, Mousavi-Roknabadi RS. Burnout among Healthcare Providers of COVID-19; a Systematic Review of Epidemiology and Recommendations. *Archives of academic emergency medicine* 2021;9(1):e7. doi: 10.22037/aaem.v9i1.1004 [published Online First: 2021/01/26]

9. Greenberg N, Docherty M, Gnanapragasam S, et al. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *BMJ* 2020;368:m1211. doi: 10.1136/bmj.m1211 [published Online First: 2020/03/29]

10. Jack T, Bryan D-W, Gary L. Psychosocial Support for Healthcare Workers During the COVID-19 Pandemic. *Front Psychol* 2020;11 doi: 10.3389/fpsyg.2020.01960

11. Lokuge A. Racing Against the Virus from Inside Australia's Healthcare System. *The New York Times* 2020.

12. Lokuge A. A Doctor Asks: Is Covid Scaring Us Away From Our Humanity? *The New York Times* 2020 28th August 2020.

13. Pollock A, Campbell P, Cheyne J, et al. Interventions to support the resilience and mental health of frontline health and social care professionals during and after a disease outbreak, epidemic or pandemic: a mixed methods systematic review. *Cochrane Database of Systematic Reviews* 2020(11) doi: 10.1002/14651858.CD013779

14. Yue J-L, Yan W, Sun Y-K, et al. Mental health services for infectious disease outbreaks including COVID-19: a rapid systematic review. *Psychological Medicine* 2020;50(15):2498-513. doi: 10.1017/S0033291720003888 [published Online First: 2020/11/05]

15. American Medical A. Caring for our caregivers during COVID-19. 2020 17th June 2020. https://www.ama-assn.org/delivering-care/public-health/caring-our-caregivers-during-covid-19 (accessed 3rd November 2020).

31

16. World Health Organization. Mental health and psychosocial considerations during the COVID-19 outbreak. 2020 [Available from: https://www.who.int/docs/default-source/coronaviruse/mental-health-considerations.pdf?sfvrsn=6d3578af_2.

17. Yang L, Yin J, Wang D, et al. Urgent need to develop evidence-based self-help interventions for mental health of healthcare workers in COVID-19 pandemic. *Psychological Medicine* 2021;51(10):1775-76. doi: 10.1017/S0033291720001385 [published Online First: 2020/04/28]

18. Drissi N, Ouhbi S, Marques G, et al. A Systematic Literature Review on e-Mental Health Solutions to Assist Health Care Workers During COVID-19. *Telemedicine journal and e-health : the official journal of the American Telemedicine Association* 2021;27(6):594-602. doi: 10.1089/tmj.2020.0287 [published Online First: 2020/09/25]

19. Moreno C, Wykes T, Galderisi S, et al. How mental health care should change as a consequence of the COVID-19 pandemic. *The Lancet Psychiatry* 2020;7(9):813-24. doi: 10.1016/S2215-0366(20)30307-2

20. Chang BP, Kessler RC, Pincus HA, et al. Digital approaches for mental health in the age of COVID-19. *British Medical Journal* 2020

21. Lewis M, Palmer VJ, Kotevski A, et al. Rapid Design and Delivery of an Experience-Based Co-designed Mobile App to Support the Mental Health Needs of Health Care Workers Affected by the COVID-19 Pandemic: Impact Evaluation Protocol. *JMIR Res Protoc* 2021;10(3):e26168. doi: 10.2196/26168

22. Bate P, Robert G. Experience-based design: from redesigning the system around the patient to co-designing services with the patient. *Qual Saf Health Care* 2006;15(5):307-10. doi: 10.1136/qshc.2005.016527 [published Online First: 2006/11/01]

23. Dimopoulos-Bick T, Dawda P, Maher L, et al. Experience-Based Co-Design: Tackling common challenges. *The Journal of Health Design* 2018;3(1):86-93. doi: 10.21853/jhd.2018.46

24. McKenzie JE, Brennan SE. Chapter 12: Synthesizing and presenting findings using other methods. In: Higgins JPT, Thomas J, Chandler J, et al., eds. Cochrane Handbook for Systematic Reviews of Interventions Version 6-2 (updated February 2021): Cochrane, 2021.

25. Aiello A, Khayeri MY, Raja S, et al. Resilience training for hospital workers in anticipation of an influenza pandemic. *Journal of Continuing Education in the Health Professions* 2011;31(1):15-20.

26. Maunder RG, Lancee WJ, Mae R, et al. Computer-assisted resilience training to prepare healthcare workers for pandemic influenza: a randomized trial of the optimal dose of training. *BMC Health Services Research* 2010;10:72.

27. Chen R, Chou K-R, Huang Y-J, et al. Effects of a SARS prevention programme in Taiwan on nursing staff's anxiety, depression and sleep quality: A longitudinal survey. *International Journal of Nursing Studies* 2006;43(2):215-25. doi: 10.1016/j.ijnurstu.2005.03.006

28. Blake H, Bermingham F, Johnson G, et al. Mitigating the Psychological Impact of COVID-19 on Healthcare Workers: A Digital Learning Package. *International Journal of Environmental Research & Public Health [Electronic Resource]* 2020;17(9):26.

29. Kameno Y, Hanada A, Asai D, et al. Individual psychotherapy using psychological first aid for frontline nurses at high risk of psychological distress during the COVID-19 pandemic. *Psychiatry and Clinical Neurosciences* 2021;75(1):25-27. doi: https://doi.org/10.1111/pcn.13170

30. Hong X, Cao J, Wei J, et al. Stress and psychological impact of the COVID-19 outbreak on the healthcare staff at the fever clinic of a tertiary general hospital in Beijing: a cross-sectional study. *BJPsych Open* 2021;7(3):e76. doi: 10.1192/bjo.2021.32 [published Online First: 2021/04/06]

31. Cheng W, Zhang F, Liu Z, et al. A psychological health support scheme for medical teams in COVID-19 outbreak and its effectiveness. *Gen Psychiatr*

33

2020;33(5):e100288. doi: 10.1136/gpsych-2020-100288 [published Online First: 2021/07/01]

32. Amsalem D, Lazarov A, Markowitz JC, et al. Video intervention to increase treatment-seeking by healthcare workers during the COVID-19 pandemic: randomised controlled trial. *The British Journal of Psychiatry* 2022;220(1):14-20. doi: 10.1192/bjp.2021.54 [published Online First: 2021/05/05]

33. Cole CL, Waterman S, Hunter ECM, et al. Effectiveness of small group cognitive behavioural therapy for anxiety and depression in Ebola treatment centre staff in Sierra Leone. *International Review of Psychiatry* 2020;33(1-2):189-97.

34. Wu K, Wei X. Analysis of Psychological and Sleep Status and Exercise Rehabilitation of Front-Line Clinical Staff in the Fight Against COVID-19 in China. *Medical science monitor basic research* 2020; 26. (accessed 2020 May 11).

35. Zhan J, Yang K, Sun Z, et al. The Sleep Quality of the Frontline Healthcare Workers and the Improving Effect of Tai Chi. *Front Psychiatry* 2022;13(101545006):883590. doi: https://dx.doi.org/10.3389/fpsyt.2022.883590

36. Osman I, Hamid S, Singaram VS. Efficacy of a brief online mindfulness-based intervention on the psychological well-being of health care professionals and trainees during the COVID-19 pandemic: A mixed method design. *Health SA = SA Gesondheid* 2021;26(101213385):1682. doi: https://dx.doi.org/10.4102/hsag.v26i0.1682

37. Zingela Z, van Wyk S, Bronkhorst A, et al. Developing a healthcare worker psychological preparedness support programme for the COVID-19 outbreak. *The South African journal of psychiatry : SAJP : the journal of the Society of Psychiatrists of South Africa* 2022;28(100958626):1665. doi: https://dx.doi.org/10.4102/sajpsychiatry.v28i0.1665

38. Beverly E, Hommema L, Coates K, et al. A tranquil virtual reality experience to reduce subjective stress among COVID-19 frontline healthcare workers. *PloS one* 2022;17(2):e0262703. doi: https://dx.doi.org/10.1371/journal.pone.0262703
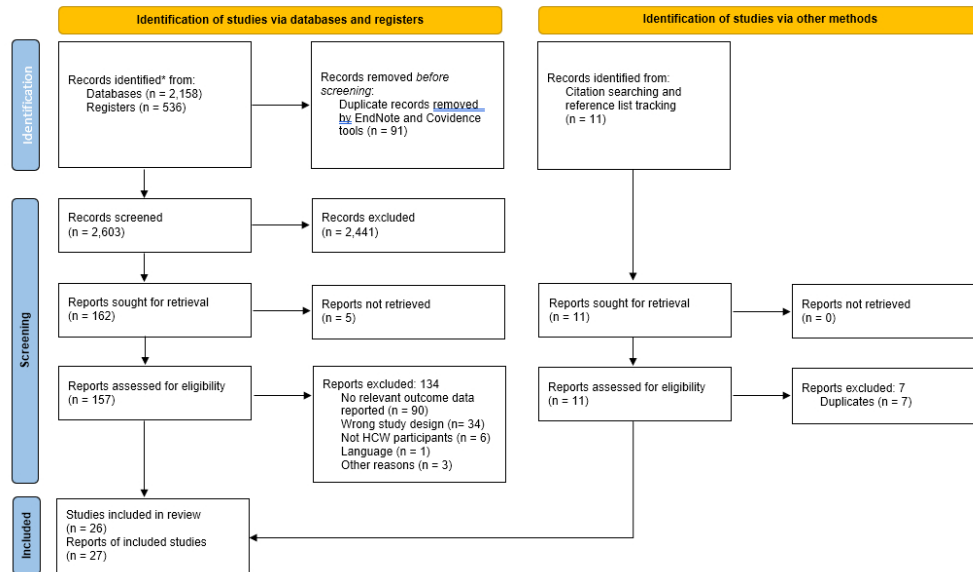
34

39. Sun L. Intervention Effect of Time Management Training on Nurses' Mental Health during the COVID-19 Epidemic. *Psychiatria Danubina* 2021;33(4):626-33. doi: https://dx.doi.org/10.24869/psyd.2021.626

40. Zhou M, Yuan F, Zhao X, et al. Research on the individualized short-term training model of nurses in emergency isolation wards during the outbreak of COVID-19. *Nursing open* 2020;7(6):1902-08. doi: https://dx.doi.org/10.1002/nop2.580

41. Chan GMF, Kanneganti A, Yasin N, et al. Well-being, obstetrics and gynaecology and COVID-19: Leaving no trainee behind. *The Australian & New Zealand journal of obstetrics & gynaecology* 2020;60(6):983-86. doi: https://dx.doi.org/10.1111/ajo.13249

42. Fiol-DeRoque MA, Serrano-Ripoll MJ, Jiménez R, et al. A Mobile Phone-Based Intervention to Reduce Mental Health Problems in Health Care Workers During the COVID-19 Pandemic (PsyCovidApp): randomized Controlled Trial. 2021;9(5):e27039. doi: 10.2196/27039

43. De Kock JH, Latham HA, Cowden RG, et al. Brief Digital Interventions to Support the Psychological Well-being of NHS Staff During the COVID-19 Pandemic: 3-Arm Pilot Randomized Controlled Trial. 2022;9(4) doi: 10.2196/34002

44. Yıldırım D, Çiriş Yıldız C. The Effect of Mindfulness-Based Breathing and Music Therapy Practice on Nurses' Stress, Work-Related Strain, and Psychological Well-being During the COVID-19 Pandemic: a Randomized Controlled Trial. 2022;36(3):156-65. doi: 10.1097/HNP.0000000000000511

45. Dincer B, Inangil D. The effect of Emotional Freedom Techniques on nurses' stress, anxiety, and burnout levels during the COVID-19 pandemic: a randomized controlled trial. 2021;17(2):109-14. doi: 10.1016/j.explore.2020.11.012

46. Thimmapuram J, Pargament R, Bell T, et al. Heartfulness meditation improves loneliness and sleep in physicians and advance practice providers during COVID-19 pandemic. 2021;49(3):194-202. doi: 10.1080/21548331.2021.1896858

35

47. Nourian M, Nikfarid L, Khavari AM, et al. The Impact of an Online Mindfulness-Based Stress Reduction Program on Sleep Quality of Nurses Working in COVID-19 Care Units: A Clinical Trial. 2021;35(5):257-63. doi: 10.1097/HNP.0000000000000466

48. Blake H, Gupta A, Javed M, et al. COVID-Well Study: Qualitative Evaluation of Supported Wellbeing Centres and Psychological First Aid for Healthcare Workers during the COVID-19 Pandemic. *Int J Environ Res Public Health* 2021;18(7):27. doi: 10.3390/ijerph18073626

49. Ha Y, Lee SH, Lee DH, et al. Effectiveness of a Mobile Wellness Program for Nurses with Rotating Shifts during COVID-19 Pandemic: A Pilot Cluster-Randomized Trial. *Int J Environ Res Public Health* 2022;19(2):11. doi: 10.3390/ijerph19021014

50. Trottier K, Monson CM, Kaysen D, et al. Initial findings on RESTORE for healthcare workers: an internet-delivered intervention for COVID-19-related mental health symptoms. *Transl Psychiatr* 2022;12(1):7. doi: 10.1038/s41398-022-01965-3

51. Giordano F, Scarlata E, Baroni M, et al. Receptive music therapy to reduce stress and improve wellbeing in Italian clinical staff involved in COVID-19 pandemic: A preliminary study. *The Arts in Psychotherapy* 2020;70:101688. doi: https://doi.org/10.1016/j.aip.2020.101688

52. Brooks SK, Dunn R, Amlôt R, et al. A Systematic, Thematic Review of Social and Occupational Factors Associated With Psychological Outcomes in Healthcare Employees During an Infectious Disease Outbreak. *Journal of Occupational & Environmental Medicine* 2018;60(3):248-57. doi: 10.1097/JOM.0000000000001235

53. De Brier N, Stroobants S, Vandekerckhove P, et al. Factors affecting mental health of health care workers during coronavirus disease outbreaks (SARS, MERS & COVID-19): A rapid systematic review. *PLOS ONE* 2020;15(12):e0244052. doi: 10.1371/journal.pone.0244052

54. Preti E, Di M, Perego G, et al. The Psychological Impact of Epidemic and Pandemic Outbreaks on Healthcare Workers: Rapid Review of the Evidence. *Current Psychiatry Reports* 2020;22:43. doi: https://dx.doi.org/10.1007/s11920-020-01166-z

36

55. Serrano-Ripoll MJ, Meneses-Echavez JF, Ricci-Cabello I, et al. Impact of viral epidemic outbreaks on mental health of healthcare workers: a rapid systematic review and meta-analysis. *Journal of Affective Disorders* 2020;277:347-57. doi: 10.1016/j.jad.2020.08.034

56. Buysse DJ, Reynolds CF, 3rd, Monk TH, et al. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989;28(2):193-213. doi: 10.1016/0165-1781(89)90047-4 [published Online First: 1989/05/01]

57. Maslach C, Jackson SE. The measurement of experienced burnout. *Journal of Organizational Behavior* 1981;2(2):99-113. doi: https://doi.org/10.1002/job.4030020205

58. Proudfoot J, Clarke J, Birch M-R, et al. Impact of a mobile phone and web program on symptom and functional outcomes for people with mild-to-moderate depression, anxiety and stress: a randomised controlled trial. *BMC Psychiatry* 2013;13(1):312. doi: 10.1186/1471-244X-13-312

59. Lovibond SH, Lovibond PF. Manual for the Depression Anxiety Stress Scales. 2nd. ed. Sydney: Psychology Foundation 1995.

60. Davidson J. Davidson Tauma Scale: Multi-Health Systems, Inc. 1996.

61. Morin CM, Belleville G, Bélanger L, et al. The Insomnia Severity Index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep* 2011;34(5):601-8. doi: 10.1093/sleep/34.5.601 [published Online First: 2011/05/03]

62. Herrero R, Espinoza M, Molinari G, et al. Psychometric properties of the General Self Efficacy-12 Scale in Spanish: General and clinical population samples. *Comprehensive Psychiatry* 2014;55(7):1738-43. doi: https://doi.org/10.1016/j.comppsych.2014.05.015

63. Zung WW. A rating instrument for anxiety disorders. *Psychosomatics* 1971;12(6):371-9. doi: 10.1016/s0033-3182(71)71479-0 [published Online First: 1971/11/01]

64. Zung WW. A self-rating depression scale. *Arch Gen Psychiatry* 1965;12:63-70. doi: 10.1001/archpsyc.1965.01720310065008 [published Online First: 1965/01/01]

37

65. Cao J, Wei J, Zhu H, et al. A Study of basic needs and psychological wellbeing of medical workers in the fever clinic of a tertiary general hospital in Beijing during the COVID-19 outbreak. *Psychotherapy and Psychosomatics* 2020;89(4):252-54. doi: 10.1159/000507453

66. Weiss DS, Marmar CR. The Impact of Event Scale-Revised. In: Wilson JP, Keane TM, eds. Assessing Psychological Trauma and PTSD: A Practitioner's Handbook. New York: Guilford Press 1997:399-411.

67. Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine* 2006;166(10):1092-7. doi: 10.1001/archinte.166.10.1092 [published Online First: 2006/05/24]

68. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001;16(9):606-13. doi: 10.1046/j.1525-1497.2001.016009606.x [published Online First: 2001/09/15]

69. Milner AJ, Maheen H, Bismark MM, et al. Suicide by health professionals: a retrospective mortality study in Australia, 2001–2012. 2016;205(6):260-65. doi: 10.5694/mja15.01044

70. Chen Q, Liang M, Li Y, et al. Mental health care for medical staff in China during the COVID-19 outbreak. *The Lancet Psychiatry* 2020;7(4):e15-e16. doi: 10.1016/s2215-0366(20)30078-x

71. EPPI Centre. COVID-19: a living systematic map of the evidence United Kingdom: EPPI Centre; 2020 [Available from: http://eppi.ioe.ac.uk/cms/Projects/DepartmentofHealthandSocialCare/Publishedreviews/COVID-19Livingsystematicmapoftheevidence/tabid/3765/Default.aspx accessed 18th September 2020 2020.

72. Glasziou PP, Sanders S, Hoffmann T. Waste in covid-19 research. *BMJ (Clinical research ed)* 2020;369:m1847. doi: 10.1136/bmj.m1847

73. Janiaud P, Axfors C, Hooft Jvt, et al. The worldwide clinical trial research response to the COVID-19 pandemic - the first 100 days. *F1000Research* 2020;9:1193. doi: 10.12688/f1000research.26707.1

38

Figure 1. Study Selection PRISMA 2020 flow diagram

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
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.	P5-6
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	P6
METHODS			
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 catastrophi*: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 catastrophi?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

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 intensions 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 trusts. 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

				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 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. [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. **App 1 My Possible Self (MPS)**: 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. **App 2 NHS Highland Wellbeing Project (NHSWBP)** 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 acupressure points in Traditional Chinese Medicine to send the brain either activating or deactivating signals. **Intervention** – one 20 minute online session teaching participants EFT in groups of 5. **Control** – 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

			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 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. [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.

						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. **Intervention:** received MBSR program; **Control:** 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 **Intervention** received time management training and Balint group. **Control group** 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. **Intervention:** mindfulness; **Control**: 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 +1month follow-up	Single group repeated measures. Outcome measures baseline; mid intervention; end-of-intervention; +1 month.

			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 **Intervention:** online session; **Control;** 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.

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.	**Baseline to day 30**: intervention significantly increased help-seeking intentions compared to controls. Larger impact in Group 1 than Group 2. **Day 14**: Group 1 had increased intention to seek treatment compared to immediately post-intervention, this was not the case for Group 2.	**ATSPPH-SH Baseline** Group 1 7.9 (CI 7.3-8.4) Group 2 7.9 (CI 7.9-8.8) **ATSPPH-SH immediately post-intervention** Group 1 9.2 (CI 8.7-9.7) Group 2 9.4 (CI 9.0-9.7) **ATSPPH-SH 30 days post** 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 ≥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	**Pre-simulation VAS** 5.1 SD 2.2 **Post-simulation VAS** 3.3 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	**Survey:** 819 completed - 94% aware of centres; 55.2% had accessed a centre. **Interviews:** 24 interviews with centre users, buddies and those involved in operationalising the centres.	**Survey:** 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. **Interviews:** 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.	**UWES** Centre users 5.02 SD 1.14 Non-users 4.83 SD 1.15

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.	**SAS** T1 60 SD 9.28 T2 51 SD 10.32 T3 50 SD 9.84 T4 46 SD 7.48 **SDS** T1 61 SD 12.62 T2 51 SD 11.94 T3 50 SD 10.60 T4 48 SD 10.76 **PSQI** 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.	**GAD-7** T1 13.42 SD 0.49 T2 8.96 SD 0.47 **PHQ-9** T1 15.41 SD 0.66 T2 10.90 SD 0.61 **WSAS** 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.	**GAD-7** *MPS* Baseline 7.16 SD 5.60 Midpoint 6.45 SD 5.03 Post 6.89 SD 5.71 *NHSWBP*

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 *Control* Baseline 7.43 SD 5.10 Midpoint 7.35 SD 5.23 Post 6.72 SD 5.59 **PHQ-9** *MBS* Baseline 6.76 SD 5.04 Midpoint 5.74 SD 4.31 Post 5.18 SD 3.27 *NHSWBP* Baseline 7.60 SD 4.31 Midpoint 7.23 SD 5.47 Post 5.68 SD 4.39 *Control* Baseline 7.80 SD 5.23 Midpoint 8.00 SD 5.06 Post 7.56 SD 6.25 **WEMWBS** *MBS*

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

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 **GQ** MHS Baseline 27.3 SD 3.46 Midpoint 27.9 SD 3.63 Post 28.2 SD 4.23 NHSWBP 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);	**SUD** *Intervention* Pre 7.82 SD 1.33 Post 2.85 SD 1.21 *Control* 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.	**SAS** *Intervention* Pre 67.68 SD 9.05 Post 32.25 SD 4.67 *Control* Pre 64.7 SD 8.05 Post 64.43 SD 7.68 **Burnout Inventory** *Intervention* Pre 3.62 SD 0.76 Post 2.48 SD 1.06 *Control* Pre 3.56 SD 0.72 Post 3.43 SD 0.76
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	**Total DASS-21 Primary outcome overall score DASS-21** *Intervention* Pre 5.84 SD 3.85 Post 3.83 SD 3.21 *Control* Pre 6.14 SD 3.77 Post 4.27 SD 3.47

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.	**DTS** *Intervention* Pre 34.57 SD 23.47 Post 24.91 SD 20.41 *Control* Pre 36.91 SD 23.18 Post 26.36 SD 21.02 **MBI EE** *Intervention* Pre 23.27 SD 12.20 Post 19.43 SD 12.25 *Control* Pre 23.57 SD 12.34 Post 19.67 SD 12.91 **MBI PA** *Intervention* Pre 39.69 SD 6.43 Post 40.33 SD 6.31 *Control* 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)[*]
				MHI D *Intervention* Pre 4.69 SD 5.08 Post 4.51 SD 4.96 *Control* Pre 5.24 SD 5.41 Post 4.78 SD 5.25 **ISI** *Intervention* Pre 9.80 SD 6.19 Post 8.07 SD 6.18 *Control* Pre 10.16 SD 6.53 Post 8.44 SD 6.68 **GSE** *Intervention* Pre 32.42 SD 4.71 Post 33.22 SD 4.65 *Control* Pre 32.00 SD 4.73 Post 32.54 SD 4.88

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.	**Total PSQI** *Intervention* Pre 9.23 SD 3.18 Post 7.50 SD 2.95 *Control* Pre 8.73 SD 3.02 Post 8.53 SD 2.82 **SEE** *Intervention* Pre 2.74 SD 1.62 Post 3.47 SD 1.91 *Control* 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)[*]
				Post 2.90 SD 1.73 **BREQ-2** *Intervention* Pre 3.26 SD 0.36 Post 3.71 SD 0.44 *Control* Pre 3.38 SD 0.63 Post 3.45 SD 0.48 **MPF** *Intervention* Pre 92.63 SD 14.61 Post 87.37 SD 16.00 *Control* Pre 94.83 SD 13.90 Post 93.65 SD 19.00 **WEKWS** *Intervention* Pre 2.89 SD 0.47 Post 3.42 SD 0.55 *Control* Pre 3.17 SD 0.42

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)			**WCI problem solving** Pre 1.5 SD 0.5 Post 1.5 SD 0.7 **WCI seek support** Pre 1.5 SD 0.5 Post 1.4 SD 0.6 **WCI escape-avoidance** Pre 0.6 SD 0.5 Post 0.6 SD 0.5
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.	**PSQI** *Intervention group* Pre 9.90 SD 2.48 Post 9.33 SD 3.15 *Control group* Pre 9.40 SD 2.30 Post 10.60 SD 2.49
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	**MAAS** Pre 3.5 SD 0.83 Post 3.94 SD 0.75

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.	**PSS** Pre 21.1 SD 6.83 Post 15.26 SD 5.38 **MBI EE** Pre 10.3 SD 4.86 Post 8.89 SD 4.6 **MBI D (median and IQR)** Pre 2 IQR 0-4 Post 1 IQR 0-3 **MBI PA (median and IQR)** Pre 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.	**UCLA loneliness score** *Intervention* Pre 42.1 SD 9.71 Post 39.42 SD 9.01 *Control* Pre 42.22 SD 10.75 Post 41.15 SD 12.45 **PSQI** *Intervention* Pre 10.7 SD 3.84 Post 9.1 SD 2.99 *Control* 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	**Results for intention to intervene sample N=21 GAD-7** Pre 11.12 SD 5.32 Mid-point 8.06 SD 4.93 Post 4.99 SD 3.59

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 **PHQ-9** 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 **PCL-5** 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-	**SAI** *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.	Pre 51.86 SD 15.89 Post 42.96 SD 11.75 *Control* Pre 51.28 SD 13.38 Post 50.36 SD 14.48 **WRSS** *Intervention* Pre 42.03 SD 9.85 Post 37.32 SD 5.62 *Control* Pre 41.55 SD 7.46 Post 40.71 SD 7.87 **PWBS** *Intervention* Pre 39.84 SD 8.48 Post 46.76 SD 7.22 *Control* Pre 41.34 SD 11.08 Post 41.61 SD 12.10

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	**BAI** *Intervention* Pre 26.14 SD 7.68 Dy 7 24.30 SD 5.41 Dy 14 23.82 SD 3.17 *Control* Pre 26.41 SD 12.19 Dy 7 29.86 SD 11.64 Dy 14 33.14 SD 13.73 **PSQI** *Intervention* Pre 5.48 SD 3.46 Dy 7 3.60 SD 1.96 Dy 14 4.18 SD 3.62 *Control* Pre 6.00 SD 3.79 Dy 7 6.00 SD 3.07 Dy 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. **SAS** change -3.06 SD 10.54 **SDS**

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

SCHOLARONE™
Manuscripts

BMJ

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

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

Authors: Kate Robins-Browne[1], Matthew Lewis[1,5], Luke Burchill[2,3], Cecily Gilbert[4], Caroline Johnson[1,5], Meaghan L O'Donnell[6], Aneta Kotevski[2], Jasmine Poonian[7], Victoria J Palmer[1,5].

1. Primary Care Mental Health Research Program, Department of General Practice, Melbourne Medical School, The University of Melbourne, Melbourne, Australia

2. Department of Medicine, The University of Melbourne, Parkville, Australia

3. Department of Cardiology, Royal Melbourne Hospital, Parkville, Australia

4. Centre for Digital Transformation of Health, The University of Melbourne, Melbourne, Australia

5. The ALIVE National Centre for Mental Health Research Translation, Department of General Practice, Melbourne Medical School, The University of Melbourne, Melbourne, Australia

6. Phoenix Australia, Department of Psychiatry, The University of Melbourne, Melbourne, Australia

7. Emergency Department, The Royal Melbourne Hospital, Melbourne, Victoria, Australia

Corresponding Author:

Professor Victoria Palmer

The ALIVE National Centre for Mental Health Research Translation

Department of General Practice, Melbourne Medical School

The University of Melbourne,

780 Elizabeth St, Melbourne VIC, Australia 3010

Email: v.palmer@unimelb.edu.au

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

Word Count: 5337 (including in-text citations)

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 1st January 2000 to 14th 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

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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.

Abstract word count: 299

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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

impacts on HCWs working within pandemics is recognised, there is a mismatch between the interventions offered, focusing on relieving individual symptoms, versus HCWs' expressed preferences for social support.[3] The COVID-19 pandemic has highlighted that few evidence-based interventions exist supporting the short and long-term mental health of HCWs both within and outside pandemics and are urgently 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 are available, but there remains a paucity of evidence about HCW specific digital interventions and the uptake, acceptability and feasibility both inside and outside of pandemics.[18 20]

This evidence review and synthesis informed a larger project that involved the development, design, implementation and evaluation 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 people who are directly impacted by a topic or issue at hand.[21] EBCD typically involves two interconnected stages (1) information/experience gathering and (2) engaging people with lived-experience as content co-creators, designers and co-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.

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.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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 1st 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 1st of January 2000 with the intention 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.

13

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.

14

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]

15

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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

16

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.[47] Yıldırım and Çiriş Yıldız [45] reported that a single 30-minute, online, mindfulness based breathing session decreased work related strain and anxiety and improved psychological wellbeing.

Beverly, et al. [39] reported decreased HCWs stress on a visual analogue scale after viewing a 3-minute immersive virtual reality nature scene using a pre-post design. Dincer and Inangil [46] 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 (Subjective units of distress scale (SUD)), anxiety (State Anxiety Scale (SAS)) and burnout (Burnout Inventory (BAI)) in a RCT.

Giordano, et al. [52] 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 pre-post analysis showed 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 however.

Three studies described exercise-based interventions.[35 36 50] Ha, et al. [50] described a 12-week fitness program aiming to increase physical activity and improve sleep quality. In this RCT 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 [35] 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 measurement data was presented.

17

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 Disoder-7 (GAD-7) in their non-randomised pre-post study. Trottier, 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

18

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

19

the NHS that addressed an unmet need. Staff described pre-pandemic wellbeing initiatives as focussing on healthy lifestyle changes rather than addressing the core issues that impact staff. Buddies described 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. [30] reported that individual psychotherapy for nurses who were experiencing high levels of psychological distress, decreased in 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.[40] The intervention was poorly described, and the findings were 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.[28 31 32 41 42] Four of these involved multicomponent interventions. Chen, et al. [28] 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[64]) and depression scale (SDS[65]) and the PSQI[57] 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 (M:60 (SD:9.28)) and SDS (M:61 (SD:12.62)) indicated moderate anxiety and depression, which reduced to mild anxiety

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

21

improved COVID-19 knowledge and clinic activity; without a control sample and appropriately powered study this is difficult to establish.

Zhou, et al. [41] 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[64] M: -3.06, SD:10.54, p=.019) and non-significantly decreased depression (SDS[65] M:−1.99, SD:16.21, p=.306) from pre-post. The authors concluded that knowledge regarding infection prevention and psychological support decreased anxiety, but that not enough time had elapsed to decrease depression. The lack of a control condition makes it difficult to determine the observed outcomes to the intervention.

One intervention delivered virtual continuing medical education (vCME) for 44 obstetrics and gynaecology trainees in Singapore to support trainee mental health to allow trainees to continue training and maintain skills when elective surgeries were cancelled.[42] Twenty-eight trainees completed a program audit including three questions about wellbeing. The authors reported on only one question, with 75% of respondents indicating that the sessions helped them cope with the difficulties of team segregation.

Across the 26 studies, 41 mental health-focused outcome measures were reported with 30 only being used in one study each, six in two studies, two in three studies (Zung's Self-rating Anxiety Scale, Zung's Self-rating Depression Scale[64 65]), two in four studies (GAD-7, PHQ-9[68 69]) and one in five studies (PSQI[57]). Some studies used well recognised and validated instruments, whereas other studies used modified versions of existing instruments or developed their own instruments, with little presentation of how these instruments were developed or validated, if at all.

Trends can be seen in the outcomes across included studies. Six studies demonstrated improvements in sleep,[28 35 36 47 48 50] three in wellbeing,[29 40 45 49] and two in coping[38 42] and in confidence[26 27]. Seven studies demonstrated decreased anxiety,[28 34 36 41 44 46 51] five decreased stress,[35 37 39 45 46] four decreased depression,[28 34 44 51] two decreased burnout,[37 46] and one

22

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.

23

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,

24

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.

25

Generating evidence within pandemics is understandably complex[17] as interventions are rapidly developed and deployed, participants are already burdened, and the system is under strain. Our review excluded many papers describing interventions that did not present efficacy data. The included studies had variable design quality. Most studies had small samples and no indication of power, and only 10/26 studies included control data. Long-term follow-up was infrequent. There was significant heterogeneity in the interventions, reported outcomes, dosage description, and rigour of the evaluations. The use of proxy outcome measurements was common such that confidence was used as a proxy for resilience[26 27] and sleep quality as a proxy for mental health and wellbeing.[48 50]

Our search identified two HCW mobile mental health app studies designed specifically in response to the COVID-19.[43 44] Despite a good retention rate and being adequately powered, Fiol-DeRoque, et al. [43] 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 terms of engagement and usage, and time to see a change. De Kock, et al. [44] showed their COVID-19 specific app was of greater benefit that a non-specific mental health app, however there was 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 understandably likely to impact on research participation. These mixed findings indicate that there is some potential for HCW focused mental health mobile applications to be developed and implemented though 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. Existing reviews of interventions (e.g.[2 7 13 18]) cited useful studies, and we acknowledge lessons learned from their work. The use of digital techniques in 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

27

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.

28

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

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

29

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.

Funding source

This research was funded by a grant from the Australian Government Department of Health, the Peter Doherty Philanthropic Trust Fund, the Royal Melbourne Hospital, and the University of Melbourne. The funding bodies had no role in study design, data collection, data analysis, data interpretation, or writing of the manuscript. The corresponding author has full access to all the data in the study and had final responsibility for the decision to submit for publication.

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

30

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.

31

References

1. Petrie K, Crawford J, Baker STE, et al. Interventions to reduce symptoms of common mental disorders and suicidal ideation in physicians: a systematic review and meta-analysis. *The Lancet Psychiatry* 2019;6(3):225-34. doi: https://doi.org/10.1016/S2215-0366(18)30509-1

2. Kisely S, Warren N, McMahon L, et al. Occurrence, prevention, and management of the psychological effects of emerging virus outbreaks on healthcare workers: rapid review and meta-analysis. *BMJ* 2020;369:m1642. doi: 10.1136/bmj.m1642 [published Online First: 2020/05/07]

3. Muller A, Hafstad E, Himmels JPW, et al. The mental health impact of the covid-19 pandemic on healthcare workers, and interventions to help them: A rapid systematic review. *Psychiatry Research* 2020;293:113441.

4. Kunzler AM, Helmreich I, Chmitorz A, et al. Psychological interventions to foster resilience in healthcare professionals. *Cochrane Database of Systematic Reviews* 2020 2020 Jul 5. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=edswsc&AN=000568666400016&site=eds-live&scope=site&custid=s2775460 (accessed 2020 Aug 5).

5. Ruotsalainen JH, Verbeek JH, Marine A, et al. Preventing occupational stress in healthcare workers. *Cochrane Database of Systematic Reviews* 2015 2015 Apr 7; 4. https://search.ebscohost.com/login.aspx?direct=true&AuthType=sso&db=edswsc&AN=000209933000008&site=eds-live&scope=site&custid=s2775460 (accessed 2020 Aug 15).

6. Albert CM, Andreotti G, Bala B, et al. Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study. *The Lancet Public Health* 2020;5(9):e475-e83. doi: 10.1016/S2468-2667(20)30164-X

7. Billings J, Ching BCF, Gkofa V, et al. Experiences of frontline healthcare workers and their views about support during COVID-19 and previous pandemics: a systematic review and qualitative meta-synthesis. *BMC Health Services Research* 2021;21(1):923. doi: 10.1186/s12913-021-06917-z

8. Sharifi M, Asadi-Pooya AA, Mousavi-Roknabadi RS. Burnout among Healthcare Providers of COVID-19; a Systematic Review of Epidemiology and Recommendations. *Archives of academic emergency medicine* 2021;9(1):e7. doi: 10.22037/aaem.v9i1.1004 [published Online First: 2021/01/26]

9. Greenberg N, Docherty M, Gnanapragasam S, et al. Managing mental health challenges faced by healthcare workers during covid-19 pandemic. *BMJ* 2020;368:m1211. doi: 10.1136/bmj.m1211 [published Online First: 2020/03/29]

10. Jack T, Bryan D-W, Gary L. Psychosocial Support for Healthcare Workers During the COVID-19 Pandemic. *Front Psychol* 2020;11 doi: 10.3389/fpsyg.2020.01960

11. Lokuge A. Racing Against the Virus from Inside Australia's Healthcare System. *The New York Times* 2020.

12. Lokuge A. A Doctor Asks: Is Covid Scaring Us Away From Our Humanity? *The New York Times* 2020 28th August 2020.

13. Pollock A, Campbell P, Cheyne J, et al. Interventions to support the resilience and mental health of frontline health and social care professionals during and after a disease outbreak, epidemic or pandemic: a mixed methods systematic review. *Cochrane Database of Systematic Reviews* 2020(11) doi: 10.1002/14651858.CD013779

14. Yue J-L, Yan W, Sun Y-K, et al. Mental health services for infectious disease outbreaks including COVID-19: a rapid systematic review. *Psychological Medicine* 2020;50(15):2498-513. doi: 10.1017/S0033291720003888 [published Online First: 2020/11/05]

15. American Medical A. Caring for our caregivers during COVID-19. 2020 17th June 2020. https://www.ama-assn.org/delivering-care/public-health/caring-our-caregivers-during-covid-19 (accessed 3rd November 2020).

16. World Health Organization. Mental health and psychosocial considerations during the COVID-19 outbreak. 2020 [Available from: https://www.who.int/docs/default-source/coronaviruse/mental-health-considerations.pdf?sfvrsn=6d3578af_2.

17. Yang L, Yin J, Wang D, et al. Urgent need to develop evidence-based self-help interventions for mental health of healthcare workers in COVID-19 pandemic. *Psychological Medicine* 2021;51(10):1775-76. doi: 10.1017/S0033291720001385 [published Online First: 2020/04/28]

18. Drissi N, Ouhbi S, Marques G, et al. A Systematic Literature Review on e-Mental Health Solutions to Assist Health Care Workers During COVID-19. *Telemedicine journal and e-health : the official journal of the American Telemedicine Association* 2021;27(6):594-602. doi: 10.1089/tmj.2020.0287 [published Online First: 2020/09/25]

19. Moreno C, Wykes T, Galderisi S, et al. How mental health care should change as a consequence of the COVID-19 pandemic. *The Lancet Psychiatry* 2020;7(9):813-24. doi: 10.1016/S2215-0366(20)30307-2

20. Chang BP, Kessler RC, Pincus HA, et al. Digital approaches for mental health in the age of COVID-19. *British Medical Journal* 2020;369:m2541.

21. Lewis M, Palmer VJ, Kotevski A, et al. Rapid Design and Delivery of an Experience-Based Co-designed Mobile App to Support the Mental Health Needs of Health Care Workers Affected by the COVID-19 Pandemic: Impact Evaluation Protocol. *JMIR Res Protoc* 2021;10(3):e26168. doi: 10.2196/26168

22. Bate P, Robert G. Experience-based design: from redesigning the system around the patient to co-designing services with the patient. *Qual Saf Health Care* 2006;15(5):307-10. doi: 10.1136/qshc.2005.016527 [published Online First: 2006/11/01]

23. Dimopoulos-Bick T, Dawda P, Maher L, et al. Experience-Based Co-Design: Tackling common challenges. *The Journal of Health Design* 2018;3(1):86-93. doi: 10.21853/jhd.2018.46

24. McKenzie JE, Brennan SE. Chapter 12: Synthesizing and presenting findings using other methods. In: Higgins JPT, Thomas J, Chandler J, et al., eds. Cochrane Handbook for Systematic Reviews of Interventions Version 6-2 (updated February 2021): Cochrane, 2021.

25. Veritas Health Innovation. Covidence systematic review software: Melbourne, Australia; 2022 [Available from: www.covidence.org accessed August 2022.

26. Aiello A, Khayeri MY, Raja S, et al. Resilience training for hospital workers in anticipation of an influenza pandemic. *Journal of Continuing Education in the Health Professions* 2011;31(1):15-20.

27. Maunder RG, Lancee WJ, Mae R, et al. Computer-assisted resilience training to prepare healthcare workers for pandemic influenza: a randomized trial of the optimal dose of training. *BMC Health Services Research* 2010;10:72.

28. Chen R, Chou K-R, Huang Y-J, et al. Effects of a SARS prevention programme in Taiwan on nursing staff's anxiety, depression and sleep quality: A longitudinal survey. *International Journal of Nursing Studies* 2006;43(2):215-25. doi: 10.1016/j.ijnurstu.2005.03.006

29. Blake H, Yildirim M, Wood B, et al. COVID-Well: Evaluation of the Implementation of Supported Wellbeing Centres for Hospital Employees during the COVID-19

Pandemic. *International journal of environmental research and public health.* Switzerland: MDPI, 2020.

30. Kameno Y, Hanada A, Asai D, et al. Individual psychotherapy using psychological first aid for frontline nurses at high risk of psychological distress during the COVID-19 pandemic. *Psychiatry and Clinical Neurosciences* 2021;75(1):25-27. doi: https://doi.org/10.1111/pcn.13170

31. Hong X, Cao J, Wei J, et al. Stress and psychological impact of the COVID-19 outbreak on the healthcare staff at the fever clinic of a tertiary general hospital in Beijing: a cross-sectional study. *BJPsych Open* 2021;7(3):e76. doi: 10.1192/bjo.2021.32 [published Online First: 2021/04/06]

32. Cheng W, Zhang F, Liu Z, et al. A psychological health support scheme for medical teams in COVID-19 outbreak and its effectiveness. *Gen Psychiatr* 2020;33(5):e100288. doi: 10.1136/gpsych-2020-100288 [published Online First: 2021/07/01]

33. Amsalem D, Lazarov A, Markowitz JC, et al. Video intervention to increase treatment-seeking by healthcare workers during the COVID-19 pandemic: randomised controlled trial. *The British Journal of Psychiatry* 2022;220(1):14-20. doi: 10.1192/bjp.2021.54 [published Online First: 2021/05/05]

34. Cole CL, Waterman S, Hunter ECM, et al. Effectiveness of small group cognitive behavioural therapy for anxiety and depression in Ebola treatment centre staff in Sierra Leone. *International Review of Psychiatry* 2020;33(1-2):189-97.

35. Wu K, Wei X. Analysis of Psychological and Sleep Status and Exercise Rehabilitation of Front-Line Clinical Staff in the Fight Against COVID-19 in China. *Medical science monitor basic research* 2020; 26. (accessed 2020 May 11).

36. Zhan J, Yang K, Sun Z, et al. The Sleep Quality of the Frontline Healthcare Workers and the Improving Effect of Tai Chi. *Front Psychiatry* 2022;13(101545006):883590. doi: https://dx.doi.org/10.3389/fpsyt.2022.883590

37. Osman I, Hamid S, Singaram VS. Efficacy of a brief online mindfulness-based intervention on the psychological well-being of health care professionals and trainees during the COVID-19 pandemic: A mixed method design. *Health SA = SA Gesondheid* 2021;26(101213385):1682. doi: https://dx.doi.org/10.4102/hsag.v26i0.1682

38. Zingela Z, van Wyk S, Bronkhorst A, et al. Developing a healthcare worker psychological preparedness support programme for the COVID-19 outbreak. *The*

South African journal of psychiatry : SAJP : the journal of the Society of Psychiatrists of South Africa 2022;28(100958626):1665. doi: https://dx.doi.org/10.4102/sajpsychiatry.v28i0.1665

39. Beverly E, Hommema L, Coates K, et al. A tranquil virtual reality experience to reduce subjective stress among COVID-19 frontline healthcare workers. *PloS one* 2022;17(2):e0262703. doi: https://dx.doi.org/10.1371/journal.pone.0262703

40. Sun L. Intervention Effect of Time Management Training on Nurses' Mental Health during the COVID-19 Epidemic. *Psychiatria Danubina* 2021;33(4):626-33. doi: https://dx.doi.org/10.24869/psyd.2021.626

41. Zhou M, Yuan F, Zhao X, et al. Research on the individualized short-term training model of nurses in emergency isolation wards during the outbreak of COVID-19. *Nursing open* 2020;7(6):1902-08. doi: https://dx.doi.org/10.1002/nop2.580

42. Chan GMF, Kanneganti A, Yasin N, et al. Well-being, obstetrics and gynaecology and COVID-19: Leaving no trainee behind. *The Australian & New Zealand journal of obstetrics & gynaecology* 2020;60(6):983-86. doi: https://dx.doi.org/10.1111/ajo.13249

43. Fiol-DeRoque MA, Serrano-Ripoll MJ, Jiménez R, et al. A Mobile Phone-Based Intervention to Reduce Mental Health Problems in Health Care Workers During the COVID-19 Pandemic (PsyCovidApp): randomized Controlled Trial. 2021;9(5):e27039. doi: 10.2196/27039

44. De Kock JH, Latham HA, Cowden RG, et al. Brief Digital Interventions to Support the Psychological Well-being of NHS Staff During the COVID-19 Pandemic: 3-Arm Pilot Randomized Controlled Trial. *JMIR Ment Health* 2022;9(4) doi: 10.2196/34002

45. Yıldırım D, Çiriş Yıldız C. The Effect of Mindfulness-Based Breathing and Music Therapy Practice on Nurses' Stress, Work-Related Strain, and Psychological Well-being During the COVID-19 Pandemic: a Randomized Controlled Trial. 2022;36(3):156-65. doi: 10.1097/HNP.0000000000000511

46. Dincer B, Inangil D. The effect of Emotional Freedom Techniques on nurses' stress, anxiety, and burnout levels during the COVID-19 pandemic: a randomized controlled trial. 2021;17(2):109-14. doi: 10.1016/j.explore.2020.11.012

47. Thimmapuram J, Pargament R, Bell T, et al. Heartfulness meditation improves loneliness and sleep in physicians and advance practice providers during COVID-19 pandemic. 2021;49(3):194-202. doi: 10.1080/21548331.2021.1896858

48. Nourian M, Nikfarid L, Khavari AM, et al. The Impact of an Online Mindfulness-Based Stress Reduction Program on Sleep Quality of Nurses Working in COVID-19 Care Units: A Clinical Trial. 2021;35(5):257-63. doi: 10.1097/HNP.0000000000000466

49. Blake H, Gupta A, Javed M, et al. COVID-Well Study: Qualitative Evaluation of Supported Wellbeing Centres and Psychological First Aid for Healthcare Workers during the COVID-19 Pandemic. *Int J Environ Res Public Health* 2021;18(7):27. doi: 10.3390/ijerph18073626

50. Ha Y, Lee SH, Lee DH, et al. Effectiveness of a Mobile Wellness Program for Nurses with Rotating Shifts during COVID-19 Pandemic: A Pilot Cluster-Randomized Trial. *Int J Environ Res Public Health* 2022;19(2):11. doi: 10.3390/ijerph19021014

51. Trottier K, Monson CM, Kaysen D, et al. Initial findings on RESTORE for healthcare workers: an internet-delivered intervention for COVID-19-related mental health symptoms. *Transl Psychiatr* 2022;12(1):7. doi: 10.1038/s41398-022-01965-3

52. Giordano F, Scarlata E, Baroni M, et al. Receptive music therapy to reduce stress and improve wellbeing in Italian clinical staff involved in COVID-19 pandemic: A preliminary study. *The Arts in Psychotherapy* 2020;70:101688. doi: https://doi.org/10.1016/j.aip.2020.101688

53. Brooks SK, Dunn R, Amlôt R, et al. A Systematic, Thematic Review of Social and Occupational Factors Associated With Psychological Outcomes in Healthcare Employees During an Infectious Disease Outbreak. *Journal of Occupational & Environmental Medicine* 2018;60(3):248-57. doi: 10.1097/JOM.0000000000001235

54. De Brier N, Stroobants S, Vandekerckhove P, et al. Factors affecting mental health of health care workers during coronavirus disease outbreaks (SARS, MERS & COVID-19): A rapid systematic review. *PLOS ONE* 2020;15(12):e0244052. doi: 10.1371/journal.pone.0244052

55. Preti E, Di M, Perego G, et al. The Psychological Impact of Epidemic and Pandemic Outbreaks on Healthcare Workers: Rapid Review of the Evidence. *Current Psychiatry Reports* 2020;22:43. doi: https://dx.doi.org/10.1007/s11920-020-01166-z

56. Serrano-Ripoll MJ, Meneses-Echavez JF, Ricci-Cabello I, et al. Impact of viral epidemic outbreaks on mental health of healthcare workers: a rapid systematic

review and meta-analysis. *Journal of Affective Disorders* 2020;277:347-57. doi: 10.1016/j.jad.2020.08.034

57. Buysse DJ, Reynolds CF, 3rd, Monk TH, et al. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989;28(2):193-213. doi: 10.1016/0165-1781(89)90047-4 [published Online First: 1989/05/01]

58. Maslach C, Jackson SE. The measurement of experienced burnout. *Journal of Organizational Behavior* 1981;2(2):99-113. doi: https://doi.org/10.1002/job.4030020205

59. Proudfoot J, Clarke J, Birch M-R, et al. Impact of a mobile phone and web program on symptom and functional outcomes for people with mild-to-moderate depression, anxiety and stress: a randomised controlled trial. *BMC Psychiatry* 2013;13(1):312. doi: 10.1186/1471-244X-13-312

60. Lovibond SH, Lovibond PF. Manual for the Depression Anxiety Stress Scales. 2nd. ed. Sydney: Psychology Foundation 1995.

61. Davidson J. Davidson Tauma Scale: Multi-Health Systems, Inc. 1996.

62. Morin CM, Belleville G, Bélanger L, et al. The Insomnia Severity Index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep* 2011;34(5):601-8. doi: 10.1093/sleep/34.5.601 [published Online First: 2011/05/03]

63. Herrero R, Espinoza M, Molinari G, et al. Psychometric properties of the General Self Efficacy-12 Scale in Spanish: General and clinical population samples. *Comprehensive Psychiatry* 2014;55(7):1738-43. doi: https://doi.org/10.1016/j.comppsych.2014.05.015

64. Zung WW. A rating instrument for anxiety disorders. *Psychosomatics* 1971;12(6):371-9. doi: 10.1016/s0033-3182(71)71479-0 [published Online First: 1971/11/01]

65. Zung WW. A self-rating depression scale. *Arch Gen Psychiatry* 1965;12:63-70. doi: 10.1001/archpsyc.1965.01720310065008 [published Online First: 1965/01/01]

66. Cao J, Wei J, Zhu H, et al. A Study of basic needs and psychological wellbeing of medical workers in the fever clinic of a tertiary general hospital in Beijing during the COVID-19 outbreak. *Psychotherapy and Psychosomatics* 2020;89(4):252-54. doi: 10.1159/000507453

67. Weiss DS, Marmar CR. The Impact of Event Scale-Revised. In: Wilson JP, Keane TM, eds. Assessing Psychological Trauma and PTSD: A Practitioner's Handbook. New York: Guilford Press 1997:399-411.

68. Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine* 2006;166(10):1092-7. doi: 10.1001/archinte.166.10.1092 [published Online First: 2006/05/24]

69. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001;16(9):606-13. doi: 10.1046/j.1525-1497.2001.016009606.x [published Online First: 2001/09/15]

70. Milner AJ, Maheen H, Bismark MM, et al. Suicide by health professionals: a retrospective mortality study in Australia, 2001–2012. 2016;205(6):260-65. doi: 10.5694/mja15.01044

71. Chen Q, Liang M, Li Y, et al. Mental health care for medical staff in China during the COVID-19 outbreak. *The Lancet Psychiatry* 2020;7(4):e15-e16. doi: 10.1016/s2215-0366(20)30078-x

72. EPPI Centre. COVID-19: a living systematic map of the evidence United Kingdom: EPPI Centre; 2020 [Available from: http://eppi.ioe.ac.uk/cms/Projects/DepartmentofHealthandSocialCare/Publishedreviews/COVID-19Livingsystematicmapoftheevidence/tabid/3765/Default.aspx accessed 18th September 2020 2020.

73. Glasziou PP, Sanders S, Hoffmann T. Waste in covid-19 research. *BMJ (Clinical research ed)* 2020;369:m1847. doi: 10.1136/bmj.m1847

74. Janiaud P, Axfors C, Hooft Jvt, et al. The worldwide clinical trial research response to the COVID-19 pandemic - the first 100 days. *F1000Research* 2020;9:1193. doi: 10.12688/f1000research.26707.1
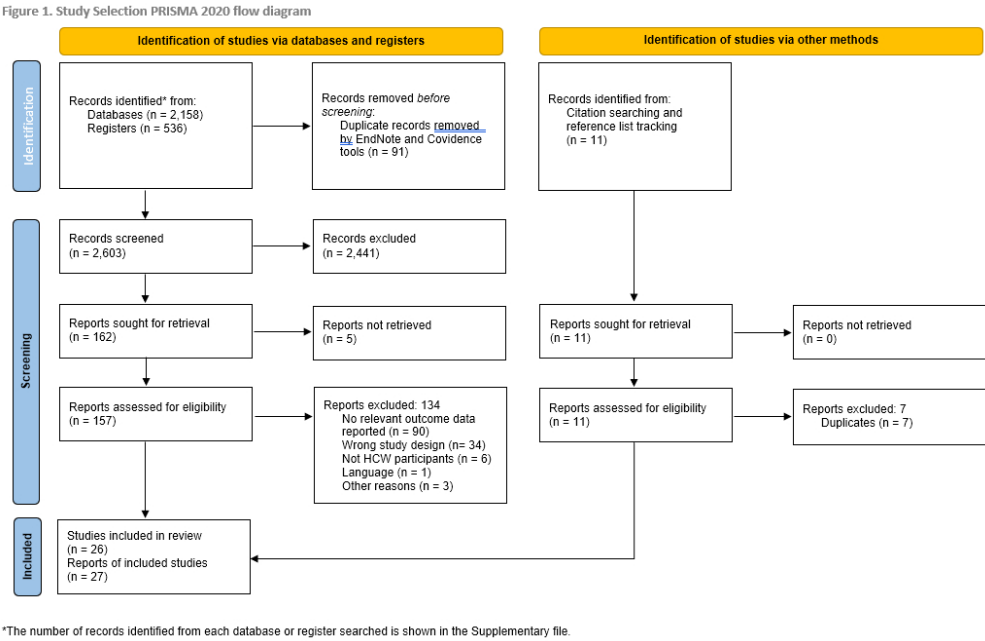
Figure 1. Study Selection PRISMA 2020 flow diagram

686x446mm (38 x 38 DPI)

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
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.	P5-6
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	P6
METHODS			
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
catastrophi*: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 catastrophi?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

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 intensions 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. [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

				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.		
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. **App 1 My Possible Self (MPS)**: 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).

| | | | | **App 2 NHS Highland Wellbeing Project (NHSWBP)** 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 acupressure points in Traditional Chinese Medicine to send the brain either activating or deactivating signals. **Intervention** – one 20 minute online session teaching participants EFT in groups of 5. **Control** – 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.

				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. **Intervention:** received MBSR program; **Control:** 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 100 nurses regarding mental	Two arm RCT **Intervention** 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.	**Control group** 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. **Intervention:** mindfulness; **Control**: 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 **Intervention:** online session; **Control;** 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 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.
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. |

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.	**Baseline to day 30**: intervention significantly increased help-seeking intentions compared to controls. Larger impact in Group 1 than Group 2. **Day 14**: Group 1 had increased intention to seek treatment compared to immediately post-intervention, this was not the case for Group 2.	**ATSPPH-SH Baseline** Group 1 7.9 (CI 7.3-8.4) Group 2 7.9 (CI 7.9-8.8) **ATSPPH-SH immediately post-intervention** Group 1 9.2 (CI 8.7-9.7) Group 2 9.4 (CI 9.0-9.7) **ATSPPH-SH 30 days post** 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 ≥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	**Pre-simulation VAS** 5.1 SD 2.2 **Post-simulation VAS** 3.8 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	**Survey:** 819 completed - 94% aware of centres; 55.2% had accessed a centre. **Interviews:** 24 interviews with centre users, buddies and those involved in operationalising the centres.	**Survey:** 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. **Interviews:** 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.	**UWES** Centre users 5.02 SD 1.14 Non-users 4.83 SD 1.15

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.	**SAS** T1 60 SD 9.28 T2 51 SD 10.32 T3 50 SD 9.84 T4 46 SD 7.48 **SDS** T1 61 SD 12.62 T2 51 SD 11.94 T3 50 SD 10.60 T4 48 SD 10.76 **PSQI** 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.	**GAD-7** T1 13.42 SD 0.49 T2 8.96 SD 0.47 **PHQ-9** T1 15.41 SD 0.66 T2 10.90 SD 0.61 **WSAS** 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.	**GAD-7** *MPS* Baseline 7.16 SD 5.60 Midpoint 6.45 SD 5.03 Post 6.89 SD 5.71 *NHSWBP*

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 *Control* Baseline 7.43 SD 5.10 Midpoint 7.35 SD 5.23 Post 6.72 SD 5.59 **PHQ-9** *MBS* Baseline 6.76 SD 5.04 Midpoint 5.74 SD 4.31 Post 5.18 SD 3.27 *NHSWBP* Baseline 7.60 SD 4.31 Midpoint 7.23 SD 5.47 Post 5.68 SD 4.39 *Control* Baseline 7.80 SD 5.23 Midpoint 8.00 SD 5.06 Post 7.56 SD 6.25 **WEMWBS** *MBS*

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

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 **GQ** MHS Baseline 27.3 SD 3.46 Midpoint 27.9 SD 3.63 Post 28.2 SD 4.23 NHSWBP 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);	**SUD** *Intervention* Pre 7.82 SD 1.33 Post 2.85 SD 1.21 *Control* 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.	**SAS** *Intervention* Pre 67.68 SD 9.05 Post 32.25 SD 4.67 *Control* Pre 64.7 SD 8.05 Post 64.43 SD 7.68 **Burnout Inventory** *Intervention* Pre 3.62 SD 0.76 Post 2.48 SD 1.06 *Control* Pre 3.56 SD 0.72 Post 3.43 SD 0.76
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	**Total DASS-21** **Primary outcome overall score DASS-21** *Intervention* Pre 5.84 SD 3.85 Post 3.83 SD 3.21 *Control* Pre 6.14 SD 3.77 Post 4.27 SD 3.47

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.	**DTS** *Intervention* Pre 34.57 SD 23.47 Post 24.91 SD 20.41 *Control* Pre 36.91 SD 23.18 Post 26.36 SD 21.02 **MBI EE** *Intervention* Pre 23.27 SD 12.20 Post 19.43 SD 12.25 *Control* Pre 23.57 SD 12.34 Post 19.67 SD 12.91 **MBI PA** *Intervention* Pre 39.69 SD 6.43 Post 40.33 SD 6.31 *Control* 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)*
				MHI D *Intervention* Pre 4.69 SD 5.08 Post 4.51 SD 4.96 *Control* Pre 5.24 SD 5.41 Post 4.78 SD 5.25 **ISI** *Intervention* Pre 9.80 SD 6.19 Post 8.07 SD 6.18 *Control* Pre 10.16 SD 6.53 Post 8.44 SD 6.68 **GSE** *Intervention* Pre 32.42 SD 4.71 Post 33.22 SD 4.65 *Control* Pre 32.00 SD 4.73 Post 32.54 SD 4.88

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.	**Total PSQI** *Intervention* Pre 9.23 SD 3.18 Post 7.50 SD 2.95 *Control* Pre 8.73 SD 3.02 Post 8.53 SD 2.82 **SEE** *Intervention* Pre 2.74 SD 1.62 Post 3.47 SD 1.91 *Control* 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)*
				Post 2.90 SD 1.73
				BREQ-2
				Intervention
				Pre 3.26 SD 0.36
				Post 3.71 SD 0.44
				Control
				Pre 3.38 SD 0.63
				Post 3.45 SD 0.48
				MDF
				Intervention
				Pre 92.63 SD 14.61
				Post 87.37 SD 16.00
				Control
				Pre 94.83 SD 13.90
				Post 93.65 SD 19.00
				WEKWS
				Intervention
				Pre 2.89 SD 0.47
				Post 3.42 SD 0.55
				Control
				Pre 3.17 SD 0.42

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)			**WCI problem solving** Pre 1.5 SD 0.5 Post 1.5 SD 0.7 **WCI seek support** Pre 1.5 SD 0.5 Post 1.4 SD 0.6 **WCI escape-avoidance** Pre 0.6 SD 0.5 Post 0.6 SD 0.5
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.	**PSQI** *Intervention group* Pre 9.90 SD 2.48 Post 9.33 SD 3.15 *Control group* Pre 9.40 SD 2.30 Post 10.60 SD 2.49
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	**MAAS** Pre 3.5 SD 0.83 Post 3.94 SD 0.75

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.	**PSS** Pre 21.1 SD 6.83 Post 15.26 SD 5.38 **MBI EE** Pre 10.3 SD 4.86 Post 8.89 SD 4.6 **MBI D (median and IQR)** Pre 2 IQR 0-4 Post 1 IQR 0-3 **MBI PA (median and IQR)** Pre 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.	**UCLA loneliness score** *Intervention* Pre 42.1 SD 9.71 Post 39.42 SD 9.01 *Control* Pre 42.22 SD 10.75 Post 41.15 SD 12.45 **PSQI** *Intervention* Pre 10.7 SD 3.84 Post 9.1 SD 2.99 *Control* 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	**Results for intention to intervene sample N=21 GAD-7** Pre 11.12 SD 5.32 Mid-point 8.06 SD 4.93 Post 4.99 SD 3.59

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 **PHQ-9** 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 **PCL-5** 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-	**SAI** *Intervention*

For peer review only

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.	Pre 51.86 SD 15.89 Post 42.96 SD 11.75 *Control* Pre 51.28 SD 13.38 Post 50.36 SD 14.48 **WRSS** *Intervention* Pre 42.03 SD 9.85 Post 37.32 SD 5.62 *Control* Pre 41.55 SD 7.46 Post 40.71 SD 7.87 **PWBS** *Intervention* Pre 39.84 SD 8.48 Post 46.76 SD 7.22 *Control* Pre 41.34 SD 11.08 Post 41.61 SD 12.10

For peer review only

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	**BAI** *Intervention* Pre 26.14 SD 7.68 Dy 7 24.30 SD 5.41 Dy 14 23.82 SD 3.17 *Control* Pre 26.41 SD 12.19 Dy 7 29.86 SD 11.64 Dy 14 33.14 SD 13.73 **PSQI** *Intervention* Pre 5.48 SD 3.46 Dy 7 3.60 SD 1.96 Dy 14 4.18 SD 3.62 *Control* Pre 6.00 SD 3.79 Dy 7 6.00 SD 3.07 Dy 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. **SAS** change -3.06 SD 10.54 **SDS**

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.