SYSTEMATIC REVIEW

Interventions to mitigate the impact of COVID-19 pandemic on mental health status of healthcare workers: a systematic review

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Abstract

Objective: To evaluate the effectiveness of interventions in addressing the impact of coronavirus disease-2019 on the mental health status of healthcare workers.

Method: The systematic review was conducted from January to August 2023 in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, and comprised search on Medical Literature Analysis and Retrieval System Online, Excerpta Medica database, Allied and Complementary Medicine Database Cumulative Index to Nursing and Allied Health Literature and Cochrane Central Register of Controlled Trials databases for relevant randomised clinical trials published till January 25, 2022, focussing on assessing the effectiveness of interventions addressing the impact of coronavirus disease-2019 on healthcare workers. The risk of bias of the studies was assessed using the revised Cochrane risk of bias tool for randomised clinical trials RoB 2.0.

Results: There were 17 randomised clinical trials with 4,511 participants. Overall findings showed that mindfulness-based interventions, yoga/music, music therapy/meditation, psychological interventions, creative arts therapy, and acupuncture could be effective in improving mental health outcomes for healthcare workers dealing with coronavirus disease-2019 patients. Pharmacological interventions and transcendental meditation may not be as effective.

Conclusion: Implementing non-pharmacological interventions to support the mental health of healthcare workers during times of crisis could be a positive approach.

Key Words: COVID-19, Mental health, Anxiety, Depression, Post-traumatic distress syndrome.

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Introduction

The coronavirus disease-2019 (COVID-19) pandemic had a profound impact on a global scale, with its widespread transmission almost reaching every corner of the world. The pandemic caused unprecedented challenges, particularly in economic and healthcare domains.[1] The healthcare systems of many developing nations were severely strained, leading to a collapse in their infrastructure and resources.[2] In a healthcare system, the health workforce is an essential building block, and it holds paramount importance, especially in developing countries where there is often a shortage of healthcare workers. It is documented that during an outbreak, healthcare workers suffer the most, and experience significant impacts on their performance and overall wellbeing, particularly in terms of their mental health.[3] The World Health Organisation (WHO) has consistently emphasised the critical importance of addressing the impact of the COVID-19 pandemic on the physical and mental health of healthcare workers.[4]

Healthcare workers are often overburdened during disease outbreaks due to the constant increase in infected cases, rising death rates, lack of specific treatments or vaccines, unrest in the media, lack of personal protective equipment (PPE), and a feeling of inadequate organisational support. The increased workload and the risk of infection place immense pressure on healthcare workers, and can result in physical and mental health problems, as well as emotional distress. Therefore, working in such situations can lead to the development of psychological and mental illnesses, making it important to prioritise the wellbeing of healthcare workers during times of crisis.[5] Healthcare workers worldwide have been found to experience significant levels of anxiety, insomnia, depression and post-traumatic stress disorder (PTSD), according to studies conducted around the globe.[6-9] According to a systematic review, healthcare workers have reported varying levels of mental health challenges, including anxiety (24.1% to 44.6%), depression (12.1% to 50.4%), sleep disturbance (34.0% to 58.4%), and post-traumatic distress (25.5% to 50.5%).[10]

Studies have shown that coping strategies can have a positive impact on reducing stress levels and mitigating

the risk of psychological symptoms. These strategies can involve a wide range of actions aimed at addressing emotions, seeking help from friends or peers, developing resilience, and improving self-efficacy.[4] In a systematic review published in 2021, four types of interventions were identified for addressing mental health issues among healthcare workers: informational support (such as preventive guidelines and training), instrumental support (such as personal protection protocols and equipment), organisational support (such as flexibility in working hours, allocation of manpower, structural reorganisation, and rest areas), and emotional and psychological support (such as psychological support, peer support groups, and digital tele-support).[11]

The current systematic review was planned to evaluate the effectiveness of mental health interventions in addressing the impact of COVID-19 on the mental health status of healthcare workers.

Materials and Methods

The systematic review was conducted from January to August 2023 in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[12] The review was registered with the International Prospective Register of Systematic Reviews (PROSPERO) registry (CRD42022377452).

Initially, search was conducted on Medical Literature Analysis and Retrieval System Online (Medlie), Excerpta Medica database (EMBASE), Allied and Complementary Medicine Database (ACMD), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Central Register of Controlled Trials and Google Scholar databases for relevant randomised clinical trials (RCTs) published till January 25, 2022, focussing on assessing the effectiveness of interventions addressing the impact of COVID-19 on healthcare workers. The search strategy employed a combination of Medical Subject Heading (MeSH) terms, index terms, text terms, and key words. The development of the search strings was performed with the aid of an information specialist, and a piloting phase was carried out to refine the search terms and adjust them to the different databases. The search terms were structured based on Population-intervention-control-outcome-study design (PICOS) framework,[13] and differed from database to database (Tables 1-2).

The inclusion criteria for the review were studies that focussed on COVID-19 frontline healthcare workers, including medical doctors, residents, nurses, dentists, pharmacists and allied healthcare staff. Studies that did not clearly identify healthcare staff as frontline workers during the pandemic, or those that included healthcare staff who were not frontline workers were excluded.

The included studies were those evaluating a wide range of interventions for COVID-19 frontline healthcare workers. These interventions encompassed various approaches, such as pharmacotherapy, herbal therapy, behavioural therapy, psychoeducation, counselling, educational training, mobile-based digital interventions, mindfulness, meditation, yoga/exercise, breathing exercises, and music therapy.

The included studies had comparison groups comprising routine care, standard of care, usual care, or placebo.

The primary outcome measures that were considered in this systematic review related to the mental health status of COVID-19 frontline healthcare workers. These measures included anxiety, depression, insomnia, stress and post-traumatic distress syndrome, and they were evaluated using any standardised tool. Outcome measures that were not related to mental health, such as heart rate variability and burnout, were excluded.

The systematic review focussed solely on fully published RCTs and excluded all other study designs, such as RCT protocols, quasi-experimental designs, observational studies, case reports, conference abstracts, editorials and commentaries.

After conducting the initial search, the search results from each database were exported and imported into the EndNote citation manager software for deduplication purposes. This set of deduplicated articles was imported into the Rayyan software for abstract screening which was done by three independent reviewers. Conflict resolution was done by an independent reviewer. Finally, the included abstracts were retrieved for full-text review, and

Table-1: Key words used for literature search based on the population, intervention, control and outcome, study design (PICOS) terms.

Population		Intervention		Outcome		Study Design
Healthcare workers OR healthcare professionals OR doctors OR nurses OR pharmacists OR allied healthcare staff	**AND**	Intervention OR psychological OR behaviour therapy OR counselling OR education* intervention OR mindfulness OR protective guidelines OR training OR instrumental support OR protect* equipment OR organization* support OR emotion* support	**AND**	Mental health OR mental health status OR depression OR anxiety OR post-traumatic stress disorder OR insomnia	**AND**	Randomized controlled trial

Table-2: List of search hits for each database.

	Database	Hits
	Excerpta Medica database (EMBASE)Offshore Vessel Inspection Database (Ovid) platform2018 to 2023 Week 2Date: 25th Jan 2023	
1	(Healthcare workers or healthcare professionals or doctors or nurses or pharmacists or allied healthcare staff or front-line COVID-19 workers). ab, kf,ti.	141411
2	(Intervention or psychological or behaviour therapy or counselling or education* intervention or mindfulness or protective guidelines or training or instrumental support or protect* equipment or organization* support or emotion* support).ab,kf,ti.	718847
3	(Mental health or mental health status or depression or anxiety or post-traumatic stress disorder or insomnia).ab,kf,ti.	304765
4	(COVID-19 or covid or covid 19 or SARS-CoV-2).ab,kf,ti.	305224
5	1 and 2 and 3 and 4	1948
6	limit 5 to (randomized controlled trial and last 3 years and covid-19)	**38**
	Medical Literature Analysis and Retrieval System Online (MEDLINE)Offshore Vessel Inspection Database (Ovid) platformAll 1946 to January 12, 2023Date: Jan 25, 2023.	
1	(Healthcare workers or healthcare professionals or doctors or nurses or pharmacists or allied healthcare staff or front-line covid workers).ab,kf,ti.	358608
2	(Intervention or psychological or behaviour therapy or counselling or education* intervention or mindfulness or protective guidelines or training or instrumental support or protect* equipment or organization* support or emotion* support).ab,kf,ti.	1484322
3	(Mental health or mental health status or depression or anxiety or post-traumatic stress disorder or insomnia).ab,kf,ti.	710664
4	(COVID-19 or covid or covid 19 or SARS-CoV-2). ab,kf,ti.	286544
5	1 and 2 and 3 and 4	1797
6	limit 5 to (clinical trial, all and last 3 years and covid-19)	**15**
	Allied and Complementary Medicine Database (AMED) Offshore Vessel Inspection Database (Ovid) platform1985 to December 2022Date: 25th Jan 2023	
1	(Healthcare workers or healthcare professionals or doctors or nurses or pharmacists or allied healthcare staff or front-line covid workers).mp.	7352
2	(Intervention or psychological or behaviour therapy or counselling or education* intervention or mindfulness or protective guidelines or training or instrumental support or protect* equipment or organization* support or emotion* support).ti,ab.	48957
3	(Mental health or mental health status or depression or anxiety or post-traumatic stress disorder or insomnia).ti,ab.	17290
4	(COVID-19 or covid or covid 19 or SARS-CoV-2).ti,ab.	530
5	1 and 2 and 3 and 4	**3**
	Cumulative Index to Nursing and Allied Health Literature (CINAHL)Elton B. Stephens Company (EBSCO) host platform Complete Date: 25th Jan 2023	
1	(Healthcare workers OR healthcare professionals OR doctors OR nurses OR pharmacists OR allied healthcare staff OR front-line covid workers) abstract	360,013
2	(Intervention OR psychological OR behaviour therapy OR counselling OR education* intervention OR mindfulness OR protective guidelines OR training OR instrumental support OR protect* equipment OR organization* support OR emotion* support) abstract	724,967
3	(Mental health OR mental health status OR depression OR anxiety OR post-traumatic stress disorder OR insomnia) abstract	271,022
4	(COVID-19 OR covid OR covid 19 OR SARS-CoV-2) abstract	63,404
5	S1 AND S2 AND S3 AND S4 AND S5	802
6	S1 AND S2 AND S3 AND S4 AND S5, limited to Published Date: 20180101-20221031; Publication Type: Randomized Controlled Trial	**10**
	Cochrane Central Register of Controlled Trials (Cochrane Central) Cochrane library Date: 25th Jan 2023	
1	(Healthcare workers OR healthcare professionals OR doctors OR nurses OR pharmacists OR allied healthcare staff OR front-line covid workers) abstract	26,912
2	(Intervention OR psychological OR behaviour therapy OR counselling OR education* intervention OR mindfulness OR protective guidelines OR training OR instrumental support OR protect* equipment OR organization* support OR emotion* support) abstract	581,223
3	(Mental health OR mental health status OR depression OR anxiety OR post-traumatic stress disorder OR insomnia) abstract	161,463
4	(COVID-19 OR covid OR covid 19 OR SARS-CoV-2) abstract	12,810
5	#1 AND #2 AND #3 AND #4 AND #5	186
6	(#1 AND #2 AND #3 AND #4 AND #5) with Publication Year from 2018 to 2022, in Trials	**163**

ab, kf,ti=abstract, keyword, title, mp=abstract, heading words, title, ti,ab=title, abstract

the obtained articles were again thoroughly reviewed by three independent reviewers based on pre-decided inclusion/exclusion criteria. Conflict resolution was done by an independent reviewer.

The three reviewers independently extracted data from

each included study using a predefined data collection tool, which was an adapted template from Cochrane reviews of RCTs,[13] and any discrepancies were resolved through mutual agreement. The extracted data included the author's name, publication year, sample size, gender, type of participants, treatment intervention, control intervention, duration of intervention, predefined outcome measures, and the main findings.

To assess the quality of the included RCTs, three independent reviewers performed a risk of bias (RoB) assessment using the tools recommended by the Cochrane handbook for systematic reviews[13], and the RoB tool interface.[14] Each study was evaluated for all the six domains of bias, and the overall RoB was determined based on the worst RoB in any of the six domains. In case of any conflicts, an independent reviewer intervened to resolve the issue through discussion.

A meta-analysis was not feasible due to the utilisation of various interventions and control groups in the included studies, which hindered the calculation of a pooled effect.

Results

Of the 235 studies identified, 51(21.7%) were found to be duplicates, while 184(78.3%) underwent title/abstract screening (Table 3). After all the exclusions, 17(7.2%) studies[15-31] were included (Figure 1).

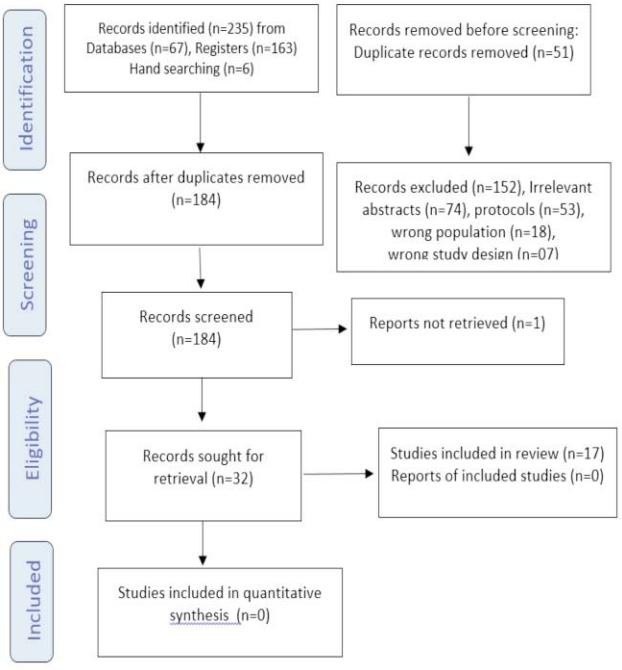

Figure-1: The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart.

Of the RCTs reviewed, 3(17.6%) were conducted in India, 3(17.6%) in the United States, 2(11.7%) in the United Kingdom, 2(11.7%) in Turkey, and 1(5.9%) each in Spain, Malaysia, Italy, Taiwan, Brazil, China, and Iran (Table 4).

There were 4(23.5%) studies that used mindfulness-based interventions[15-18] with the time period of intervention ranging from a 30-minute single session to three weeks of daily sessions lasting 10 minutes. There were 3(17.6%) studies that used yoga/music interventions[19-21] with the time period of intervention ranging 4-12 weeks. There were 3(17.6%) studies that used meditation interventions [22-24], with the period of intervention ranging 1-12 weeks. Further, 4(23.5%) studies used psychological intervention[25-28], with the period of intervention ranging from 7-10 days to 6 weeks, and 1(5.9%) study each used pharmacotherapy[29], creative arts therapy[30], and acupuncture[31], with time periods of 4 weeks, 4 weeks, and 12 weeks, respectively.

In most of the studies 11(64.7%), the participants were health workers[15-17,19,21,25-30], while 3(17.6%)included nurses as participants.[22,27,31] Most of the included studies were designed as two-arm parallel RCTs (Table 4). The mean age of participants ranged from 31.0±4.4 years[27] to 46.0±11.3 years[23] The sample size ranged from 35[26] to 2,182[17] participants.

Among the studying that used mindfulness-based interventions(15-18), Fiol-De Roque et al.[15] included 482 healthcare workers randomised to mindfulness-based mHealth (mobile health) intervention vs general recommendations about mental healthcare for 2 weeks. The primary outcome was a composite of depression, anxiety, and stress measured using Depression, Anxiety and Stress Scale - 21 Items (DASS-21) scale. After 2 weeks, data was analysed for 436 participants, with a dropout rate of 9.5%. There was no significant difference in the primary outcome between two groups in general (p=0.15). Participants with a history of mental health issues, who were already on psychotropic medication, showed significant improvements in the primary outcome (p=0.004).

Keng et al.[16] had 80 healthcare workers who were randomised to mindfulness practice using Headspace vs active control condition (Lumosity; involving playing cognitive games) 3 weeks daily (10min/day). The primary outcome was composite of depression, anxiety and stress measured using DASS-21. Assessments were made before delivering the intervention, at the end of intervention, and 1-month post-intervention. There was no significant improvement in terms of primary outcome between the groups (p>0.05) at the two follow-up time points (p>0.05)

Table-3: List of the studies screened.

SR.no.	Title	Year	Authors	Included	Reason for exclusion
1	Stress-reduction Using Probiotics to Promote Ongoing Resilience Throughout COVID-19 for Healthcare Workers (SUPPORT COVID-19 Healthcare Workers)	2020	Slykerman R	NO	Irrelevant article, Study protocol
2	A research study to determine the effect of a smartphone application (app) on management of patients with heart failure in isolation due to COVID-19	2020	Rivers J	NO	Irrelevant article
3	The effect of light acupuncture and five-element music therapy for nurses' mental health and wellbeing during and post COVID-19	2021	Wang CC, Lo J, Saunders R et al	NO	Irrelevant article, Study protocol
4	Effect of one shot cognitive behavioural therapy on insomnia and heart rate variability in health care workers during COVID- 19 epidemic	2022	Amra V, Ghadiri F, Vaezi A et al	YES	
5	Video intervention to increase treatment-seeking by healthcare workers during the COVID-19 pandemic: randomized controlled trial	2022	Amsalem D, Lazarov A, Markowitz R et al	NO	Irrelevant article
6	Eighth Annual Scientific Conference of the European Association of Psychosomatic Medicine (EAPM)	2021	Anonymous	NO	Irrelevant article, Study protocol
7	Death Cafes for prevention of burnout in intensive care unit employees: study protocol for a randomized controlled trial (STOPTHEBURN)	2020	Bateman ME, Hammer R, Byrne A et al	NO	Irrelevant article, Study protocol
8	Effectiveness of a Mindful Compassion Care Program in reducing burnout and psychological distress amongst frontline hospital nurses during the COVID-19 pandemic: a study protocol for a randomized controlled trial	2022	Bodini L, Bonetto C, Cheli S et al	NO	Irrelevant article, Study protocol
9	Dear Doctor, a text message intervention to reduce burnout in trainee anaesthetists: a randomized controlled trial	2021	Brazier A, Larson E, Xu Y et al	NO	Irrelevant article, Study protocol
10	Listening to music tuned to 440 hz versus 432 hz to reduce anxiety and stress in emergency nurses during the Covid-19 pandemic: a double-blind, randomized controlled pilot study	2022	Calamassi D, Li Vigni ML, Fumagalli C et al	YES	
11	Ecological momentary intervention to enhance emotion regulation in healthcare workers via smartphone: a randomized controlled trial protocol	2022	Castilla D, Navarro-Haro MV, Suso-Ribera C et al	NO	Irrelevant article, Study protocol
12	Double-blind placebo-controlled randomized clinical trial to assess the efficacy of montelukast in mild to moderate respiratory symptoms of patients with long COVID: E-SPERANZA COVID Project study protocol	2022	Cordero FM, Monne SB, Ortega JA et al	NO	Irrelevant article, Study protocol
13	Impact of COVID-19 on the level of work engagement of nurses at a small, rural hospital	2022	Courson S, Breen K, Smith J et al	NO	Irrelevant article, Study protocol
14	Efficacy and Safety of Cannabidiol Plus Standard Care vs Standard Care Alone for the Treatment of Emotional Exhaustion and Burnout Among Frontline Health Care Workers During the COVID-19 Pandemic: A Randomized Clinical Trial	2021	Crippa JAlex, Zuardi AW.	YES	
15	Yoga for Nurses (COVID-19)	2020	Patil NJ	NO	Study protocol
16	Yoganidra benefits on COVID health care workers	2020	Gunjiganvi M	NO	Study protocol
17	Ayurveda and Yoga trial for preventing COVID 19 among healthcare workers	2020	Sharma G	NO	Study protocol
18	Effect of pranayama and meditation on psychological well-being of healthcare workers during COVID-19 pandemic	2020	Bharadwaj B	NO	Study protocol
19	Effect of chyawanprash on immune system when administered after covid-19 vaccination in health care personnel	2021	Reddy G	NO	Study protocol
20	Effect of pranayama on mental health of nurses taking care of COVID-19 patients	2021	Sarwal R	NO	Study protocol
21	Effect of Gayatri Mantra and Pranayama on covid-19 patients	2021	Dua R	NO	Study protocol
22	Effect of yoga on pulmonary function, autonomic function and stress in healthcare workers due to COVID-19 pandemic	2021	Ravi M	NO	Study protocol
23	Caring for Healthcare Professionals	2021	Perry S	NO	Study protocol
24	Brief Digital Interventions to Support the Psychological Well-being of NHS Staff During the COVID-19 Pandemic: 3-Arm Pilot Randomized Controlled Trial	2022	De Kock JH, Latham HA et al	YES	
25	Timely Short-Term Specialized Palliative Care for Older People with Frailty and Their Family in Primary Care: Easier Said Than Done	2022	De Nooijer K, Pivodic L, Van DN et al	NO	Study protocol
26	The effect of Emotional Freedom Techniques on nurses' stress, anxiety, and burnout levels during the COVID-19 pandemic: A randomized controlled trial	2021	Dincer B, Inangil, D et al	YES	
27	E-Health Psychological Intervention for COVID-19 Healthcare Workers: Protocol for its Implementation and Evaluation	2022	Dominguez RA, Martinez ARJ	NO	Study protocol
28	Clinical implementation and evaluation of three implementation interventions for a family-oriented care for children of mentally ill parents (ci-CHIMPS)	2021	Scot S	NO	Irrelevant article, Study protocol
29	Embedded RCT Short Title: smartphone app-based mental health and wellbeing intervention for healthcare workers during Covid-19	2021	Prat QR	NO	Irrelevant article, Study protocol

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30	Impact of COVID-19 primary healthcare service restrictions on patients with chronic obstructive pulmonary disease in Cape Town, South Africa	2022	Farrant L, Harding, R, Nkhoma K et al	NO	Irrelevant article
31	Assessment of Acceptability and Initial Effectiveness of a Unified Protocol Prevention Program to Train Emotional Regulation Skills in Female Nursing Professionals during the COVID-19 Pandemic	2022	Ferreres GV, Navarro HM	NO	Wrong study design, wrong outcome
32	Impact of COVID-19 restrictions on behavioural and psychological symptoms in home-dwelling people with dementia: a prospective cohort study (PAN.DEM)	2022	Gedde MH, Husebo B, Vahia IV	NO	Wrong study design, wrong outcome
33	How has COVID-19 changed our views on delivering clinical trials?	2021	Gillespie BS	NO	Irrelevant article
34	Self-measured blood pressure monitoring (SBPM) during the COVID-19 pandemic	2021	Girma B, Curtis NC	NO	Irrelevant article
35	Feasibility and Effectiveness of Tele-counselling on the Psychological Problems of Frontline Healthcare Workers Amidst COVID-19: A Randomized Controlled Trial from Central India	2021	Gupta S, Kumar M, Rozatkar AR et al	YES	
36	Tiny Habits for Gratitude-Implications for Healthcare Education Stakeholders	2022	Hollingsworth JC, Redden DT	NO	Irrelevant article
37	Virtual post-intensive-care rehabilitation for survivors of COVID-19: A feasibility study	2021	Howroyd F, Earle N	NO	Irrelevant article
38	Occupational Burnout and Stress of Nurses in Taiwan Regarding COVID-19: An Intervention with Gong Medication	2022	Hsieh HF, Huang YT, Wang YW	YES	
39	Evaluation of the effectiveness of Logotherapy on the anxiety, depression, and distress of nurses	2022	Hosseni SH	NO	Study protocol
40	The effect of Jacobsen relaxation application on anxiety and job stress of nurses	2021	Mirbagher N	NO	Study protocol
41	The Effect of Supportive Educative Program in COVID-19	2021	Faham AAZ	NO	Study protocol
42	study the effect of cognitive therapy on insomnia and heart rate variability of health care workers	2021	Amra B	NO	Study protocol
43	The effectiveness of online mindfulness training on mental health and quality of work life of nurses fighting on the frontlines against COVID-19	2020	Feizipour H	NO	Study protocol
44	The effects of Melissa officinalis on Stress, Anxiety, Depression, sleep disturbances and Compassion Fatigue among Nurses	2021	Aziznejadroshan P	NO	Study protocol
45	The effect of eye movement desensitization and reprocessing therapy on cognitive failure in nurses working in COVID-19 wards	2022	Abdi N	NO	Study protocol
46	Comparing the effectiveness of online Balint group and SSRIs in Coronavirus anxiety	2021	Ardabili HM	NO	Study protocol
47	The effect of environmental health education on self-efficacy and anxiety caused of Covid-19	2021	Sedaghati F	NO	Study protocol
48	The effect of spiritual practice along routine medical care on the recovery of patients hospitalized with Covid-19: a randomized clinical trial	2021	Mousvi B	NO	Study protocol
49	Comparative study of the Effect of Desensitization with Eye movements and Reprocessing on the fear of Covid 19 in a virtual and real way on nurses	2022	Mousavi SM	NO	Study protocol
50	Psychological intervention to improve the mental health of patients with COVID-19	2020	Li JZ	NO	Study protocol
51	Behavioural Activation in Social IsoLation (BASIL): benefiting from activities to improve your mood while you are socially isolating	2020	Littlewood L	NO	Wrong population, Study protocol
52	The development, testing and evaluation of a COVID-19 fundamental nursing care protocol	2020	Richard D	NO	Study protocol
53	Eye movement desensitization and reprocessing group therapy for frontline and emergency workers in response to the COVID-19 pandemic	2021	Farrell D	NO	Study protocol
54	Behavioural activation in social isolation (BASIL+): benefiting from activities while you socially isolate to help your mood and wellbeing	2021	Littlewood L	NO	Wrong population, Study protocol
55	Kidney-specific psychosocial assessment and support	2021	Hamilton A	NO	Irrelevant article
56	Managing Unusual Sensory Experiences using a new treatment manual, in people who are experiencing psychosis for the first time	2021	Dudley R, Dodgson G, Common S	NO	Irrelevant article
57	Chatbot use and mental wellbeing of health workers	2022	Lamba T	NO	Study protocol
58	Comparative study of the mental health impact of the COVID-19 pandemic on health care professionals in India	2021	Jakhar J, Biswas PS, Kapoor M	NO	Wrong study design, Wrong outcome
59	Effect of a group-based acceptance and commitment therapy program on the mental health of clinical nurses during the COVID-19 sporadic outbreak period	2022	Jing H, Zhang L, Liu Y et al	NO	Study protocol
60	Targeting Healthcare Provider Burnout During the COVID-19 Pandemic	2022	Joshi S, Vaishnavi S, Brucker A et al	YES	

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61	Internet-based stress recovery intervention FOREST for healthcare staff amid COVID-19 pandemic: study protocol for a randomized controlled trial	2021	Jovarauskaite L, Dumarkaite A, Truskauskaite KI et al	NO	Study protocol
62	Side effects of BNT162b2 mRNA COVID-19 vaccine: a randomized, cross-sectional study with detailed self-reported symptoms from healthcare workers	2021	Kadali RAK, Janagama R, Peruru S	NO	Irrelevant article
63	Reducing Maternal Stress in Paediatric Hospitalization during the COVID-19 Pandemic by Improving Family-Centred Care with Bedside Telehealth: A Pilot Randomized Clinical Trial	2022	Khaksar S, Maroufi M, Kalhor F	NO	Irrelevant article
64	Using a Chatbot to Address Psychological Distress Among First Responders	2021	Kosyluk K, Baeder T, Tran J et al	NO	Study protocol
65	Nurses' emotional stress levels when caring for COVID-19 patients in an intensive care unit	2021	Lin Q, Zheng Y	NO	Wrong study design
66	Effects of progressive muscle relaxation on anxiety and sleep quality in patients with COVID-19	2020	Liu Ki, Chen Y, Wu D et al	NO	Wrong population, Study protocol
67	Internet-assisted cognitive behavioural therapy with telephone coaching for anxious Finnish children aged 10-13 years: study protocol for a randomized controlled trial	2021	Luntamo T, Korpilahti LT, Ristkari T et al	NO	Wrong population, Study protocol
68	Psychological stress self-help interventions for healthcare workers in the context of COVID-19 in China: a randomized controlled trial protocol	2022	Luo R, Guo P, Shang M	NO	Study protocol
69	Establishing a novel digital platform supporting physical and emotional wellbeing for people living with kidney disease- The Kidney Beam pilot	2022	Mayes J, Billany RE, Vadaszy N et al	NO	Irrelevant article
70	A training programme for community pharmacists to support people living with severe and persistent mental illness: Intervention mapping in the context of a pandemic	2022	McMillan SS, El-Den S	NO	Irrelevant article
71	Acute stress of the healthcare workforce during the COVID-19 pandemic evolution: a cross-sectional study in Spain	2020	Mira JJ, Carrillo I, Guilabert M et al	NO	Wrong study design, Wrong outcome
72	The Effect of Creative Arts Therapy on Psychological Distress in Health Care Professionals	2022	Moss M. Edelblute A, Sinn H et al	YES	
73	The role of the ICU liaison nurse services on anxiety in family caregivers of patients after ICU discharge during COVID-19 pandemic: a randomized controlled trial	2022	Mottaghi K, Hasanv S	NO	Wrong population, Study protocol
74	The effectiveness of virtual cognitive-behavioural group therapy on anxiety, stress, and fatigue in Coronavirus Intensive Care Unit nurses	2021	Naeim M, Rezaeisharif A, Ghobadibagv S	NO	Study protocol
75	PROTECT Trial: a cluster-randomized study with hydroxychloroquine versus observational support for prevention or early-phase treatment of Coronavirus disease (COVID-19): a structured summary of a study protocol for a randomized controlled trial	2020	Nanni O, Viale P, Vertogen B et al	NO	Irrelevant article
76	App Intervention to Protect Mental Health in Healthcare Workers at Frontline Against COVID19: a Randomized Trial	2020	Serrano-Ripoll MJ, Ricci-Cabello I, Jimenez R	NO	Study protocol
77	Efficacy of Therapist Guided e-Therapy Versus Self-Help Therapy on Psychological Distress Among Individuals in Oman During COVID-19 Pandemic	2020	Alawi MA	NO	Wrong population
78	Cereset Research in Healthcare Workers During COVID-19	2020	Tegeler CH	NO	Irrelevant article
79	Health cAre woRkers exposeD to COVID-19	2020	Wissam EH	NO	Irrelevant article
80	Effectiveness of Basic Body Awareness Therapy in Survivors of Covid-19 and Health Workers Regarding Post-Traumatic Stress Disorders	2020	Bravo C	NO	Study protocol
81	The COVID-19 and Healthcare Workers: An Active Intervention	2020	Charles M	NO	Study protocol
82	General Psychological Distress, PTSD, and Co-Morbidities in Healthcare Workers Consequent to COVID-19	2020	Nikita ZA	NO	Study protocol
83	Online 1-Day CBT-Based Workshops for PPD	2020	Neda SA	NO	Study protocol
84	MejoraCare-Paraguay: mHealth Solution for Chronic Patients During the COVID-19 Outbreak in Paraguay	2020	Rosa RD	NO	Wrong population, Study protocol
85	Impact of a Minimal Psychoeducational Intervention on Anxiety Among Hospitalized COVID-19 Patients in Denmark	2020	Weis N	NO	Wrong population, Study protocol
86	Reducing Burnout Among Frontline Healthcare Workers During COVID-19	2020	Samaan Z	NO	Study protocol
87	Home-Based Covid-19 Rehabilitation Program	2020	Verghese J	NO	Irrelevant article
88	Emotional Freedom Technique (EFT) Effect on Nurses	2020	Okut G	NO	Study protocol
89	Breath Regulation and Yogic Exercise An Online Therapy for Calm and Happiness	2020	Lai KSP, Watt C, Ionson E, et al	NO	Study protocol

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90	Goal Management Training in Individuals with PTSD (Post-Traumatic Stress Disorder)	2020	Lanius RA	NO	Irrelevant article
91	MIND-VR: virtual Reality for COVID-19 Operators' Psychological Support	2020	Spark GA	NO	Irrelevant article
92	Use of a Live Attenuated Vaccine as an Immune-based Preventive Against COVID-19-associated Sepsis	2020	Emily SR	NO	Irrelevant article
93	Peer Champion Support for Hospital Staff During and After the COVID-19 Pandemic	2020	Stan RE	NO	Study protocol
94	Treatment of Depressive Symptoms in Older Individuals in Isolation During Covid-19	2020	Smantha M	NO	Wrong population, Wrong study design
95	RECHARGE: a Brief Psychological Intervention to Build Resilience in Healthcare Workers During COVID-19	2020	Morina N	NO	Study protocol
96	Music Therapy in Frontline Healthcare Workers	2020	Frazor S	NO	Study protocol
97	Digital Cardiac Counselling Trial: DCC Trial	2020	Simon H	NO	Irrelevant article
98	PanDirect: self-care Tools and Telephone Coaching for Depression and Anxiety During Pandemics	2020	David RA	NO	Wrong population, Wrong study design
99	Increasing Access to Evidence-based Treatments for Depression	2020	Nick T	NO	Wrong population, Wrong outcome, Wrong study design
100	Effects of Online and Recovery-oriented Peer Support Groups Facilitated by Peer Support Workers in Times of COVID-19	2020	Norrie GF	NO	Wrong population, Wrong outcome
101	Online Multi-component Psychological Intervention for Anxiety, Depression, and Burnout on Healthcare Workers During the COVID-19 Pandemic	2021	Rodriguez AD	NO	Study protocol
102	Mindful Prevention of Psychopathology in Healthcare Workers During the COVID-19 Crisis (COVID-19 MindPreP)	2021	Speckens A	NO	Study protocol
103	Reflective Tasks with Healthcare Workers During COVID-19	2021	Lamb V	NO	Results not reported
104	Efficacy of Adaptogens in Patients with Long COVID-19	2021	Ross F	NO	Irrelevant article
105	Couple HOPES (Helping Overcome PTSD and Enhance Satisfaction)	2021	Emma TH	NO	Irrelevant article
106	Effects of Mindfulness Practice on Healthcare Workers	2021	Simon W	NO	Study protocol
107	Online Peer-Delivered 1-Day CBT Workshops for PPD	2021	Hosseni RA	NO	Study protocol
108	Testing a Mindfulness/Acceptance-Based Smartphone App for Nurses Impacted by the COVID-19 Pandemic	2021	Nicky TR	NO	Results not reported
109	Effect Of Music Therapy on Anxiety Levels In COVID-19 Pandemic	2021	Robert AA	NO	Study protocol
110	A Scalable Psychological Intervention to Reduce Psychological Distress Among Healthcare Workers: A Randomized Trial	2021	Jack V	NO	Results not reported
111	A Self-directed Mobile Mindfulness Intervention to Address Distress and Burnout in Frontline Healthcare Workers	2021	Cox C	NO	Results not reported
112	Mental Health Among Patients, Providers, and Staff During the COVID-19 Era	2021	Raddin A	NO	Wrong population, Wrong study design
113	ENO Breathe vs Usual Care in COVID-19 Recovery: an RCT	2021	Philip KEJ	NO	Irrelevant article
114	The Effect of a Combined Nature-based and Virtual Mindfulness Intervention on Perceived Stress in Healthcare Workers	2021	Berger A	NO	Study protocol
115	SSIPP vs. PST vs. WLC	2021	Vasudev A	NO	Irrelevant article
116	Frontline Clinician Psilocybin Study	2021	Young TF	NO	Irrelevant article
117	Perceived Stress and Anxiety Levels of Nurses	2021	Zafra MD	NO	Wrong study design
118	The Effect of Music on Compliance of Patients in COVÄ°D-19 Intensive Care Unit with CPAP Device	2021	Bilgili S	NO	Wrong population
119	Multimodal CARES Intervention	2021	Mathai S	NO	Irrelevant article
120	COVID-19 Lockdown Related Telemedicine for Type 2 Diabetes	2021	Jack RE	NO	Irrelevant article
121	Digital Mental Health Care for COVID-19 High-Risk Populations	2021	Jeff TY	NO	Wrong population
122	A Randomized Controlled Evaluation of a Compassion-course for Healthcare Professionals	2021	Bratt A	NO	Study protocol
123	Fostering Resilience in Adolescents at Risk	2021	Llistosella M	NO	Irrelevant article
124	Pragmatic Comparative Effectiveness Trial of Evidence-based, On-demand, Digital Behavioural Treatments for Chronic Pain	2021	Spiegel B	NO	Irrelevant article

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125	Effectiveness of 10-minute Chair Massage Versus 10-minute Break to Reduce Stress and Improve Well-being	2021	Evans SA	NO	Irrelevant article
126	CUIDA-TE, an APP for the Emotional Management	2021	Castilla D	NO	Irrelevant article
127	Enhancing Group Lifestyle Intervention for Depression with Self-Tracking Tools	2021	Fionna YY	NO	Irrelevant article
128	Comprehensive Palliative Care for Cancer Patients in Vietnam	2021	Troung V	NO	Irrelevant article
129	Peer and Text Message Support to Reduce Readmission Rates for Patients Discharged from Acute Psychiatric Care	2021	Emma FD	NO	Irrelevant article
130	Laser Acupuncture Improves Constipation in Patients Hospitalized for Stroke During the COVID-19 Pandemic	2021	Eboreimi F	NO	Irrelevant article
131	Experimental Study to Reduce Low Birthweight	2021	Smith AA	NO	Irrelevant article
132	The Impact of Back and Breast Massage	2021	Erciyas SK	NO	Irrelevant article
133	Virtual Reality Distraction for Anxiety (VR-IMAGINE)	2021	May SL	NO	Irrelevant article
134	Health Promoting Work Schedules: The Effect of Abolishing Quick Returns	2021	Harris A	NO	Irrelevant article
135	Randomized Controlled Trial of the Mindful Compassion Care Program in Reducing Psychological Distress Amongst Nurses During the COVID-19 Pandemic	2022	Lasalvia A	NO	Study protocol
136	Psychological Well-being and Burnout in Healthcare Workers During the COVID-19 Pandemic	2022	Evans C	NO	Study protocol
137	Diagnostic Accuracy of Self-sampling Versus Healthcare Sampling for Coronavirus-Disease-2019 Detection	2022	Ross RE	NO	Irrelevant article
138	ASAP - Assisted Immediate Augmented Post-/Long-COVID Plan	2022	Smigle FQ	NO	Irrelevant article
139	The Effect of Demographic, Mental, and Physical Activity Profiles Towards Burnout in Frontline Healthcare Workers Facing COVID-19 Pandemics in Dr. Soetomo General Hospital Surabaya	2022	Pratt W	NO	Irrelevant article
140	Evaluation of Online Mental Well-being Intervention for Working Adults	2022	Robert F	NO	Irrelevant article
141	COVID-19 Research: COPE Trial in Health Care Workers	2022	Mestdagh R	NO	Study protocol
142	The Effect of Video Information on Anxiety in Adolescents Having rRT-PCR Test During Corona Virus Pandemic	2022	Gillard F	NO	Wrong population
143	PACT Programme for Parents of Children With SHCN	2022	Pirnay P	NO	Irrelevant article
144	Clinical Hypnosis and Home Blood Pressure Monitoring in Children with Neurofibromatosis Type 1	2022	Linder K	NO	Irrelevant article
145	Adapting and Evaluating a Brief Advice Tobacco Intervention in High-Reach, Low-Resource Settings in India	2022	Vishwanath V	NO	Irrelevant article
146	Impact of Virtual Visit on Mothers' Attachment and Satisfaction	2022	Tiryaki O	NO	Irrelevant article
147	Effects Of Mindfulness-Based Yoga and Meditation Colorectal Cancer	2022	Sengul T	NO	Irrelevant article
148	Prevention of mental health problems in healthcare workers, from a randomized controlled trial to the implementation in workplaces	2022	Nieuwenhuijsen K.	NO	Results not reported
149	Intensive Care Unit Specific Virtual Reality (ICU-VR) to improve psychological impairments in survivors of COVID-19; a multi-centre, randomized controlled trial	2020	Nick I	NO	Wrong population
150	I-PHAN Study - Use of E-learning modules to Promote Physical activity and wellness among Nurses in order to improve mental and physical health: a research protocol for a randomized controlled trial	2021	Okechukwu CE, Gholamalishahi S	NO	Results not reported
151	A virtual reality home-based training for the management of stress and anxiety among healthcare workers during the COVID-19 pandemic: study protocol for a randomized controlled trial	2022	Pallavicini F, Orena E, di Santo S et al	NO	Results not reported
152	Effect of guided imagery on anxiety, muscle pain, and vital signs in patients with COVID-19: A randomized controlled trial	2021	Parizad N, Goli R	NO	Results not reported
153	Mindfulness-Based Intervention for the Reduction of Compassion Fatigue and Burnout in Nurse Caregivers of Institutionalized Older Persons with Dementia: A Randomized Controlled Trial	2022	Perez V, Menendez C	NO	Results not reported
154	A qualitative study of reinforcement workers perceptions and experiences of working in intensive care during the COVID-19 pandemic: a PsyCOVID-ICU sub study	2022	Perraud F, Ecarnot F, Loiseau M	NO	Irrelevant article
155	Mobile Mindfulness Intervention to Reduce Emotional Distress and Burnout in Frontline Healthcare Workers: The LIFT- healthcare workers Pilot RCT	2022	Pratt EH, Cox CE, Olsen MK	NO	Full article not retrieved, Conference Abstract

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156	The Impact of the COVID-19 Pandemic on Pregnant Women with Perinatal Anxiety Symptoms in Pakistan: A Qualitative Study	2021	Rauf N, Zulfiqar S	NO	Irrelevant article
157	Implementing an intensive care unit (ICU) diary program at a large academic medical centre: results from a randomized control trial evaluating psychological morbidity associated with critical illness	2020	Sayde GE, Stefanescu A, Conrad E	NO	Irrelevant article
158	Effect of a mobile-based intervention on mental health in frontline healthcare workers against COVID-19: protocol for a randomized controlled trial	2021	Serrano-Ripoll MJ, Ricci-Cabello I	NO	Results not reported
159	Efficacy of add-on Ayurveda and Yoga intervention in health care workers of tertiary care hospital during COVID-19: Randomized controlled trial	2022	Sharma V, Khuntia BK, Soneja M.	YES	
160	Investigation of anxiety levels of 1637 healthcare workers during the epidemic of COVID-19	2020	Shen, M. and Xu, H. and Fu, J. and Wang, T.	NO	Wrong study design, Wrong outcome
161	Working scenario of doctors during early days of coronavirus disease 2019 in India: lessons for future	2021	Sindhu S, Gautam M, Agrawal NK	NO	Irrelevant article
162	Scaling Up Maternal Mental healthcare by Increasing access to Treatment (SUMMIT) through non-specialist providers and telemedicine: a study protocol for a non-inferiority randomized controlled trial	2021	Singla DR, Meltzer-Brody SE	NO	Irrelevant article
163	The Infant Health Study - Promoting mental health and healthy weight through sensitive parenting to infants with cognitive, emotional, and regulatory vulnerabilities: protocol for a stepped-wedge cluster-randomized trial and a process evaluation within municipality settings	2022	Skovgaard AM, Bakermans-Kranenburg M	NO	Irrelevant article
164	A Virtual, Simulated Code White for Undergraduate Nursing Students	2022	Stephen T, King K, Taylor M	NO	Irrelevant article
165	Online HOPE intervention on help-seeking attitudes and intentions among young adults in Singapore: A randomized controlled trial and process evaluation	2022	Tay JL	NO	Irrelevant article
166	A Randomized Controlled Trial on Effectiveness of Mental Health & Psychosocial Support Module (MHPSS) in Reduction of Depression, Anxiety and Stress among Healthcare Workers during COVID-19 Pandemic in Jerantut, Pahang	2020	Zou X	NO	Results not reported
167	The effect of online psychoeducation and relaxation training programme on mental health problems in asymptomatic or mild symptomatic COVID-19 patients: a randomized controlled trial study	2022	Trent AS	NO	Wrong population
168	The impact of the COVID-19 pandemic on care delivery and quality of life in lung cancer surgery	2022	Teteh DK, Ferrell B	NO	Irrelevant article
169	Heartfulness meditation improves loneliness and sleep in physicians and advance practice providers during COVID-19 pandemic	2021	Thimmapuram J, Pargament R	YES	
170	A randomized controlled trial of the effect of an Internet cognitive behavioural therapy e-learning program for nurses in Vietnam and Thailand	2021	Umin Z	NO	Results not reported
171	Yoga and music intervention to reduce depression, anxiety, and stress during COVID-19 outbreak on healthcare workers	2022	Vajpeyee M, Tiwari S	YES	
172	Community Health Workers as a Strategy to Tackle Psychosocial Suffering Due to Physical Distancing: A Randomized Controlled Trial	2021	Bossche D, Lagaert S	NO	Irrelevant article
173	Online meditation as an aid in reducing symptoms of Depression, Anxiety and Psychological Stress in Resident Physicians during COVID-19 pandemic in Brazil	2020	Toscano MR	NO	Study protocol
174	Light acupuncture and five-element music therapy for nurses' mental health and well-being during and post-COVID-19: Protocol for a randomized cross-over feasibility study	2022	Wang CC, Lo J, Saunders R	NO	Results not reported
175	Efficacy of an online cognitive behavioural therapy program developed for healthcare workers during the COVID-19 pandemic: the REduction of STress (REST) study protocol for a randomized controlled trial	2020	Weiner L, Berna F, Nourry N et al	NO	Results not reported
176	Effects of cognicise-Neurofeedback on health locus of control, depression, and quantitative electroencephalography alpha asymmetry in elderly women	2021	Weon H, Yoo J, Yu J et al	NO	Irrelevant article
177	Effect of a Telecare Case Management Program for Older Adults Who Are Homebound During the COVID-19 Pandemic: A Pilot Randomized Clinical Trial	2021	Wong AK, Wong FKY	NO	Irrelevant article
178	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	Yildirim D, Ciris YC et al	YES	
179	Positive impacts of e-aid cognitive behavioural therapy on the sleep quality and mood of nurses on site during the COVID-19 pandemic	2022	Zhou K, Kong J, Wan Y et al	YES	
180	Evaluation of the efficacy and safety of Melatonin in moderately ill patients with COVID-19: A structured summary of a study protocol for a randomized controlled trial	2020	Ziaei A, Davoodian P, Dadv H.	NO	Irrelevant article

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181	Randomized controlled trial (RCT) of symptom screening with targeted early palliative care (STEP) versus usual care in patients with advanced cancer	2022	Zimmermann C, Pope A. Hannon B et al	NO	Irrelevant article
182	A Mobile Phone–Based Intervention to Reduce Mental Health Problems in Health Care Workers During the COVID-19 Pandemic (PsyCovidApp): Randomized Controlled Trial	2021	Fiol-DeRoque MA, Serrano-Ripoll MJ, Jiménez R et al	YES	
183	Effects of Mobile App-Based Mindfulness Practice on Healthcare Workers: A Randomized Active Controlled Trial	2022	Keng SL, Joseph WEC, Mammadova M et al	YES	
184	Health Care Workers' Need for Headspace: Findings from a Multisite Definitive Randomized Controlled Trial of an Unguided Digital Mindfulness-Based Self-help App to Reduce Healthcare Worker Stress	2022	Taylor H, Cavanagh K, Field AP, Strauss C et al	YES	

Other parameters, including no fear of COVID-19, compassion satisfaction, trait mindfulness, self-compassion and sleep quality, improved significantly ($p<0.05$).

Taylor et al.[17] had 2,182 healthcare workers, randomised to mindfulness-based practices (Headspace) vs psychosocial advice (Moodzone) for 10 days (10min/day). The primary outcome was a composite of depression, anxiety and stress measured using DASS-21. A significant effect of intervention was observed on anxiety and depression at 1.5 months and 4.5 months post-intervention ($p<0.05$) with a difference of –0.31 units per month in the study groups.

Yildirirum et al.[17] had 110 nurses managing COVID-19 patients, and they were randomised to mindfulness-based breathing and music therapy vs no-treatment, where a single 30-minute session was provided. Anxiety was measured using the State-Trait Anxiety Inventory (STAI) scale, and post-therapy, the intervention group had significantly lower stress scores compared to the control group ($p=0.010$).

Of the RCTs that had yoga/music interventions, Vajpayee et al.[19] had 209 healthcare providers, and showed significant improvement in mean DASS-24 score post-intervention in both abnormal and normal baseline groups. The mean change in abnormal baseline group was 7.20 vs 1.10 for depression, 6.09 vs 1.73 for anxiety and 6.67 vs 1.29 for stress ($p<0.001$) in intervention and control groups, respectively. For normal baseline group, the mean change in depression score was 3.24 vs 0.90, for anxiety 1.45 vs 0.12, and for stress 2.53 vs 0.31 ($p<0.001$), respectively for intervention and control groups.

The pilot RCT of Calamassi et al[20] had 54 nurses who were randomised to music therapy or liberal activity for 4 weeks, with significant reduction in stress score in the two intervention groups compared to the control group ($p<0.05$).

Sharma et al.[21] randomised 356 healthcare workers to a 12-week Comprehensive Ayurveda and mindfulness-based Yoga (CAY) regimen or usual care. Anxiety and depression were assessed using Generalized Anxiety Disorder scale 7-Items (GAD-7) and Patient Health Questionnaire 9-item (PHQ-9) questionnaires. The intervention group showed statistically significant improvement in anxiety and depression scores ($p>0.01$) and had lower incidence of COVID-19 compared to the control group ($p=0.05$).

Among the studies using meditation interventions, Hsieh et al.[22] found significant reduction in stress after gong meditation compared to usual activities, with a mean difference of -10.14 to -26.10 at different time points ($p<0.001$). Gong meditation could be an effective intervention for managing stress and improving mental health.

Thimmapuram et al.[23] with 155 subjects showed that heartfulness meditation for 4 weeks resulted in a significant decrease in loneliness score in the intervention group compared to the control group ($p<0.001$), measured using University of California Los Angeles (UCLA) Loneliness Scale.

Joshi et al.[24] randomised 80 healthcare workers to transcendental meditation or treatment as usual for 12 weeks. Transcendental meditation did not significantly reduce acute psychological distress or anxiety, but had a significant positive effect on depression. At 3-month follow-up, there was no significant difference in psychological distress score between the groups, but the intervention group had significantly greater decrease in depression score ($p=0.01$) and a non-significant decrease in anxiety score ($p=0.06$).

Among the studies using psychological interventions, De Kock et al.[25] randomised 169 healthcare workers to digital psychological interventions and a waitlist control group for 4 weeks. GAD-7 and PHQ-9 were used to measure anxiety and depression, respectively. The interventions led to a significant decrease in both depression and anxiety scores compared to the control group ($p<0.05$).

Gupta et al.[26] with 35 healthcare workers examined the

Table 4: Summary characteristics of the randomised clinical trials (RCTs) analysed.

Author, Year	Design, Setting, Country	Included population, sample (interv, control), analysis	Female gender %, mean age	Interv vs Control,	time of interv	Outcome measures	main findings
Mindfulness-based Interventions							
Fiol-DeRoque, 2021[15]	2pRCT, Hospitals, Spain	HW 482 (248, 234), ITT	83.2%, 41.37±10.4 years	Mindfulness-based mHealth intervention vs general recommendations about mental health care,	2 weeks	Composite of depression, anxiety, and stress (DASS-21)	MFB intervention through psyCovid App statistically reduces mental health problems.
Keng, 2021[16]	2pRCT, Hospitals, Malaysia	HW, 80 (40, 40), ITT	90%, 30.18± 6.19 years	Mindfulness practice using Headspace vs active control condition (Lumosity; involving playing cognitive games),	3 weeks daily (10mins/days)	(DASS-21)	MA-MFB statistically reduce distress and improve psychological wellbeing.
Taylor 2022[17]	2pRCT design, ratio 1:1, NHS, UK	HW, 2182 (1095, 1087), ITT	83.1%, 40.53±10.9 years	Mindfulness-based practices alongside psychoeducation (Headspace) vs psychosocial advice (Moodzone),	10 days (10 mins/day)	(DASS-21)	MSBH intervention can statistically reduce worker stress.
Yildirium, 2021[18]	2pRCT, tertiary care hospital, Turkey	Nurses, 110 (55,55), modified ITT [104 (52,52)]	50% (77%, 23%), 27.55±5.24 and 29.11 ± 6.57 years	Mindfulness-based breathing and music therapy vs no-treatment,	30 mins single session	STAI-I)	MFB and MT statistically reduces stress and increases social wellbeing.
Yoga/Music Intervention							
Vajpeyee 2022[19]	Pre- and post-intervention trial,India	HW, 209 (116, 93), ITT	16.26%, 18–35years =52.63%	Yoga and music vs no intervention,	4 weeks	(DASS-24)	yoga and music statistically reduce depression, anxiety and stress score
Calamassi, 2022[20]	3pRCT, medical emergency units, Italy	Nurses, 54 (18,19,17), ITT	59.3%, 39.64±9.94 years	Music therapy (440 Hz, 432 Hz) vs Liberal activity,	4 weeks (10mins each day)	STAIX1)	MT statistically reduces stress and anxiety.
Sharma 2022[21]	pRCT, tertiary care hospital, India	HW, 356 (181, 175), modified ITT [309 (145, 164)]	48.2%, 39.3±10.1 years, 36.6±10 years	Ayurveda and mindfulness-based Yoga (CAY) regimen vs usual care control,	12 weeks	(GAD-7), (PHQ-9)	Yoga and Ayurveda show no statistical difference between control and CAY gp.
Meditation							
Hsieh, 2021[22]	2pRCT, Hospitals, Taiwan	Nurses, 79 (40, 39), ITT	100%, 42.30±8.49 years, 32.5±8.24 years	Gong meditation vs usual activities,	7 sessions of 60 mins each over one-week	Stress (perceived stress scale)	Gong Meditation statistically alleviates burnout and stress.
Thimmapuram 2021[23]	RCT, USA	HC, 155 (77, 78), ITT	70%, 46.0±11.3 years	Heartfulness Meditation **(HF)** vs care as usual,	4 weeks	Loneliness (UCLA Loneliness Scale)	Statistical improvement was seen with HF Meditation.
Joshi, 2022[24]	pRCT, medical centre, USA	HW N=80 (41,39), ITT	82.5%, 40±11 years.	Transcendental Meditation vs Treatment as Usual,	12 weeks (20 mins twicedaily)	Acute psychological distress (GSI), Secondary outcomes, Anxiety (GAD-7), Depression (PHQ-9)	MT statistically improved burn out anxiety and insomnia.
Psychological Intervention							
De Kock, 2022[25]	3pRCT, UK	HW 69 (51, 60, 58), modified ITT [107 (27, 34, 46)]	88.2%, >40 years=73.4%	Digital psychological interventions vs waitlist control,	4 weeks	Anxiety (GAD-7), Depression (PHQ-9)	Digital psychological intervention statistically reduces anxiety, depression and mental well-being.

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Gupta, 2021[26]	2pRCT, Hospitals, India	HW, 35 (18,17), ITT	63.15%, <30 years=80%	Tele counselling psychotherapy vs general education control,	3 sessions of 30 mins each provided over 7-10 days	(DASS-21)	Tele counselling show a significant random effect participants with p<0.001.
Zhou, 2022[27]	2pRCT, Tertiary care hospital, China	Nurses with chronic insomnia, n= 118 (60, 58), ITT	99%, 31.0±4.4 years	Behavioural therapy group vs usual care,	6 weeks	Insomnia ((PSQI), (ISI), Secondary outcomes, Anxiety (GAD-7), Depression (PHQ-9)	eCBT statistically improve sleep quality and depression and anxiety
Amra, 2022[28]	pRCT, tertiary care hospitals, Iran	HW with acute insomnia, 64 (32, 32), modified ITT [	80.6%, 65.4%, 34.6±9.53 years, 36.6±6.95 years	behavioural therapy vs routine care, one session	(Post assessment after 4 weeks)	Insomnia (ISI)	CBT-I statistically reduces acute insomnia.
Pharmacotherapy							
Crippa, 2021[29]	pRCT, tertiary care hospital, Brazil	HW, 120 (61, 59), ITT	65.8%, 33.4 years, 33.9 years	Cannabidiol, 300 mg plus standard care vs standard care alone,	4 weeks	Secondary outcomes, Anxiety (GAD-7), Depression (PHQ-9)	CBD therapy statistically reduces burn out and emotional exhaustion.
Creative Arts Therapy							
Moss 2022[30]	pRCT 4:1 randomization, Denver hospitals, USA	HW, 146 (114, 32), ITT	89.7%, 33.5±8.3 years, 36.5±9.7 years	Creative Arts Therapy **(CAT)** sessions vs usual care,	12 weeks (12 session 90 mins each)	Secondary outcome, anxiety depression (HADS)	A CAT program can statistically reduce distress and turnover.
Acupuncture							
Dincer, 2021[31]	pRCT, tertiary care hospitals, Turkey	Nurses, 72 (35, 37), modified ITT [57 (31, 26)]	88.8%, 33.45±9.63 years	Emotional Freedom Technique session vs no intervention,	20 mins single session	Stress (STAIX1), Distress (subjective units of distress scale)	A single offline EFT statistically reduces stress anxiety and burn out.

*pRCT: Parallel arm randomised clinical trial, HW: Health workers, DASS-21: Depression, anxiety and stress, HADS: Hospital Anxiety and Depression Scale, ISI: Insomnia Scale Index, STAIX1: State-Trait Anxiety Inventory, PSQI: Pittsburgh Sleep Quality Index, GSI: Global Severity Index.

feasibility and effectiveness of tele-counselling for psychological problems. The participants received three 30-minute tele-counselling sessions over 7-10 days. Results showed that tele-counselling was feasible and improved the symptoms of depression, anxiety and stress significantly (p<0.05).

Zhou et al.[27] had 118 female nurses with chronic insomnia who were randomised to receive 6 weeks of behavioural therapy or care as usual. The intervention significantly improved insomnia (Pittsburgh Sleep Quality Index (PSQI), Insomnia Severity Index (ISI)), anxiety (GAD-7), and depression (PHQ-9) scores compared to the control group (p<0.05).

Amra et al.[28] conducted a behaviour intervention RCT on 64 healthcare workers with acute insomnia, randomised to receive one-shot behaviour therapy session or routine care. The primary outcome was insomnia. After 4 weeks, both intervention and control groups had a significantly lower insomnia score, with the intervention group showing a greater reduction (p>0.001).

With respect to pharmacological interventions, Crippa et al.[29] conducted an RCT on 120 healthcare providers to test the effectiveness of 300mg of cannabidiol drug once a day for 4 weeks compared to the usual-care control group on mental health outcomes, including anxiety and depression measured by GAD-7 and PHQ-9. The burnout score decreased significantly (p<0.05), but anxiety and depression scores did not show a significant difference between the groups (p>0.05).

As for the creative arts therapy intervention, Moss et al.[30] conducted an RCT on 146 healthcare professionals, randomised to four study arms, including three intervention arms and one usual-care control. The study measured anxiety and depression outcomes using Hospital Anxiety and Depression Scale (HADS). The interventions significantly reduced scores for all the study outcomes, including secondary outcomes. The intervention group had significantly greater improvements in anxiety and depression scores, PTSD scores, burnout scores, positive and negative affect scores, and turnover intention scores (p<0.05). In the intervention group, anxiety, depression, total PTSD, and emotional exhaustion Maslach Burnout Inventory (MBI) scores decreased by 27.8%, 35.5%, 25.8% and 11.5%, respectively.

Moreover, Dincer et al[31] had 72 nurses who received a

Supplementary Table 5: Risk of bias assessment.

Study ID	Randomization process	Deviations from intended interventions	Missing outcome data	Measurement of the outcome	Selection of the reported result	Overall Bias
Amra	Low	Low	Low	High	Low	High
Calamassi	Low	Low	Low	Low	Low	Low
Crippa	Low	High	Low	High	Low	High
Dincer	Some concerns	High	Low	High	Low	High
Joshi	Low	Low	Low	High	Low	High
Yildrium	Low	Low	Low	High	Low	High
Zhou	Some concerns	Low	Low	High	Low	High
Vajpayee	Some concerns	Low	Low	High	Low	High
Kock	Low	Low	Low	Low	Low	Low
Hsieh	Some concerns	Low	Low	Some concerns	High	High
Keng	Low	Some concerns	Low	Low	Low	Some concerns
Gupta	High	High	Low	Low	Low	High
De-Roque	Low	Low	Low	Low	Low	Low
Moss	High	Low	Low	High	Low	High
Sharma	Low	High	Low	Low	Low	High
Taylor	Low	Low	Low	Low	Low	Low
Thimmapuram	Low	Low	Low	High	Low	High

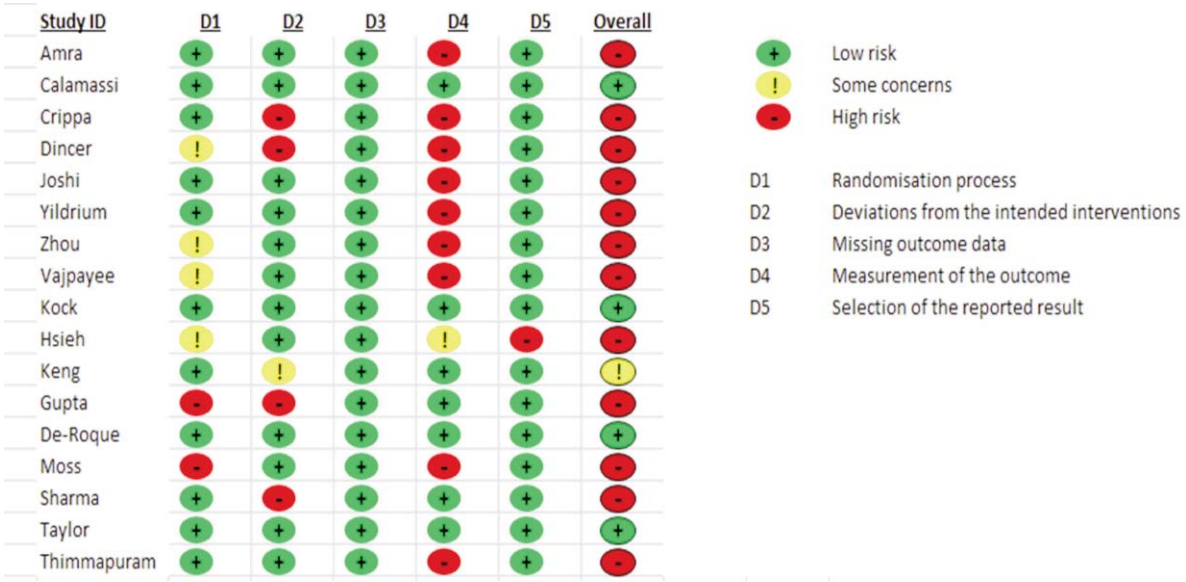

Figure-2: Risk of bias assessment.

single 20-minute acupuncture session, with the primary outcome being stress measured by STAI and distress measured by Subjective Units of Distress Scale (SUDs). The study found that the intervention was effective in reducing stress, with a mean score reduction from 67.68±9.0 to 32.35±4.6 in the intervention group compared to 64.43±7.6 to 64.71±8.0 in the control group ($p<0.001$).

The overall RoB for the studies analysed was 70% (Table 5). The most common domain where high risk of bias was found was in the measurement of the outcome, accounting for 9(52.9%) of the studies. The next most

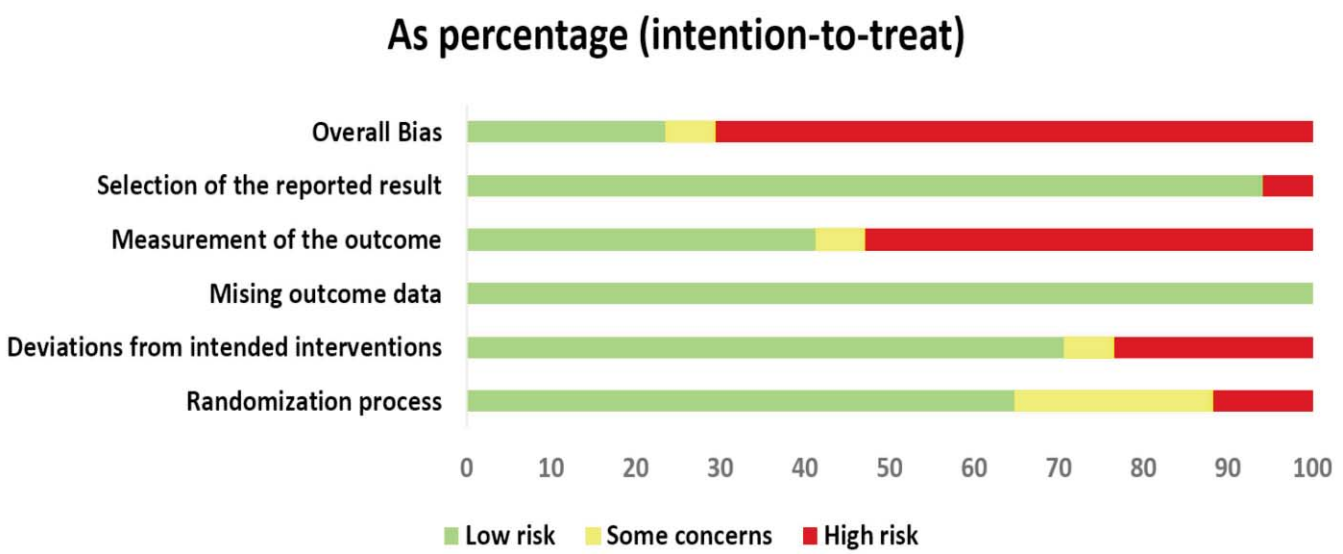

Figure-3: Risk of bias elements.

common domains where high RoB was found were deviations from intended interventions 4(23.5%) and the randomisation process 2(11.7%). Only 1(5.8%) of the studies showed high RoB for selective reporting (Figure 2). High RoB was found for outcome measurement in 9(52.9%) studies, deviation from intended intervention in 4(23.5%) studies, randomisation process in 2(11.7%) studies and selective reporting in 1(5.9%) study (Figure 3).

Discussion

The COVID-19 pandemic had a negative impact on the mental health of individuals, particularly frontline healthcare workers.[32] Different mitigating strategies have been used to counter this phenomenon. To synthesise the evidence of these interventions, the current systematic review was conducted by searching the literature for relevant studies, resulting in 17 RCTs being included in the review.

The aim of the review was to examine the effectiveness of various interventions, including pharmacotherapy, behavioural therapy, counselling, educational training, mobile-based digital interventions, mindfulness, meditation, yoga/exercise, breathing exercise, and music therapy, in mitigating the impact of COVID-19 on the mental health of frontline healthcare workers. The results showed that these interventions had a significantly positive effect on reducing perceived anxiety, depression, insomnia, stress and post-traumatic distress syndrome in healthcare workers.

A mindful intervention is a type of intervention that involves practices, such as mindful breathing, mindfulness of thoughts, and mindfulness of sounds. It typically requires participants to engage in daily mindfulness practice for a set period of time, as well as complete assessments before and after the intervention to measure outcomes, such as stress, anxiety and depression.[33]

The current systematic review examined the effectiveness of mindfulness-based interventions in managing stress, anxiety and depression among healthcare workers dealing with COVID-19 patients. Four studies were analysed, each conducted by different researchers.[15-18] Three of them reported a significant positive impact of mindfulness-based interventions on healthcare workers with primary outcomes of stress, anxiety and depression, regardless of whether or not they were taking psychotropic medication. However, one study, which compared the use of Headspace to an active control condition, did not report any significant effect in terms of the outcomes.[16] These findings suggest that mindfulness-based interventions may be effective in improving mental health outcomes for healthcare workers dealing with COVID-19 patients, but further research is needed to identify the most effective types of interventions and their optimal duration and frequency.

Three studies in the systematic review showed that yoga/music interventions can improve depression, anxiety and stress among healthcare workers in a cost-effective way. [19-21] Music therapy and meditation can be affordable and effective interventions to manage stress, loneliness and sleep problems in healthcare workers and other professionals.[20] Psychological interventions were also found to significantly improve primary insomnia and secondary anxiety and depression. However,

pharmacological interventions and transcendental meditation were less effective in reducing mental health problems. An RCT on creative arts therapy showed significantly greater improvements in anxiety, depression and PTSD scores.[25-28] Acupuncture intervention provided in the review was found to be effective in improving stress among healthcare workers.[31] Overall, the included studies suggest that yoga/music, music therapy/meditation, psychological interventions, creative arts therapy, and acupuncture are effective interventions for mitigating COVID-19-related psychological stress and anxiety. However, pharmacological interventions and transcendental meditation appear to be less effective.

The RoB results in the current review showed that the overall risk for the studies analysed was 70%. The most common domain where high RoB was found was in the measurement of the outcome, accounting for 52% of the studies. The next most common domains where high RoB was found were deviations from intended interventions (23%) and the randomisation process (11.8%). Only 5% of the studies showed high risk of bias for selective reporting. These results suggest that careful consideration should be given to the measurement of outcomes when designing and conducting future studies in this area. Additionally, efforts should be made to minimise deviations from intended interventions and ensure a robust randomisation process to minimise bias.

The current review also identified several limitations of the studies analysed. The studies were RCTs that examined different interventions and treatments for various conditions. The most common limitation was a small sample size, which was identified in several studies.[20,22,24-31] Another limitation was that some of RCTs were pilot studies.[20.30.31] Sharma et al[21] identified a high dropout rate as a limitation. Other limitations included non-blinding of outcome assessor[22], self-reported outcomes[20,22,24,26,30], pre-post assessment without long-term assessments[22], lack of monitoring of the control arm [22,23], and higher attrition rates.[23,25] In addition, Thimmapuram et al[23] did not perform second intention to treat analysis and did not consider personal factors of the participants. Kock et al[31] had a short intervention duration, and Amra et al[28] provided just one behaviour treatment session, observing only acute effects. Crippa et al[29] did not use double-blind placebo, had a short follow-up period, had a small sample size, and did not have a primary focus on mental health issues. Zhou et al[27] had a blank control group and all female subjects in the study population. Dincer et al[31] used a single acupuncture session and did not have long-term follow-up.

While conducting the current systematic review, one of the major drawbacks that emerged was the inherent heterogeneity across the studies. Different studies used different interventions, or combinations of different interventions, and applied different scales to record the outcomes, such as depression, insomnia and anxiety. Additionally, there was variation in the duration and frequency of the interventions, which contributed to the heterogeneity. Another reason for heterogeneity was the variability in the control group, ranging from no intervention to active intervention. As a result, it was not possible to pool the outcomes even with subgroup analysis, and a meta-analysis could not be performed. Hence, the heterogeneity across the studies emerged as a significant limitation of the current review, which must be kept in mind while interpreting the findings.

Conclusion

Interventions, including mindfulness-based, yoga/music, music therapy/meditation, psychological interventions, creative arts therapy and acupuncture, could effectively mitigate psychological stress and anxiety in healthcare workers dealing with COVID-19 patients. However, pharmacological interventions and transcendental meditation were not as effective. The findings highlight the importance of implementing non-pharmacological interventions to support the mental health of healthcare workers during times of crisis.

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MZ: Concept, literature search, screening, data extraction, writing and risk of bias assessment.
UH: Risk of bias assessment, writing and proof reading.
SN & SK: Literature search, screening, risk of bias assessment and proof reading.
KR: Principal investigator and supervision.