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Review article

Effects of mental health interventions among people hospitalized with COVID-19 infection: A systematic review of randomized controlled trials

Amina Tasleem [a], Yutong Wang [a], Kexin Li [a], Xiaowen Jiang [a], Ankur Krishnan [a], Chen He [a], Ying Sun [a], Yin Wu [a,b], Suiqiong Fan [a], Jill T. Boruff [c], Sarah Markham [d], Danielle B. Rice [a,e], Olivia Bonardi [a], Tiffany Dal Santo [a], Letong Li [a], Ian Thombs-Vite [a], Branka Agic [f,g], Christine Fahim [h], Michael S. Martin [i,j], Sanjeev Sockalingam [f,k], Andrea Benedetti [l,m,n], Brett D. Thombs [a,b,e,l,m,o,*]

[a] Lady Davis Institute for Medical Research, Jewish General Hospital, Montreal, Quebec, Canada
[b] Department of Psychiatry, McGill University, Montreal, Quebec, Canada
[c] Schulich Library of Physical Sciences, Life Sciences, and Engineering, McGill University, Montreal, Quebec, Canada
[d] Department of Biostatistics and Health Informatics, King's College London, London, UK
[e] Department of Psychology, McGill University, Montreal, Quebec, Canada
[f] Centre for Addiction and Mental Health, Toronto, Ontario, Canada
[g] Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada
[h] Li Ka Shing Knowledge Institute, Unity Health Toronto, Toronto, Ontario, Canada
[i] School of Epidemiology and Public Health, University of Ottawa, Ontario, Canada
[j] Correctional Service of Canada, Ottawa, Ontario, Canada
[k] Department of Psychiatry, University of Toronto, Toronto, Ontario, Canada
[l] Department of Epidemiology, Biostatistics, and Occupational Health, McGill University, Montreal, Quebec, Canada
[m] Department of Medicine, McGill University, Montreal, Quebec, Canada
[n] Respiratory Epidemiology and Clinical Research Unit, McGill University Health Centre, Montreal, Quebec, Canada
[o] Biomedical Ethics Unit, McGill University, Montreal, Quebec, Canada

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ABSTRACT

Objective: We evaluated the effects of mental health interventions among people hospitalized with COVID-19.
Methods: We conducted a systematic review and searched 9 databases (2 Chinese-language) from December 31, 2019 to June 28, 2021. Eligible randomized controlled trials assessed interventions among hospitalized COVID-19 patients that targeted mental health symptoms. Due to the poor quality of trials, we sought to verify accuracy of trial reports including results.
Results: We identified 47 randomized controlled trials from China ($N = 42$), Iran ($N = 4$) and Turkey ($N = 1$) of which 21 tested the efficacy of psychological interventions, 5 physical and breathing exercises, and 21 a combination of interventions. Trial information could only be verified for 3 trials of psychological interventions (cognitive behavioral, guided imagery, multicomponent online), and these were the only trials with low risk of bias on at least 4 of 7 domains. Results could not be pooled or interpreted with confidence due to the degree of poor reporting and trial quality, the frequency of what were deemed implausibly large effects, and heterogeneity.
Conclusion: Trials of interventions to address mental health in hospitalized COVID-19 patients, collectively, are not of sufficient quality to inform practice. Health care providers should refer to existing expert recommendations and standard hospital-based practices.
Registration: PROSPERO (CRD42020179703); registered on April 17, 2020.

Abbreviations: ICU, intensive care unit; TIDieR, Template for Intervention Description and Replication; SMD, standardized mean difference; CI, confidence interval.

* Corresponding author at: Jewish General Hospital, 3755 Cote Ste Catherine Road, Pavilion H4.83, Montreal, Quebec H3T 1E2, Canada.
E-mail address: brett.thombs@mcgill.ca (B.D. Thombs).

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1. Introduction

People infected with COVID-19, including those who have been hospitalized, are at risk for negative mental health outcomes [1–5]. In addition to stressors faced by anybody with a serious medical condition, including the risk of disability and death, people hospitalized due to COVID-19 may be at particular risk of poor mental health outcomes due to (1) limited social contact between healthcare workers and patients, (2) smaller health care worker to patient ratios, (3) families being excluded from intensive care units, (4) limited resources such as beds and mechanical ventilators, (5) long-term health sequelae of COVID-19, and (6) stigma and discrimination associated with being infected [2–5]. Strategies for mental health management for people hospitalized due to COVID-19 are needed to reduce short- and long-term negative mental health outcomes.

Two previous systematic reviews have evaluated the effects of non-pharmacological interventions to reduce psychological distress among intensive care unit (ICU) patients, but both concluded that methodological limitations and risk of bias, small sample sizes, and heterogeneity in populations and approaches limited confidence in results [6,7]. Two systematic reviews [8,9] have sought to evaluate the effects of interventions on mental health among COVID-19 patients. One [8] searched through April 2020 and identified 16 studies but no randomized controlled trials [RCTs]. The other [9] searched for RCTs through July 2020, identified 5 (768 participants), and synthesized results quantitatively; however, low risk of bias ratings were applied to trials with major shortcomings, and results were pooled across highly heterogeneous interventions (muscle relaxation, respiratory rehabilitation, "life intervention", traditional Chinese nursing, internet-based intervention), which reduced confidence in synthesized results.

We are conducting a series of living systematic reviews [10] of changes in mental health symptoms during COVID-19 and the effects of interventions designed to improve mental health during the pandemic [11,12]. Living systematic reviews are systematic reviews that are updated frequently and provide ongoing access to results as they become available [10]. They are logistically challenging but provide value beyond conventional systematic reviews in situations where (1) important decisions need to be made that merit the resources involved; (2) the certainty in existing evidence is low or very low, posing a barrier to decision-making; and (3) there is likely to be new research evidence emerging that would inform decisions [10].

The objective of the present sub-study was to synthesize evidence from RCTs on the effects of mental health interventions for people hospitalized with COVID-19 infection. Results from trials of interventions for people not quarantined or undergoing treatment due to COVID-19 infection have been reported elsewhere [13].

2. Method

Our systematic reviews on COVID-19 mental health [11,12] were registered (CRD 42020179703), and a protocol was posted (https://osf.io/96csg/) prior to initiation. Results are posted online as data are extracted (https://www.depressd.ca/research-question-3-intervention). This manuscript adheres to the Preferred Reporting Items for Systematic Reviews and Meta-analysis statement [14].

2.1. Study eligibility

For trials to be included in the present review, all participants had to be enrolled after December 31, 2019, when China first reported on COVID-19 to the World Health Organization [15]. The population was restricted to patients receiving hospital-based care due to COVID-19 infection. Eligible interventions included any intervention described as designed primarily to address mental health symptoms from COVID-19. Trials that tested non-mental health interventions and primarily targeted non-mental health outcomes (e.g., exercise with primary outcome physical activity) were excluded. Eligible comparators included: (1) inactive control conditions (e.g., no treatment, waitlist) and (2) other eligible interventions. Eligible outcomes were defined broadly and included general mental health, mental health quality of life, anxiety symptoms, depression symptoms, stress, loneliness, anger, grief, burnout, and other emotional states. Eligible studies had to be RCTs that included at least 10 participants. There were no restrictions on language or publication format.

We did not include non-randomized studies because such studies are highly prone to bias when intervention and control groups are self-selected or there is no control group. Results from pre-post analyses of non-randomized studies without a control group are not possible to interpret unless there is a precise knowledge of the natural trajectory of symptoms or if one can safely assume that symptoms will not change over time without intervention. Even in normal times, however, this is not the case for mental health trials. Participants often seek mental health services and enrol in trials when they are experiencing high levels of symptoms, and regression to the mean is common [16–20]. Approximately 40% of participants assigned to placebo groups in drug trials or no-treatment groups in psychological intervention trials for major depression, for instance, achieve remission [21]. The Cochrane Collaboration discourages inclusion of evidence from non-randomized studies when conducting trials is feasible and when evidence from non-randomized trials is subject to these kinds of biases [22].

2.2. Search strategy

We searched MEDLINE (Ovid), PsycINFO (Ovid), CINAHL (EBSCO), EMBASE (Ovid), Web of Science Core Collection: Citation Indexes, China National Knowledge Infrastructure, Wanfang, medRxiv (preprints), and Open Science Framework Preprints (preprint server aggregator), using a search strategy designed and built by an experienced health sciences librarian. The China National Knowledge Infrastructure and Wanfang databases were searched using Chinese-language terms based on the English-language strategy. (See Appendix A).

An initial search was conducted from December 31, 2019 to April 13, 2020, then automated searches were set for daily updates. As of December 28, 2020, the automatic daily search updates were converted to weekly updates for feasibility. The present report includes trials from searches conducted up to June 28, 2021. We conducted a pre-submission study review up to searches done on February 14, 2022 to determine if any verified studies had been published since the main search date.

2.3. Selection of eligible studies

Search results were downloaded into the systematic review software DistillerSR (Evidence Partners, Ottawa, Canada) where duplicate references were identified and removed. Two reviewers independently screened titles and abstracts in random order to identify potentially eligible trials. If either reviewer deemed a study potentially eligible then a full-text review was conducted by two reviewers independently. Any disagreements at the full-text level were resolved through discussion and consensus, involving a third reviewer if necessary. An inclusion/exclusion coding guide was developed and pre-tested, and all team members were trained over several sessions. See Appendix B.

2.4. Data extraction

For each included RCT, one reviewer extracted data using a pre-specified standardized form in DistillerSR. A second reviewer validated the extracted data. Reviewers extracted (1) publication characteristics (e.g., first author, publication year, journal, funding source); (2) population characteristics and demographics (e.g., country, study eligibility criteria, number of participants, age, sex or gender, recruitment setting; (3) COVID-19 characteristics (e.g., severity); (4) intervention components, and (5) mental health outcomes. If sufficient

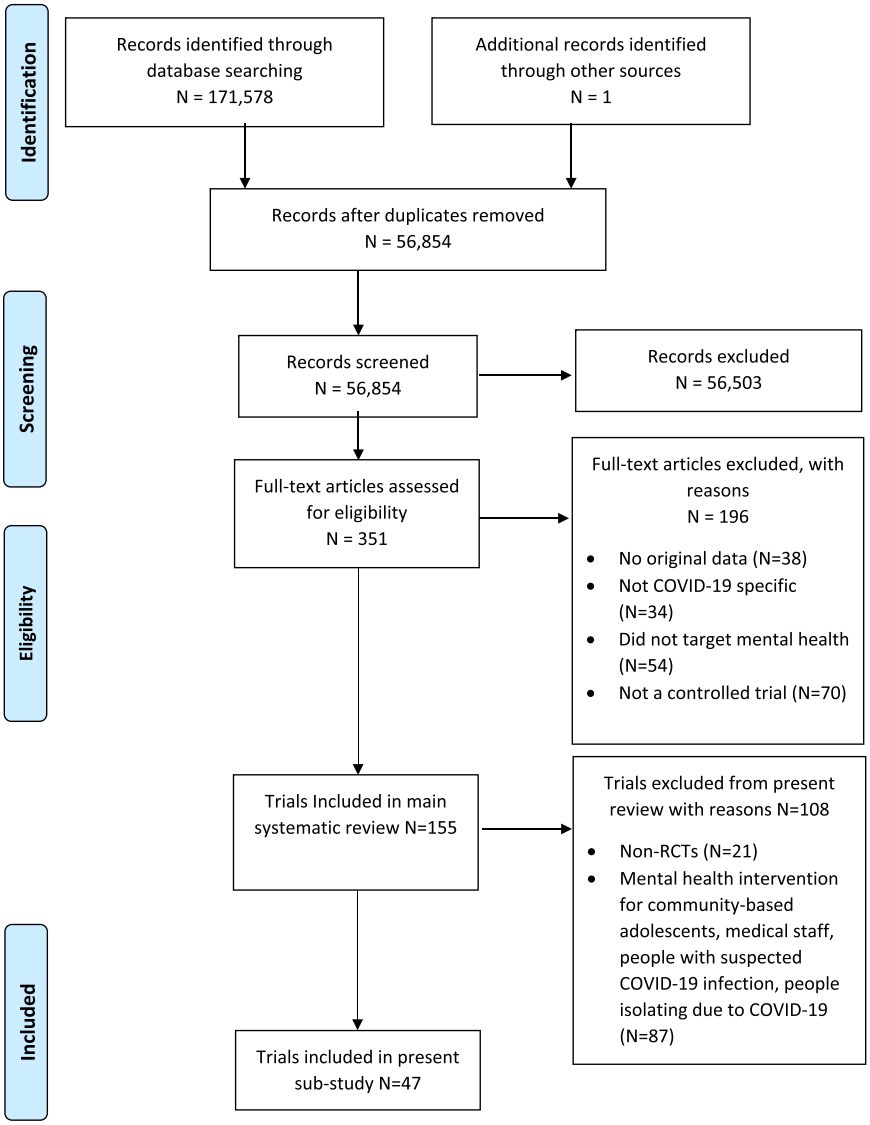

Fig. 1. PRISMA flow diagram of study selection.

information to calculate effect sizes was not provided, we attempted to obtain from authors.

We encountered many trials of unclear origin and funding, of very poor quality, and with effect sizes that exceeded plausibility. Thus, we emailed all included study authors twice (if no response to initial email) and requested that they verified the (1) authenticity of methods and results and (2) accuracy of our extracted outcomes. Authors of Chinese-language studies were contacted in both English and Chinese.

2.5. Assessment of risk of bias

We used the 2011 Cochrane Risk of Bias tool [23], which includes 7 domains that are rated as high risk, low risk, or unclear risk of bias. Two independent reviewers assessed each study independently; disagreements were resolved through discussion and consensus with a third reviewer consulted as necessary.

2.6. Assessment of reporting quality of trials

We used the Template for Intervention Description and Replication (TIDieR) checklist [24] to evaluate intervention reporting adequacy. The checklist is comprised of 12 items that assess reporting of intervention name; rationale for use of the intervention; materials used; intervention provider and background; delivery mode; location and necessary infrastructure; intervention frequency and duration; any tailoring; any modifications; if adherence or fidelity was assessed; and, if assessed, degree to which intervention was delivered as planned. TIDieR was done independently by two reviewers with consensus-based resolution of conflicts, including a third reviewer if necessary.

2.7. Data analysis

We calculated between-groups standardized mean difference (SMD) effect size for each outcome using Hedges' g with 95% confidence interval (CI) when possible. We did not pool results quantitatively in a meta-analysis due to substantial heterogeneity of populations, interventions, and outcomes and because of serious concerns about risk of bias.

2.8. Protocol amendments

Protocol amendments are shown in Appendix C.

Table 1
Characteristics of included trials.

First author Dates Country Registration	Verified	Setting	Participants	Intervention	Comparator	N Intervention/ Comparator Analyzed	Outcome Domain(s)	Mean (SD) Age	% Female
Psychological Interventions									
Ding [25] NR China NR	No	Hospital isolation ward	COVID-19 patients with pneumonia	Multifaceted, including COVID-19 related education; relaxation techniques, and encouragement to use electronic devices to connect with family	Routine nursing	31/31	Anxiety, Depression	Range: 22–72	16
Gharaati [26] 05–06/2020 Iran NR	No	General hospital	COVID-19 patients	Crisis intervention package including 4 60-min psychotherapy sessions over 4 weeks focusing on empathy, adjustment, responsibility, and spirituality	Standard individual psychotherapy	14/16	Anxiety, Depression, Mental Health Function, Stress	Range: 18–65	53
Gu [27] 01–02/2020 China NR	No	Hospital isolation ward	COVID-19 patients able to use a video chat platform	Mindfulness-based stress reduction therapy 2 20–30-min sessions per week for 4 weeks	WeChat group where doctors answer patients' questions, assess their mental health, and provide therapy and health education	33/30	Anxiety, Depression	41 (14)	46
Guo [28] 02–03/2020 China NR	No	COVID-19 hospital isolation ward	Patients with mild COVID-19 symptoms	Psychological nursing, including evaluation of psychological status, prevention of negative emotions, and encouragement of family support	Standard nursing	30/30	Anxiety, Depression	Intervention median 54 (3) Comparator median 53 (3)	45
Hui [29] 01–02/2020 China NR	No	COVID-19 hospital isolation ward	Patients with mild COVID-19 symptoms	2× per day, 14-day psychological crisis intervention	2× per day,14-day standard psychological care	36/36	Anxiety, Depression	58 (8)	46
Jiang [30] 02–03/2020 China NR	No	COVID-19 hospital isolation ward	Patients with mild COVID-19 symptoms and anxiety or depression	Psychological care, including mindfulness therapy, health education, communication with patients, positive movies and soft songs	Standard nursing	43/43	Anxiety, Depression	NR	NR
Li J. [31] 02–03/2020 China ISRCTN68675756	Yes	COVID-19 treatment hospital isolation ward	Patients with mild COVID-19 symptoms with no previously diagnosed depression, current psychiatric medication, prior cognitive dysfunction or major stressful event	30-min CBT in the morning daily for 4 weeks	Routine nursing	47/46	Anxiety, Depression, Stress	48 (12)	65
Liu Ying [32] 03/2020-NR China NR	No	General hospital	Patients hospitalized with mild COVID-19 infection	Group psychological intervention delivered via WeChat group and	Standard COVID-19 treatment	70/70	Anxiety	<25	59

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Table 1 (*continued*)

First author Dates Country Registration	Verified	Setting	Participants	Intervention	Comparator	N Intervention/ Comparator Analyzed	Outcome Domain(s)	Mean (SD) Age	% Female
				pulmonary rehabilitation exercises including five-tone breathing and Baduanjin exercises 30 min a day for 4 weeks					
Liu Yiwei [33] NR China NR	No	Hospital isolation ward	Patients aged 18–60 with mild COVID-19 infection; no cognitive dysfunction, mental or psychiatric disorder; no severe underlying diseases	90–120 min daily art therapy for 10 days	Standard nursing	25/25	Anxiety, Depression, Mental Health Function	44 (9)	42
Liu Z [34]. NR China ChiCTR2000030084	No	General hospital isolation ward	Patients with mild or common type COVID-19, mild to moderate depressive or anxiety symptoms (HAMD17 or HAMA ≥7, HAMD <24, HAMA <21), no psychiatric diagnosis in last 6 months, no psychotic symptoms, no high risk of suicide, no organic mental disorders, no substance abuse or dependence, no current treatment for mental health problems	Self-directed computerized cognitive behavioral therapy (cCBT) 10 min per day for 1 week	Treatment as usual including periodic psychological assessment, general psychological support, and discussion of overall well-being and disease activity.	126/126	Anxiety, Depression	43 (13)	40
Pan H. [35] 01–03/2020 China NR	No	COVID-19 hospital isolation ward	Patients with severe COVID-19 symptoms	Routine care plus non-specific psychological interventions tailored to patient presentation: (1) for panic, assign more experienced nursing staff; (2) for dysphoria, emphasize being patient and sympathetic; (3) for depression: analyze origin of pessimistic mood and target communication	Routine care	30/30	Anxiety, Depression, Mental Health Function	NR	45
Pan R. [36] 01–04/2020 China NR	No	COVID-19 hospital isolation ward	Patients with mild COVID-19 symptoms	Psychological nursing, including building comfortable environment, stabilizing mood,	Standard nursing	16/16	Anxiety, Depression	53 (6)	44

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Table 1 (*continued*)

First author Dates Country Registration	Verified	Setting	Participants	Intervention	Comparator	N Intervention/ Comparator Analyzed	Outcome Domain(s)	Mean (SD) Age	% Female
				educating patients about COVID-19 knowledge, and alleviating negative affect					
Parizad [37] NR Iran IRCT20131112015390N5	Yes	General Hospital	COVID-19 patients with an oxygen saturation > 90%, no severe visual or auditory disorders, no mental disorders	25 min guided imagery sessions 2× per day for 5 consecutive days	Routine care	55/55	Anxiety	40 (12)	44
Shaygan [38] NR Iran IRCT20201001048893N1	Yes	General hospital	Mild to severely infected COVID-19 patients with no previous experience of quarantine and no history of psychiatric disorders or taking psychiatric medications.	Online multifaceted multimedia psycho-educational intervention, 1 60-min module per day for 14 days	Offer to receive telephone-based counselling if needed	26/22	Mental Health Function, Stress	37 (12)	44
Shi Q. [39] 01–03/2020 China NR	No	COVID-19 hospital isolation ward	People hospitalized with mild COVID-19 symptoms	Daily psychoeducation focused on emotional regulation; psychological assessment of patients on the 1st, 7th and 14th day after admission; daily traditional Chinese medicine emotional therapy and corresponding diet therapy	Standard nursing care	30/30	Anxiety, Depression	34 (3)	48
Shi Y. [40] 01–04/2020 China NR	No	General hospital intensive care unit	Hospitalized in intensive care with COVID-19 infection; have no pre-existing mental disorders, insomnia, or severe comorbidity	Psychological care, including COVID-19 information and relaxation support	Standard care	30/30	Anxiety	52 (10)	45
Wang M. [41] NR China NR	No	University hospital	Patients hospitalized with severe COVID-19, no recent major life events, no malignant tumor, no prior psychiatric disorder or anti-depressant use	Standard nursing plus daily 20–30 min psychological intervention including empathic listening, transposition thinking, information organizing, and feedback exchanging	Standard nursing	20/20	Anxiety, Depression	46 (7)	45
Wang Y. [42] 02–03/2020	No	COVID-19 treatment hospital	Hospitalized COVID-19 patients	Routine nursing plus multifaceted psychological	Routine nursing	39/39	Anxiety, Depression	57 (4)	47

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Table 1 (*continued*)

First author Dates Country Registration	Verified	Setting	Participants	Intervention	Comparator	N Intervention/ Comparator Analyzed	Outcome Domain(s)	Mean (SD) Age	% Female
China NR				intervention, including providing patients and their families with COVID-19 information, teaching patients relaxation and psychological regulation techniques for 14 days					
Wei [43] 02/2020 China NR	No	University hospital	COVID-19 patients with PHQ-9 or GAD-7 of ≥5 and < 15, at least a junior middle school level of education, no suicidal ideation, and no antipsychotic use.	Self-help multifaceted internet-based intervention including mindfulness techniques, relaxation training, "refuge" skills, and butterfly hug method with instructions to do 50 min daily for 2 weeks	Daily supportive care	26/22	Anxiety, Depression	45 (12)	38
Zhang A. [44] NR China NR	No	General hospital	Patients with mild and ordinary COVID-19, no cognitive disorders.	Routine treatment plus traditional Chinese medicine prescription for pneumonia and shared decision-making psychological counselling	Routine treatment	106/100	Anxiety	36 (5)	42
Zhu L [45] NR China NR	No	COVID-19 hospital isolation ward	Patients with mild COVID-19 symptoms and no psychiatric disorder	Standard nursing plus 5–6 15–30 min individualized daily acceptance and commitment therapy (ACT) sessions	Standard nursing	46/46	Anxiety, Depression	Intervention 65 (NR) Comparator 67 (NR)	45
Physical/Breathing Exercise Interventions									
Chen X. [46] 02–03/2020 China NR	No	COVID-19 hospital isolation ward	Patients with mild COVID-19 symptoms	3-week Baduanjin exercise, 10 times per week, 2 times per day	Standard care	14/15	Anxiety, Depression	69 (11)	55
Liu K. [47] 01–02/2020 China NR	No	Hospital Isolation ward	Patients with confirmed COVID-19	Progressive muscle relaxation and deep breathing 20–30 min per day for 5 consecutive days	Standard care	25/26	Anxiety	50 (13)	45
Özlü [48] 05–08/2020 Turkey NR	No	General hospital COVID-19 clinic	Adult COVID-19 patients receiving treatment	20–30 min progressive muscle relaxation exercises delivered on TV via CD twice a day for 5 days	Routine care	33/34	Anxiety	35 (12)	45
Zhang Y. [49] 02–03/2020 China NR	No	COVID-19 treatment hospital isolation ward	Patients with mild COVID-19 symptoms	Multifaceted, including Fitness Qigong group training 3 days a week, twice a day in 60 min sessions; Chinese medicine and nursing from 4 pm–5 pm daily;	Routine nursing	14/14	Anxiety, Depression	50 (4)	39

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Table 1 (*continued*)

First author Dates Country Registration	Verified	Setting	Participants	Intervention	Comparator	N Intervention/ Comparator Analyzed	Outcome Domain(s)	Mean (SD) Age	% Female
				ear acupoint bean-pressing: 10–15 times a day for 3–5 min					
Zhu [50] 02–03/2020 China NR	No	COVID-19 treatment hospital isolation ward	Patients with mild COVID-19 symptoms	One-on-one health education for 9 days including medication guidance and monitoring vital signs plus breathing exercises twice daily	Standard nursing	40/40	Anxiety, Depression	36 (12)	43
Mixed Interventions									
Cai [51] NR China NR	No	COVID-19 hospital	Mildly infected or ordinary type COVID-19 patients with no severe underlying diseases	Multifaceted intervention, including COVID-19 education, psychological intervention targeted at alleviating patients' negative emotions; nutrition guidance; and exercise	Standard nursing	30/30	Anxiety, Depression	43 (12)	45
Cao [52] 01–03/2020 China NR	No	COVID-19 treatment hospital isolation ward	Severely infected COVID-19 patients not on ventilators aged 41–79	Humanistic nursing including nutrition plan, individualized pulmonary recovery plan, and attending to patients' emotions	Standard care	68/68	Anxiety, Depression	60 (12)	29
Cha [53] 01–03/2020 China NR	No	COVID-19 treatment hospital isolation ward	Patients with mild COVID-19 symptoms	Systematic nursing, including psychological nursing to alleviate patients' negative emotions; rehabilitation training to enhance immune system; increasing ward rounds to monitor changes in patients' symptoms; and nutrition guidance	Routine nursing	50/50	Anxiety, Depression	45 (6)	48
Chakeri [54] NR Iran NR	No	Emergency department	People given a definitive diagnosis of COVID-19 and prescribed home quarantine, medication, and continued treatment at home	Information about COVID-19 symptoms and methods of preventing transmission plus tele-nursing counselling for 3 weeks every other day	Information about COVID-19 symptoms and methods of preventing transmission	50/50	Anxiety	43 (9)	NR
Chen Y. [55] NR China NR	No	COVID-19 treatment hospital	Patients with mild COVID-19 symptoms	Standard nursing plus humanized nursing (psychological care; health education;	Standard nursing	40/40	Anxiety	NR	NR

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Table 1 (*continued*)

First author Dates Country Registration	Verified	Setting	Participants	Intervention	Comparator	N Intervention/ Comparator Analyzed	Outcome Domain(s)	Mean (SD) Age	% Female
				relaxation training therapy)					
Deng [56] NR China NR	No	COVID-19 treatment hospital isolation ward	Mild to moderate COVID-19 infected patients with no other underlying diseases	Standard psychological nursing plus personalized psychological nursing and peer-support group including online psychological counselling 4× over 2 weeks	Standard psychological nursing including education about COVID-19	30/30	Anxiety, Depression	NR	45
Dong [57] 02–03/2020 China NR	No	COVID-19 treatment hospital isolation ward	Patients with mild COVID-19 symptoms	Routine nursing plus humanistic care, including sanitary improvement of the ward; educating patients on COVID-19; and using verbal encouragement to decrease patients' anxiety and loneliness; encouraging them to communicate with their families via telephone and video	Routine nursing	46/46	Anxiety, Mental Health Function	42 (8)	45
Fan [58] 01–03/2020 China NR	No	COVID-19 treatment hospital isolation ward	Patients with mild COVID-19 symptoms	Systematic nursing, including psychological nursing to alleviate patients' negative emotions; rehabilitation training to enhance immune system; increasing ward rounds to monitor changes in patients' symptoms; and nutrition guidance	Routine nursing	50/50	Anxiety, Depression	45 (6)	48
Huang [59] NR China NR	No	Traditional Chinese hospital	Patients hospitalized with COVID-19 infection	Health education and psychological nursing during and after treatment focusing on eliminating patients' negative affect	Standard nursing	37/36	Anxiety, Depression	56 (NR)	53
Li Lan [60] NR China NR	No	COVID-19 hospital	Adult patients of light or ordinary type COVID-19, with a score of HAMD ≥8 or SAS ≥50, no severe somatic diseases	Five Elements Music therapy, Six Words Formula therapy (breathing exercise) and psychological nursing twice daily for 2 weeks; practicing Six Words Formula therapy while listening to music	Routine psychological nursing focusing on encouraging patients to express their emotions, educating on COVID-19, facilitating family support, and performing abdominal breathing	30/30	Anxiety, Depression	45 (14)	48
Li Li [61] 01–04/2020	No	COVID-19 treatment hospital	Patients with mild COVID-19 symptoms	High quality nursing including psychological and	Standard care	58/57	Anxiety, Depression, Mental	54 (3)	47

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Table 1 (*continued*)

First author Dates Country Registration	Verified	Setting	Participants	Intervention	Comparator	N Intervention/ Comparator Analyzed	Outcome Domain(s)	Mean (SD) Age	% Female
China NR		isolation ward		dietary intervention			Health Function		
Liu Q. [62] NR China NR	No	COVID-19 treatment hospital isolation ward	COVID-19 patients with blood oxygen saturation > 93% and breathing rate less than 24/ min; with no psychiatric disorder or other comorbidity	Standard nursing plus psychological nursing and humanistic nursing focusing on monitoring and stabilizing patients' affect and helping them accept their negative emotions	Standard nursing	22/22	Anxiety, Depression	49 (3)	52
Liu R. [63] 02–03/2020 China NR	No	COVID-19 treatment hospital	Patients with mild COVID-19 symptoms	Individualized psychotherapy plus group music therapy and physical exercise over 4 weeks	Standard care	75/75	Anxiety, Depression	52 (7)	59
Lu [64] 01–05/2020 China NR	No	General Hospital	Hospitalized COVID-19 patients	quality care including monitoring vital signs every 30 min; psychological care focusing on decreasing patients' negative affect and increasing treatment compliance; high-protein-high-energy liquid diets with no more than 200 ml per day; and close monitoring of signs of fever	Routine care	60/60	Anxiety, Depression, Mental Health Function	55 (4)	48
Ma [65] 02–03/2020 China NR	No	COVID-19 treatment hospital isolation ward	Patients with COVID-19 symptoms	Standard nursing plus improving ward environment and individualized humanistic intervention focusing on alleviating patients' negative affect	Standard care	130/130	Depression	64 (NR)	42
Nie [66] 02–03/2020 China NR	No	COVID-19 treatment hospital isolation ward	Severely infected COVID-19 patients	Humanistic care including paying attention to negative emotions, providing proper diet, educating on COVID-19 and protecting patients' privacy for 4 weeks	Standard intensive care	15/15	Anxiety	36 (6)	43
Xu [67] 02–04/2020 China NR	No	General Hospital	Patients with mild symptoms of COVID-19	Routine nursing plus humanistic care focusing on improving patients' negative emotions, providing a comfortable ward environment, psychological care targeting patients'	Routine nursing	40/40	Anxiety, Depression	60 (7)	43

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Table 1 (*continued*)

First author Dates Country Registration	Verified	Setting	Participants	Intervention	Comparator	N Intervention/ Comparator Analyzed	Outcome Domain(s)	Mean (SD) Age	% Female
				needs, and spiritual support through reminding patients of their families					
Yang [68] NR China NR	No	COVID-19 hospital	Patients with mild COVID-19 infection, no severe cardiac, hepatic, or renal functional diseases, and no severe neurological diseases	Traditional Chinese medicine syndrome differentiation nursing methods lasting for 1 month and acupoint massage, lasting 2 min per acupoint 2–3 times daily	Routine nursing	44/44	Anxiety, Depression	49 (0)	33
Zhang Y. [69] 01–02/2020 China NR	No	COVID-19 hospital isolation ward	Patients with mild COVID-19 symptoms with no serious complications	Personalized guidance including watching educational videos and discussing effective plans every other day; 30–60 min per session, 1 session every two days for 10 days	Standard nursing	12/12	Anxiety	46 (3)	46
Zheng C. [70] NR China NR	No	COVID-19 hospital	Patients with no history of psychiatric disorder or severe cognitive disorder	Traditional health education plus "Atlas Menu" health education including presenting knowledge about what patients would encounter during their hospital stay in a menu-like pattern with images for patients' study on their own	Traditional health education at different stages of hospitalization including psychological nursing and safety risk-related information delivered once every 3–5 days	56/56	Anxiety, Depression	59 (6)	54
Zheng Y. [71] NR China NR	No	COVID-19 hospital isolation ward	Patients with mild COVID-19 infection, no mental disorder history, recent trauma, or psychiatric disorder.	Humanistic care based on Traditional Chinese Medicine, including cognitive intervention aimed at helping patients build correct cognitions about COVID-19, behavioral intervention aimed at instructing patients on exercises, music intervention to calm patients, and auricular massage intervention 3–5 times per day, 30s per session	Routine care	30/30	Anxiety, Depression	63 (4)	52

Table 2
Risk of bias for included RCTs.

First Author	Random Sequence Generation	Allocation Concealment	Blinding of Participants/ Personnel	Blinding of Outcome Assessment	Incomplete Outcome Data	Selective Reporting	Other Bias
Psychological Interventions							
Ding [25]	Unclear	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Gharaati [26]	Unclear	Unclear	High Risk	High Risk	Low risk	Unclear	Low risk
Gu [27]	Low Risk	Unclear	High Risk	High risk	Low Risk	Unclear	Low Risk
Guo [28]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Hui [29]	Unclear	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Jiang [30]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Li J.[31]	Low risk	Low risk	High risk	High risk	Low risk	Unclear	Low risk
Liu Ying [32]	Unclear	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Liu Yiwei [33]	Low Risk	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Liu Z.[34]	Low Risk	Low Risk	High Risk	High Risk	Low Risk	High Risk	Low Risk
Pan H. [35]	Unclear	Unclear	High risk	High risk	Low risk	Unclear	Low risk

Pan R. [36]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Parizad [37]	Low Risk	Low Risk	High Risk	High Risk	Low Risk	Unclear	Low Risk
Shaygan [38]	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk	Unclear	Low Risk
Shi Q. [39]	Low Risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Shi Y. [40]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Wang M. [41]	Low Risk	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Wang Y. [42]	Low Risk	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Wei [43]	Low Risk	Unclear	High Risk	High Risk	Unclear	Unclear	Low Risk
Zhang A. [44]	Low Risk	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Zhu L. [45]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Total	16 Low Risk 5 Unclear 0 High Risk	4 Low Risk 17 Unclear 0 High Risk	1 Low Risk 0 Unclear 20 High Risk	2 Low Risk 0 Unclear 19 High Risk	20 Low Risk 1 Unclear 0 High Risk	0 Low Risk 20 Unclear 1 High Risk	21 Low Risk 0 Unclear 0 High Risk
Physical and Breathing Exercise Interventions							
Chen X. [46]	Low risk	Unclear	High risk	High risk	High risk	Unclear	Low risk

Liu K. [47]	Unclear	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Özlü [48]	Low Risk	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Zhang Y. [49]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Zhu [50]	Unclear	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Total	3 Low Risk 2 Unclear 0 High Risk	0 Low Risk 5 Unclear 0 High Risk	0 Low Risk 0 Unclear 5 High Risk	0 Low Risk 0 Unclear 5 High Risk	4 Low Risk 0 Unclear 1 High Risk	0 Low Risk 5 Unclear 0 High Risk	5 Low Risk 0 Unclear 0 High Risk
Mixed Interventions							
Cai [51]	Low Risk	Unclear	High Risk	High Risk	Unclear	Unclear	Low Risk
Cao [52]	Unclear	Unclear	High risk	Unclear	Low risk	Unclear	Low risk
Cha [53]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Chakeri [54]	Unclear	Unclear	High Risk	High Risk	Unclear	Unclear	Unclear
Chen Y. [55]	Unclear	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Deng [56]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Dong [57]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Fan [58]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk

Huang [59]	Low Risk	Unclear	High Risk	High Risk	Unclear	Unclear	Low Risk
Li Lan [60]	Low Risk	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Li Li [61]	Unclear	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Liu Q. [62]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Liu R. [63]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Lu [64]	Unclear	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Ma [65]	Unclear	Unclear	High risk	High risk	Unclear	Unclear	Low risk
Nie [66]	Unclear	Unclear	High risk	High risk	Unclear	Unclear	Low risk
Xu [67]	Unclear	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Yang [68]	Low Risk	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Zhang Y. [69]	Low risk	Unclear	High risk	High risk	Low risk	Unclear	Low risk
Zheng C. [70]	Low Risk	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Zheng Y. [71]	Unclear	Unclear	High Risk	High Risk	Low Risk	Unclear	Low Risk
Total	12 Low Risk 9 Unclear 0 High Risk	0 Low Risk 21 Unclear 0 High Risk	0 Low Risk 0 Unclear 21 High Risk	0 Low Risk 1 Unclear 20 High Risk	16 Low Risk 5 Unclear 0 High Risk	0 Low Risk 21 Unclear 0 High Risk	21 Low Risk 0 Unclear 0 High Risk

Table 3
Outcomes of included trials.*

First author	Anxiety		Depression		Mental Health Function		Stress	
	Measure	Hedges' g (95% CI)	Measure	Hedges' g (95% CI)	Measure	Hedges' g (95% CI)	Measure	Hedges' g (95% CI)
Psychological Interventions								
Ding [25]	ZSAS	7.00 (5.66, 8.34)	ZSDS	4.89 (3.89, 5.89)	–	–	–	–
Gharaati [26]	DASS-21	0.76 (−0.00, 1.51)	DASS-21	1.07 (0.29, 1.85)	SCL-25 WHO-QOL	0.42 (−0.32, 1.16) 0.16 (−0.57, 0.89)	DASS-21	1.25 (0.45, −2.04)
Gu [27]	ZSAS	0.72 (0.21, 1.24)	ZSDS	0.63 (0.12, 1.14)	–	–	–	–
Guo [28]	ZSAS	0.91 (0.37, 1.44)	ZSDS	0.87 (0.33, 1.40)	–	–	–	–
Hui [29]	ZSAS	3.50 (2.76, 4.23)	ZSDS	2.40 (1.79, 3.01)	–	–	–	–
Jiang [30]	HAM-A	7.60 (6.38, 8.82)	HAM-D	7.90 (6.64, 9.17)	–	–	–	–
Li J. [31]	DASS-21	0.24 (−0.17, 0.65)	DASS-21	0.04 (−0.37, 0.45)	–	–	DASS-21	0.10 (−0.51, 0.31)
Liu Ying [32]	STAI (State)	0.61 (0.27, 0.95)	–	–	–	–	–	–
Liu Yiwei [33]	GAD-7	1.70 (1.05, 2.36)	PHQ-9	1.70 (1.05, 2.36)	WHOQOL-BREF	0.70 (0.12, 1.27)	–	–
Liu Z [34].	HAM-A ZSAS	1.70 (1.41, 1.99) 1.91 (1.61, 2.21)	HAM-D ZSDS	1.95 (1.65, 2.25) 1.79 (1.50, 2.09)	–	–	–	–
Pan H. [35]	ZSAS	4.06 (3.17, 4.96)	ZSDS	3.33 (2.54, 4.12)	SF-36	1.47 (0.90, 2.05)	–	–
Pan R. [36]	ZSAS	17.87 (13.37, 22.38)	ZSDS	19.61 (14.68, 24.55)	–	–	–	–
Parizad [37]	STAI (State) STAI (Trait)	0.72 (0.34, 1.11) 0.56 (0.18, 0.94)	–	–	–	–	–	–
Shaygan [38]	–	–	–	–	CD-RISC	0.49 (−0.09, 1.08)	PSS	0.76 (0.17, 1.35)
Shi Q. [39]	ZSAS	0.39 (−0.12, 0.91)	ZSDS	2.51 (1.83, 3.19)	–	–	–	–
Shi Y. [40]	ZSAS	0.89 (0.36, 1.43)	–	–	–	–	–	–
Wang M. [41]	HAM-A SCL-90	0.69 (0.04, 1.33) 1.18 (0.50, 1.86)	HAM-D SCL-90	0.68 (0.04, 1.33) 1.08 (0.41, 1.75)	–	–	–	–
Wang Y. [42]	HAM-A	2.30 (1.73, 2.88)	HAM-D	1.90 (1.36, 2.44)	–	–	–	–
Wei [43]	HAM-A	0.93 (0.03, 1.84)	HAM-D	0.98 (0.07, 1.89)	–	–	–	–
Zhang A. [44]	ZSAS	1.00 (0.71, 1.29)	–	–	–	–	–	–
Zhu L. [45]	ZSAS	0.41 (−0.01, 0.82)	ZSDS	0.57 (0.15, 0.98)	–	–	–	–
Physical/ Breathing Exercise Interventions								
Chen X. [46]	ZSAS	2.92 (1.85, 3.98)	ZSDS	2.53 (1.54, 3.53)	–	–	–	–
Liu K. [47]	STAI	1.09 (0.50, 1.67)	–	–	–	–	–	–
Özlü [48]	STAI (State) STAI (Trait)	2.41 (1.78, 3.04) −0.40 (−0.89, 0.09)	–	–	–	–	–	–
Zhang Y. [49]	ZSAS	1.04 (0.23, 1.84)	ZSDS	0.78 (0.00, 1.56)	–	–	–	–
Zhu [50]	ZSAS	4.06 (3.28, 4.83)	ZSDS	2.99 (2.35, 3.63)	–	–	–	–
Mixed Interventions								
Cai [51]	HAM-A	1.81 (1.21, 2.42)	HAM-D	2.50 (1.81, 3.18)	–	–	–	–
Cao [52]	HAM-A	1.29 (0.92, 1.66)	HAM-D	0.95 (0.59, 1.30)	–	–	–	–
Cha [53]	ZSAS	3.48 (2.48, 4.47)	ZSDS	0.99 (0.33, 1.66)	–	–	–	–
Chakeri [54]	STAI (State)	3.05 (2.47, 3.63)	–	–	–	–	–	–
Chen Y. [55]	ZSAS	0.45 (0.00, 0.89)	–	–	–	–	–	–
Deng [56]	ZSAS	1.20 (0.64, 1.75)	ZSDS	3.44 (2.64, 4.24)	–	–	–	–
Dong [57]	HAM-A	1.61 (1.14, 2.09)	–	–	SF-36	1.76 (1.28, 2.25)	–	–
Fan [58]	ZSAS	2.82 (2.26, 3.37)	ZSDS	1.94 (1.46, 2.42)	–	–	–	–
Huang [59]	ZSAS	6.74 (5.54, 7.93)	ZSDS	2.72 (2.08, 3.36)	–	–	–	–
Li Lan [60]	ZSAS	8.14 (6.58, 9.69)	HAM-D	9.25 (7.50, 10.99)	–	–	–	–
Li Li [61]	ZSAS	0.91 (0.53, 1.30)	ZSDS	0.87 (0.49, 1.26)	SF-36	2.28 (1.81, 2.76)	–	–
Liu Q. [62]	ZSAS	4.00 (3.44, 4.56)	ZSDS	3.43 (2.93, 3.93)	–	–	–	–
Liu R. [63]	ZSAS	2.12 (1.38, 2.87)	ZSDS	3.15 (2.25, 4.04)	–	–	–	–
Lu [64]	ZSAS	0.94 (0.56, 1.32)	ZSDS	0.85 (0.48, 1.23)	SF-36	2.26 (1.80, 2.72)	–	–
Ma [65]	–	–	PHQ-9	3.60 (3.21, 4.00)	–	–	–	–
Nie [66]	GAD-7	2.72 (1.71, 3.73)	–	–	–	–	–	–
Xu [67]	ZSAS	4.38 (3.56, 5.19)	ZSDS	3.26 (2.59, 3.93)	–	–	–	–
Yang [68]	ZSAS	26.98 (22.95, 31.01)	ZSDS	15.20 (12.90, 17.50)	–	–	–	–
Zhang Y. [69]	ZSAS	0.84 (−0.01, 1.69)	–	–	–	–	–	–
Zheng C. [70]	ZSAS	1.30 (0.89, 1.71)	ZSDS	2.23 (1.76, 2.71)	–	–	–	–
Zheng Y. [71]	ZSAS	1.74 (1.14, 2.34)	ZSDS	1.32 (0.75, 1.88)	–	–	–	–

Abbreviations: CD-RISC = Connor-Davidson Resilience Scale; DASS-21 = Depression Anxiety and Stress Scale; GAD-7 = Generalized Anxiety Disorder scale; HAM-A = Hamilton Anxiety Rating Scale; HAM-D=Hamilton Depression Rating Scale; PHQ-9 = Patient Health Questionanaire-9; PSS=Perceived Stress Scale; SCL-25 = Symptoms Checklist-25; SCL-90 = Symptom Checklist-90; SF-36 = Short-Form-36 (SF-36) Health Survey; STAI = State Trait Anxiety Inventory; WHOQOL-BREF = World Health Organization Quality of Life Questionnaire-Brief; WHOQOL = World Health Organization Quality of Life Questionnaire; ZSAS = Zung Self-rating Anxiety Scale; ZSDS = Zung Self-rating Depression Scale.

* Outcomes are reported with positive signs favoring the intervention group.

3. Results

3.1. Search results

As of June 28, 2021, our search identified 56,854 unique titles and abstracts. Of these, 56,503 were excluded after title and abstract review and 196 at the full-text level, leaving 155 trials, of which 108 were excluded from the present sub-study because they were not RCTs (N = 21) or were not conducted with people infected with COVID-19 (N = 87), resulting in 47 [25–71] included RCTs. See Fig. 1. Additional searches from the search date to February 14, 2022, did not include any eligible RCTs that were registered prior to enrolling participants, that were verified, or that were low risk of bias on at least 4 of 7 domains.

3.2. Characteristic of included trials

Of the 47 included RCTs, 42 were from China [25,27–36,39–47,49–53,55–71], 4 from Iran [26,37,38,54], and 1 from Turkey [48]. All were conducted in 2020 or did not report when conducted. One trial was registered prior to initiation but reported outcomes that differed from those registered [34], and 3 were registered retrospectively [31,37,38]. Contact information for trial authors was only included in publications for 21 trials [26,27,29,31–34,37,38,43,45,47–50,54,56,60,62,69,70], and only 3 of the 21 authors verified their results [31,37,38].

Participants in 46 trials [25–53,55–71] were hospitalized; in the other trial [54], participants received emergency department care and were sent to home quarantine. Participants in only 4 trials were required to have mental health symptoms as part of inclusion criteria [30,34,43,60]. There were 21 trials [25–45] that tested psychological interventions, 5 [46–50] that tested breathing or physical exercise interventions, and 21 [51–71] that tested mixed interventions that combined different forms of psychological, exercise-based, or what were described as humanistic care interventions. Most comparators were standard care [25,28,30–37,39–53,55–71], but two trials compared interventions to standard individual psychological care [26,29], one to an online 'We Chat' group where doctors answered patients' questions and provided psychotherapy [27], one to offering phone-based counselling [38], and one to COVID-19 education [54]. See Table 1.

3.3. Psychological interventions

The number of participants in 21 psychological intervention trials [25–45] ranged from 14 to 126 (mean = 83.7; standard deviation [SD] = 58.7; median = 60). The percentage of female participants ranged from 16% to 65%, and mean age ranged from 34 to 66 years. There were 11 trials that tested a psychological therapy [26,27,29–31,33,34,37,39,44,45] (acceptance and commitment therapy, cognitive behavioral therapy, mindfulness therapy, mixed approach); 4 that tested multifaceted interventions with components that included psychoeducation, stress management and relaxation techniques with an online component [25,32,38,43]; and 6 that tested psychological nursing with relaxation and empathic listening components [28,35,36,40–42].

3.3.1. Verification, intervention reporting, risk of bias

Out of the 21 trials, only 3 verified their results [31,37,38]. Few trials reported interventions in sufficient detail to fully understand what had occurred. Of the 8 main domains in the TIDieR checklist (4 additional domains were not applicable for most studies), all trials had 1–5 partially or not reported (median = 4). The number of trials that adequately reported was 21 (100%) for intervention name, 20 (95%) for rationale, 1 (5%) for materials used, 12 (57%) for procedures, 7 (33%) for provider, 19 (90%) for how administered, 6 (29%) for where administered, and 9 (43%) for when and how much provided. See Appendix D. Risk of bias was unclear or high in 20 of the 21 trials for blinding of participants and personnel and blinding of outcome assessment [25–37,39–45], in 5 trials for random sequence generation [25,26,29,32,35], in 17 trials [25–30,32,33,35,36,39–45] for allocation concealment, in one trial for incomplete outcome data [43], and in all 21 trials for selective reporting as none were adequately registered pre-trial [25–45]. Excluding the "other bias" domain, the median number of the other 6 domains rated as unclear or high risk was 3. There were 3 trials [31,37,38], the same trials that were verified, that were rated as low risk on at least 4 domains and not high risk on any domains other than blinding. See Table 2.

3.3.2. Outcomes

Of the 21 trials, 20 reported anxiety symptoms [25–37,39–45], 15 depression symptoms [25–31,33–36,39,41–43,45], 4 general mental health function [26,33,35,38], and 3 stress outcomes [26,31,38]. Hedges' g ranged from 0.24 to 17.87 for anxiety symptoms, 0.04 to19.61 for depression symptoms, 0.16 to 1.47 for mental health function, and 0.10 to 1.25 for stress. See Table 3.

Among the 3 verified RCTs [31,37,38] rated low risk of bias on 4 of 7 domains, one (N = 93) [31] compared daily cognitive behavioral therapy (4 weeks) to routine care in hospitalized patients with mild COVID-19 in China; it did not find significant reductions in anxiety symptoms (Hedges' g = 0.24, 95% CI -0.17 to 0.65), depressive symptoms (Hedges' g = 0.04, 95% CI -0.37 to 0.45), or stress (Hedges' g = 0.10, 95% CI -0.51 to 0.31). Another trial (N = 110) [37] tested twice daily guided imagery (5 days) against routine care among hospitalized patients in Iran with oxygen saturation > 90% and reported statistically significant reductions in state (Hedges' g = 0.72, 95% CI 0.34 to 1.11) and trait anxiety (Hedges' g = 0.56, 95% CI 0.18 to 0.94). A third trial (N = 48) [38] compared a multi-faceted online psychological intervention to an offer to receive telephone counselling among mild to severely infected patients in a general hospital in Iran. It reported a non-statistically significant reduction in mental health function (Hedges' g = 0.49, 95% CI -0.09 to 1.08) and a significant reduction in stress (Hedges' g = 0.76, 95% CI 0.17 to 1.35).

3.4. Physical and breathing exercise interventions

The number of participants in the 5 physical and breathing exercise trials [46–50] ranged from 14 to 40 (mean = 51.0; SD = 20.5; median = 51). The percentage of female participants ranged from 39% to 55%. Mean age ranged from 35 to 69 years. Two trials tested breathing exercises [47,50], and three tested physical exercises [46,48,49].

3.4.1. Verification, intervention reporting, risk of bias

None of the 5 trials were verified. Out of 8 core TIDieR domains, each trial had 3 to 5 partially or not reported (median = 3). The number of trials that adequately reported was 5 (100%) for intervention name, 3 (60%) for rationale, 0 (0%) for materials used, 4 (80%) for procedures, 2 (40%) for provider, 4 (80%) for how administered, 0 (0%) for where administered, and 4 (80%) for when and how much provided. See Appendix D. Risk of bias was unclear or high in 2 trials for random sequence generation [47,50], one for incomplete outcome reporting [46], and all 5 for allocation concealment, blinding of participants and personnel, blinding of outcome assessment, and selective outcome reporting [46–50]. Across trials, excluding "other bias", the median number of the other 6 domains rated as unclear or high risk was 4. No trials were at low risk of bias for ≥4 of 7 domains. See Table 2.

3.4.2. Outcomes

Of the 5 trials, 5 reported anxiety symptom outcomes [46–50], and 3 reported depression symptom outcomes [46,49,50]. Hedges' g ranged from −0.40 to 4.06 for anxiety symptoms and 0.78 to 2.99 for depression symptoms (Table 3).

3.5. Mixed interventions

In the 21 mixed interventions, the number of participants ranged from 15 to 130 (mean = 92.6; SD =49.3; median = 88). The proportion of female participants ranged between 29% to 59%, and mean age ranged from 36 to 64. There were 12 trials that tested some combination of 'humanized' nursing involving psychological care or a dietary intervention [52,54–59,61,64–67], 2 trials that assessed interventions with components of both music therapy and physical and breathing exercises [60,63], and 6 interventions of general medicine and health education or traditional Chinese medicine including acupoint massage [51,53,68–71]. Intervention duration, frequency, and session length were inconsistently reported.

3.5.1. Verification, intervention reporting, risk of bias

Of the 21 trials, none were verified. Interventions were generally poorly described, and each trial had 3 to 5 of the 8 core TIDieR domains either partially or not at all reported (median = 4). The number of trials that adequately reported was 21 (100%) for intervention name, 18 (86%) for rationale, 1(5%) for materials used, 14 (60%) for procedures, 2 (9.5%) for provider, 19 (91%) for how administered, 4 (19%) for where administered, and 2 (10%) for when and how much provided. See Appendix D. For risk of bias, random sequence generation was unclear in 9 trials [52,54,55,61,64–67,71], and incomplete outcome data was unclear for 5 [51,54,59,65,66]. All 21 trials were rated as unclear or high risk for allocation concealment procedures, blinding of participants and personnel, blinding of outcome assessment, and selective reporting [51–71]. Across trials, excluding "other bias", the median number of the other 6 domains rated as unclear or high risk was 4. No trials were at low risk of bias for ≥4 of 7 domains (Table 2).

3.5.2. Outcomes

Among the 21 trials, 20 reported anxiety symptom outcomes [51–64,66–71], 16 depression symptoms [51–53,56,58–65,67,68,70,71], and 3 mental health function [57,61,64]. Hedges' g ranged from 0.45 to 26.98 for anxiety symptoms, 0.85 to 15.20 for depression symptoms and 1.76 to 2.28 for mental health function (Table 3).

4. Discussion

We investigated the effects of mental health interventions among patients with COVID-19 infection. We identified and extracted data from 47 eligible RCTs from China ($N = 42$), Iran (N = 4) and Turkey ($N = 1$), of which 21 tested psychotherapy interventions, 5 physical and breathing exercises, and 21 a combination of other types of interventions (e.g., "humanistic" nursing care). All trials were conducted in hospital settings and evaluated short-term, in-hospital mental health.

Overall, poor reporting and risk of bias limited our ability to draw conclusions about the effects of interventions. Of the 47 included trials, only 21 included contact information for authors, and institutional origin was unclear for many trials. Because of the very poor quality and uncertain origin of many trials, we attempted to contact authors to verify that trials had been conducted as reported and the accuracy of our extracted results; however, authors of only 3 trials verified results. We used the TIDieR tool to describe adequacy of intervention reporting. In each of the intervention categories (psychological, physical and breathing exercise, mixed), a median of 3 to 4 of 8 core TIDieR domains were partially or not at all reported. For risk of bias, across the 3 intervention categories, the median number of unclear or high risk of bias domains per trial was 3 for psychological interventions, 4 for physical and breathing exercises, and 4 for mixed interventions. Of the 47 trials, 25 (53%) reported SMD effect sizes greater than 2.0, which is several times the effect typically seen in mental health interventions, including in ICU settings [7].

Only 3 trials [31,37,38], all of psychological interventions, were rated as low risk of bias on at least 4 risk of bias domains. These same 3 trials were the only 3 trials for which authors verified results. A cognitive behavioral intervention ($N = 93$) reported Hedges' g effects between 0.04 and 0.24 (all not statistically significant) for anxiety symptoms, depressive symptoms, and stress; a guided imagery intervention ($N = 110$) reported significant reductions in state (Hedges' g = 0.72, 95% CI 0.34 to 1.11) and trait anxiety (Hedges' g = 0.56, 95% CI 0.18 to 0.94); and an online multicomponent intervention reported a non-statistically significant reduction in mental health function (Hedges' g = 0.49, 95% CI -0.09 to 1.08) and a significant reduction in stress (Hedges' g = 0.76, 95% CI 0.17 to 1.35). It is difficult, however, to draw generalizable conclusions from these studies. They tested different types of interventions and, although better conducted than other included trials, still had important methodological limitations.

While issues of poor study design, methodology and reporting of results were a pervasive issue in research prior to COVID-19, concerns have been raised about the exceptionally high volume and unprecedented poor quality of research being generated in COVID-19. This is especially the case in COVID-19 research among trials with time pressures and insufficient research infrastructure, particularly in the earlier phases of the pandemic, which contributed to the conduct and publication of many poorly designed studies with sample sizes too small to answer the research questions being posed [72]. The set of trials included in the present review exceed what we have seen prior to COVID-19 or in other areas of COVID-19 mental health (e.g., [13]) in terms of failing to provide minimally transparent reporting, verification of origin, overall study quality, and the unusually large effects reported. For comparison, over 50% of trials reported SMD effect sizes of 2.0 or greater versus only 1 of 11 (9%) trials in the most recent pre-COVID-19 systematic review of ICU-based interventions [7].

Previous systematic reviews have, however, also reported that there are few well-conducted and reported RCTs of interventions for hospitalized patients infected with acute illnesses [5,6]. The most recent systematic review [6], which included meta-analyses of effects of different types of interventions (exercise, psychosocial, information, diaries, other) reported that diary interventions significantly improved depression and anxiety but there were only two small trials included with 88 total participants. Meta-analysis of 4 RCTs ($N = 231$) found that exercise interventions did not improve anxiety or depression symptoms; but meta-analysis of 7 different RCTs ($N = 664$) found that exercise improved general mental health function.

The limited evidence available on interventions to support mental health in acutely hospitalized patients prior to COVID-19, coupled with the very poor quality of trials done during COVID-19, reduces the ability of health care providers to use trial evidence to guide their clinical care of patients hospitalized with COVID-19. Furthermore, the resources to provide in-hospital psychological care during COVID-19 may be limited due to demands on health care systems across the globe during the pandemic [73] as well as measures taken to reduce transmission. In the absence of actionable evidence, health care providers will need to rely on expert recommendations for ICU and other hospital care. These, generally, involve initial close attention to symptom stabilization, including strategies to manage pain, maintaining contact with loved ones through virtual calls, reduce fear and anxiety, and support sleep; the normalization of experiences; and reassurance that symptoms are expected to decrease in frequency and intensity with time. Types of interventions that may be helpful include stress reduction (e.g., breathing, meditative interventions), education, diaries, supportive therapy, and movement, as possible. As patients achieve increased stability, assessment of and strategies to address anxiety, depression, and posttraumatic stress can be initiated [74].

Well-designed and conducted, adequately powered trials for different interventions to support stress reduction and improve short- and long-term mental health among hospitalized acute care patients are desperately needed in the context of COVID-19 and otherwise. Additionally, interventions are needed to address mental health for people

who experience long-term effects of COVID-19, as they appear to be at risk of negative cognitive and mental health outcomes [75,76]. We did not include studies done with people with long COVID-19 outside of hospital, but these trials would have been included in our main living systematic review, and as of February 11, 2022, no such trials had been identified.

There are several strengths of the present living systematic review. Firstly, it differs from prior systematic reviews as it investigated the effects of psychological interventions specifically among hospitalized COVID-19-infected patients based on randomized trials. Second, we included many more trials than have been included in any other review. Related to this, we included two Chinese databases in our search and included Chinese-language trials; these trials comprise the largest proportion of all trials that have been conducted. Third, we employed a rigorous methodology in conducting the present review based on best practices per the Cochrane Collaboration [77].

The findings of the current review must be interpreted in the context of limitations. Chiefly, the quality of reporting and conduct of included trials was very poor, generally. Documenting this rigorously is important for supporting health care providers to determine how usable the evidence might be and to underline the need for higher quality research in this area. We were not, however, able to use the evidence to make recommendations about which interventions may be effective in practice. Any other limitations are secondary to this main concern. For instance, we did not attempt to examine the possibility of publication bias. It is possible that well-conducted trials with disappointing outcomes may have been conducted, but we do not believe this is likely given the overall quality issues we uncovered. It is likely that producing well-designed and conducted trials of mental health interventions in the initial phases of the pandemic was simply not feasible; with less intense pressure on health care systems in more recent phases, it is possible that trials will be conducted that will be of better quality and greater utility. Additionally, all trials were from 3 countries. It is possible that more trials in later stages of the pandemic will be done in countries that normally conduct the largest numbers of mental health and other health care service trials [78].

In conclusion, the objective of the present review was to evaluate the effects of interventions to support mental health among hospitalized COVID-19 infected patients. Our inability to verify what occurred in the studies, very poor reporting and study quality, high risk of bias, and implausible reported effects, in many trials, did not allow us to draw conclusions about the likely effects of any included interventions. Our inability to draw conclusions from this evidence base is compounded by limitations in the quality of ICU-based mental health intervention trials available prior to COVID-19 [6,7]. Accordingly, our review highlights the importance of and need for carefully conducted and reported RCTs. Without trustworthy evidence, health care providers should use strategies that are considered best practice to help patients hospitalized with COVID-19 achieve symptom stability as quickly as possible and to prevent and address long term mental health ramifications. Trials are needed, both in general ICU contexts and, to the degree as possible as the COVID-19 pandemic continues, that test and compare procedures that are commonly used with acutely hospitalized patients, including different approaches for symptom stabilization and management, stress reduction, and psychological tools designed to support recovery [74]. The limitations in existing trials may highlight limitations in infrastructure. Multi-center collaborations with an ongoing commitment to adaptive trial designs, such as platform trials [79], might be considered to address the current lack of well-designed and conducted trials of interventions to support mental health in ICU settings, both prior to and during COVID-19.

Author contributions

AT: Formal analysis, Investigation, Writing – original draft, Writing – review & editing; YWa: Investigation, Writing – review & editing; KL: Investigation, Writing – review & editing; XJ: Investigation, Writing – review & editing; AK: Investigation, Data curation, Writing – review & editing; CH: Investigation, Writing – review & editing, Project administration; YS: Conceptualization, Investigation, Writing – review & editing, Project administration; YWu: Conceptualization, Methodology, Formal analysis, Investigation, Writing – review & editing; SF: Investigation, Writing – review & editing, Project administration; JTB: Methodology; Data curation; Writing – review & editing; SM: Investigation, Writing – review & editing; DBR: Conceptualization, Methodology, Investigation, Writing – review & editing; OB: Investigation, Writing – review & editing, Project administration; TDS: Investigation, Writing – review & editing; LL: Investigation, Writing – review & editing; ITV: Investigation, Writing – review & editing; BA: Conceptualization, Writing – review & editing; CF: Conceptualization, Writing – review & editing; MSM: Conceptualization, Writing – review & editing; SS: Conceptualization, Writing – review & editing; AB: Conceptualization, Methodology, Formal analysis, Writing – review & editing, Supervision, Funding acquisition; BDT: Conceptualization, Methodology, Formal analysis, Investigation; Data curation; Writing – Original draft, Writing – review & editing, Supervision, Funding acquisition.

Funding

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Data sharing

All data from the living systematic review are available in the present manuscript and its supplementary material or online (https://www.depressd.ca/research-question-3-intervention).

Declaration of Competing Interest

All authors completed the ICJME uniform disclosure form and declared no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous three years. All authors declare no other relationships or activities that could appear to have influenced the submitted work. No sponsor or funder was involved in the study design; in the collection, analysis and interpretation of the data; in the writing of the report; or in the decision to submit the paper for publication.

Appendix A. Search strategies

Ovid MEDLINE All

†New subject heading added to original search on January 27, 2021

1. Quarantine/
2. social isolation/ or loneliness/ or physical distancing/†
3. psychology.fs. or psychology/
4. Mental health/
5. mental disorders/
6. social stigma/
7. Fear/
8. Anxiety/
9. Depression/
10. Stress, Physiological/ or Stress, Psychological/
11. Anger/
12. Irritable Mood/
13. Grief/
14. burnout, psychological/ or burnout, professional/
15. or/1–14
16. (Quarantine* or Self-isolation or isolation or social distanc* or shelter*-in-place or psych* or mental health or mental illness* or mental disorder* or stigma or fear* or anxiety or anxious or depression or depressive or loneliness or stress* or trauma* or post-traumatic or posttraumatic or anger or mood* or irritability or irritable or emotional disturbance* or grief or burned out or burnout).tw,kf.
17. ((exp coronavirus/ or exp. coronavirus infections/ or (betacoronavirus* or beta coronavirus* or coronavirus* or corona virus*).mp.) and (exp china/ or (china or chinese or hubei or wuhan).af.)) or (coronavirus* or corona virus* or betacoronavirus* or beta coronavirus*).mp.
18. (severe acute respiratory syndrome coronavirus 2 or "SARS CoV-2" or "SARSCoV 2" or SARSCoV2 or cov2 or "sars 2" or COVID or "coronavirus 2" or covid19 or nCov or ((new or Novel) adj3 coronavirus*) or ncp).mp. or ((exp pneumonia/ or pneumonia.mp.) and wuhan.af.)
19. 17 or 18
20. 15 or 16
21. 19 and 20
22. ("20,191,231" or 2020* or 2021*).dt,ez,da.
23. 21 and 22

Embase (Ovid)

1. exp. coronavirinae/
2. exp. Coronavirus infection/
3. (betacoronavirus* or beta coronavirus* or coronavirus* or corona virus*).mp.
4. 1 or 2 or 3
5. exp. China/
6. (china or chinese or hubei or wuhan).af.
7. 5 or 6
8. 4 and 7
9. (betacoronavirus* or beta coronavirus* or coronavirus* or corona virus*).mp.
10. (severe acute respiratory syndrome coronavirus 2 or "SARS CoV-2" or "SARSCoV 2" or SARSCoV2 orcov2 or "sars 2" or COVID or "coronavirus 2" or covid19 or nCov or ((new or Novel) adj3 coronavirus*) or ncp).mp.
11. (exp pneumoia/ or pneumonia.mp.) and wuhan.af.
12. 8 or 9 or 10 or 11
13. quarantine/
14. social isolation/ or isolation/ or patient isolation/
15. loneliness/
16. psychology/
17. mental health/
18. mental disease/
19. social stigma/
20. fear/
21. anxiety/
22. depression/
23. physiological stress/ or mental stress/
24. anger/
25. irritability/
26. exp grief/
27. exp burnout/
28. (mental disorder* or Quarantine* or Self-isolation or isolation or social distanc* or shelter*-in-place or psych* or mental health or mental illness* or stigma or fear* or anxiety or anxious or depression or depressive or loneliness or stress* or trauma* or post-traumatic or post-traumatic or anger or mood* or irritability or irritable or emotional disturbance* or grief or burned out or burnout).tw,kw.

29. or/13-27
30. 12 and 29
31. ("20,191,231" or 2020* or 2021*).dc.
32. 30 and 31

PsycINFO (Ovid)

1. (coronavirus* or corona virus* or betacoronavirus* or beta coronavirus*).mp.
2. (severe acute respiratory syndrome coronavirus 2 or "SARS CoV-2" or "SARSCoV 2" or SARSCoV2 or cov2 or "sars 2" or COVID or "coronavirus 2" or covid19 or nCov or ((new or Novel) adj3 coronavirus*) or ncp).mp. or ((exp pneumonia/ or pneumonia.mp.) and wuhan.af.)
3. 1 or 2
4. ("20,191,231" or 2020* or 2021*).up.
5. 3 and 4

CINAHL

Search ID#	Search Terms
S26	S11 AND S25
S25	S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24
S24	TI ((mental disorder* or Quarantine* or Self-isolation or isolation or social distanc* or shelter*-in-place or psych* or mental health or mental illness* or stigma or fear* or anxiety or anxious or depression or depressive or loneliness or stress* or trauma* or post-traumatic or posttraumatic or anger or mood* or irritability or irritable or emotional disturbance* or grief or burned out or burnout)) OR AB ((mental disorder* or Quarantine* or Self-isolation or isolation or social distanc* or shelter*-in-place or psych* or mental health or mental illness* or stigma or fear* or anxiety or anxious or depression or depressive or loneliness or stress* or trauma* or post-traumatic or posttraumatic or anger or mood* or irritability or irritable or emotional disturbance* or grief or burned out or burnout))
S23	(MH "Burnout, Professional")
S22	(MH "Grief+")
S21	(MH "Anger")
S20	(MH "Stress, Physiological") OR (MH "Stress, Psychological")
S19	(MH "Depression")
S18	(MH "Anxiety")
S17	(MH "Fear")
S16	(MH "Stigma")
S15	(MH "Mental Health") or (MH "Mental Disorders")
S14	(MH "Psychology")
S13	(MH "Social Isolation") OR (MH "Loneliness") or (MH "Social Distancing") or (MH "Stay at Home Orders") †
S12	(MH "Quarantine")
S11	S7 OR S8 OR S9 OR S10
S10	((MH "Pneumonia+") or TI (pneumonia) OR AB (pneumonia)) AND (TI (wuhan) OR AB (wuhan) OR AF (wuhan))
S9	TI ((severe acute respiratory syndrome coronavirus 2 or "SARS CoV-2" or "SARSCoV 2" or SARSCoV2 or cov2 or "sars 2" or COVID or "coronavirus 2" or covid19 or nCov or ((new or Novel) N3 coronavirus*)) OR AB ((severe acute respiratory syndrome coronavirus 2 or "SARS CoV-2" or "SARSCoV 2" or SARSCoV2 or cov2 or "sars 2" or COVID or "coronavirus 2" or covid19 or nCov or ((new or Novel) N3 coronavirus*)) or (MH "Covid 19") †
S8	TI ((betacoronavirus* or beta coronavirus* or coronavirus* or corona virus*)) OR AB ((betacoronavirus* or beta coronavirus* or coronavirus* or corona virus*))
S7	S5 AND S6
S6	S1 OR S2
S5	S3 OR S4
S4	TI ((china or chinese or hubei or wuhan)) OR AB ((china or chinese or hubei or wuhan)) OR AF ((china or chinese or hubei or wuhan)) OR SO ((china or chinese or hubei or wuhan))
S3	(MH "China+")
S2	TI ((betacoronavirus* or beta coronavirus* or coronavirus* or corona virus*)) OR AB ((betacoronavirus* or beta coronavirus* or coronavirus* or corona virus*))
S1	(MH "Coronavirus+") OR (MH "Coronavirus Infections+")

Web of Science

TOPIC: (Quarantine* or "Self-isolation" or isolation or "social distanc*" or "shelter*-in-place" or psych* or "mental health" or "mental illness*" or "mental disorder*" or stigma or fear* or anxiety or anxious or depression or depressive or loneliness or stress* or trauma* or "post-traumatic" or posttraumatic or anger or mood* or irritability or irritable or "emotional disturbance*" or grief or "burned out" or burnout) AND TOPIC: ((coronavirus* or "corona virus*" or betacoronavirus* or "beta coronavirus*" or "severe acute respiratory syndrome coronavirus 2" or "SARS CoV-2" or "SARSCoV 2" or SARSCoV2 or cov2 or "sars 2" or COVID or "coronavirus 2" or covid19 or nCov or "Novel coronavirus*" or "new coronavirus*")).

Indexes = SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC Timespan = Year to date.

China National Knowledge Infrastructure

Restricted to disciplines: Medical and Public Health & Social science.

TI = (隔离 + 封城 + 社交距离+方舱 + 心理 + 心理健康+精神卫生+精神疾病+心理疾病+污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑 + 抑郁 + 孤独 + 压力 + 应激 + 创伤 + 创伤后 + 愤怒 + 情绪 + 心情 + 易怒 + 情绪障碍+心理障碍+哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(新冠 + 新型冠状) OR AB = (隔离 + 封城 + 社交距离+方舱 + 心理 + 心理健康+精神卫生+精神疾病+心理疾病+污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑 + 抑郁 + 孤独 + 压力 + 应激 + 创伤 + 创伤后 + 愤怒 + 情绪 + 心情 + 易怒 + 情绪障碍+心理障碍+哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(新

冠 + 新型冠状).

Wanfang

题名:(“隔离” + 封城+”社交距离” + 方舱 + 心理+”心理健康”+”精神卫生”+”精神疾病”+”心理疾病” + 污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑 + 抑□ + 孤独 + 压力 + 应激 + 创伤+”创伤后” + 愤怒 + 情绪 + 心情 + 易怒+”情绪障碍”+”心理障碍” + 哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(“新冠”+”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 心理+”心理健康”+”精神卫生”+”精神疾病”+”心理疾病” + 污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑 + 抑郁 + 孤独 + 压力 + 应激 + 创伤+”创伤后” + 愤怒 + 情绪 + 心情 + 易怒+”情绪障碍”+”心理障碍” + 哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(“新冠”+”新型冠状”).

We made several amendments to the original search strategies. Since the Wanfang database cannot export more than 5000 references at once, we broke the search strategies into two or more smaller search strings to get all the references. The four changes on September 1, 2020, September 28, 2020, October 15, 2020 and October 18, 2020 are all for this purpose.

To make this process more efficient, the disciplines of the China National Knowledge Infrastructure database were restricted to Medical and Public Health AND Social science subgroup 2 and those of Wanfang database were restricted to Medicine and Health AND Culture, Science, Education and PE disciplines on October 23, 2020.

September 1, 2020.

Wanfang

题名:(“隔离” + 封城+”社交距离” + 方舱 + 心理+”心理健康”+”精神卫生”+”精神疾病”+”心理疾病” + 污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑)*(“新冠” +”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 心理+”心理健康”+”精神卫生”+”精神疾病”+”心理疾病” + 污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑)*(“新冠”+”新型冠状”).

题名:(“隔离” + 封城+”社交距离” + 方舱 + 抑郁 + 孤独 + 压力 + 应激 + 创伤+”创伤后” + 愤怒 + 情绪 + 心情 + 易怒+”情绪障碍”+”心理障碍” + 哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(“新冠”+”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 抑郁 + 孤独 + □力 + 应激 + 创伤+”创伤后” + 愤怒 + 情绪 + 心情 + 易怒+”情绪障碍”+”心理障碍” + 哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(“新冠”+”新型冠状”).

September 28, 2020.

Wanfang

题名:(“隔离” + 封城+”社交距离” + 方舱 + 心理+”心理健康”+”精神卫生”+”精神疾病”+”心理疾病” + 污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑)*(“新冠” +”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 心理+”心理健康”+”精神卫生”+”精神疾病”+”心理疾病” + 污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑)*(“新冠”+”新型冠状”).

题名:(“隔离” + 封城+”社交距离” + 方舱 + 抑郁 + 孤独 + 压力 + 应激 + 创伤+”创伤后”)*(“新冠”+”新型冠状”) + 摘要:(“隔离” + 封城+”社交距□ ” + 方舱 + 抑郁 + 孤独 + 压力 + 应激 + 创伤+”创伤后”)*(“新冠”+”新型冠状”).

题名:(“隔离” + 封城+”社交距离” + 方舱 + 愤怒 + 情绪 + 心情 + 易怒+”情绪障碍”+”心理障碍” + 哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(“新冠”+”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 愤怒 + 情绪 + 心情 + 易怒+”情绪障碍”+”心理障碍” + 哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(“新冠”+”新型冠状”).

October 15, 2020.

Wanfang

题名:(“隔离” + 封城+”社交距离” + 方舱 + 心理+”心理健康”+”精神卫生”+”精神疾病”+”心理疾病”)*(“新冠”+”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 心理+”心理健康”+”精神卫生”+”精神疾病”+”心理疾病”)*(“新冠”+”新型冠状”).

题名:(“隔离” + 封城+”社交距离” + 方舱 + 污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑 + 抑郁 + 孤独 + 压力)*(“新冠”+”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑 + 抑郁 + 孤独 + 压力)*(“新冠”+”新型冠状”).

题名:(“隔离” + 封城+”社交距离” + 方舱 + 应激 + 创伤+”创伤后” + 愤怒 + 情绪 + 心情 + 易怒+”情绪障碍”+”心理障碍” + 哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(“新冠”+”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 应激 + 创伤+”创伤后” + 愤怒 + 情绪 + 心情 + 易怒+”情绪障碍”+”心理障碍” + 哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(“新冠”+”新型冠状”).

October 18, 2020.

Wanfang

题名:(“隔离” + 封城+”社交距离” + 方舱 + 心理+”心理健康”+”精神卫生”+”精神疾病”+”心理疾病”)*(“新冠”+”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 心理+”心理健康”+”精神卫生”+”精神疾病”+”心理疾病”)*(“新冠”+”新型冠状”).

题名:(“隔离” + 封城+”社交距离” + 方舱 + 污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑 + 抑郁)*(“新冠”+”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑 + 抑郁)*(“新冠”+”新型冠状”).

题名:(“隔离” + 封城+”社交距离” + 方舱 + 孤独 + 压力)*(“新冠”+”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 孤独 + 压力)*(“新冠” +”新型冠状”).

题名:(“隔离” + 封城+”社交距离” + 方舱 + 应激 + 创伤+”创伤后” + 愤怒 + 情绪 + 心情 + 易怒+”情绪障碍”+”心理障碍” + 哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(“新冠”+”新型冠状”) + 摘要:(“隔离” + 封城+”社交距离” + 方舱 + 应激 + 创伤+”创伤后” + 愤怒 + 情绪 + 心情 + 易怒+”情绪障碍”+”心理障碍” + 哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(“新冠”+”新型冠状”).

October 23, 2020.

China National Knowledge Infrastructure

Restricted to disciplines: Medical and Public Health & Social science subgroup 2.

TI = (隔离 + 封城 + 社交距离+方舱 + 心理 + 心理健康+精神卫生+精神疾病+心理疾病+污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑 + 抑郁 + 孤独 + 压力 + 应激 + 创伤 + 创伤后 + 愤怒 + 情绪 + 心情 + 易怒 + 情绪障碍+心理障碍+哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(新冠 + 新型冠状) OR AB = (隔离 + 封城 + 社交距离+方舱 + 心理 + 心理健康+精神卫生+精神疾病+心理疾病+污名 + 耻辱 + 羞辱 + 恐惧 + 焦虑 + 抑郁 + 孤

独 + 压力 + 应激 + 创伤 + 创伤后 + 愤怒 + 情绪 + 心情 + 易怒 + 情绪障碍+心理障碍+哀伤 + 悲伤 + 悲痛 + 悲哀 + 忧郁 + 倦怠)*(新冠 + 新型冠状).

Wanfang

Restricted to disciplines: Medicine and Health & Culture, Science, Education and PE.

题名:("隔离" or 封城 or "社交距离" or 方舱 or 心理 or "心理健康" or "精神卫生" or "精神疾病" or "心理疾病" or 污名 or 耻辱 or 羞辱 or 恐惧 or 焦虑 or 抑郁 or 孤独 or 压力 or 应激 or 创伤 or "创伤后" or 愤怒 or 情绪 or 心情 or 易怒 or "情绪障碍" or "心理障碍" or 哀伤 or 悲伤 or 悲痛 or 悲哀 or 忧郁 or 倦怠) and ("新冠" or "新型冠状") or 摘要:("隔离" or 封城 or "社交距离" or 方舱 or 心理 or "心理健康" or "精神卫生" or "精神疾病" or "心理疾病" or 污名 or 耻辱 or 羞辱 or 恐惧 or 焦虑 or 抑郁 or 孤独 or 压力 or 应激 or 创伤 or "创伤后" or 愤怒 or 情绪 or 心情 or 易怒 or "情绪障碍" or "心理障碍" or 哀伤 or 悲伤 or 悲痛 or 悲哀 or 忧郁 or 倦怠) and ("新冠" or "新型冠状").

MedRxiv (pre-prints).

Search 1: (isolation OR "mental health" OR "mental illness" OR "mental disorder") AND (COVID OR covid19).

Search 2: (psychology OR psychological OR psychosocial OR anxiety OR depression OR stress or trauma) AND (COVID OR covid19).

Open Science Framework (pre-prints).

(isolation OR psychology OR psychological OR psychosocial OR "mental health" OR "mental illness" OR "mental disorder" OR anxiety OR depression OR stress or trauma) AND (coronavirus OR COVID OR covid19)

Appendix B. Coding manuals for inclusion and exclusion

Inclusion and Exclusion Coding Guides for Main Interventions Review Plus Additional Criteria for Present Report.

Title and Abstract Review:

Exclude: not original human data or a case study or case series. If it is clear from the title and abstract that the article is not an original report of primary data, but, for example, a letter, editorial, systematic review or meta-analysis, or it is a single case study or case series, then it is excluded. Studies reporting only on animal, cellular, or genetic data are also excluded. Conference abstracts are included.

Exclude: not a study of any population affected by the COVID-19 outbreak. Eligible studies must be initiated after China's first announcement to the WHO on December 31, 2019. If it is clear from the title or abstract that the study is not about any population affected by the COVID-19 outbreak, it is excluded. Studies that include fewer than 10 subjects, are excluded.

Exclude: intervention does not target mental health. If it is clear from the title or abstract that the study is not about an intervention or is an intervention, but the intervention does not primarily target mental health, then it will be excluded. Mental health must be the primary trial outcome if a primary outcome or outcomes are stated.

Exclude: not a randomized or non-randomized controlled trial (RCT) with eligible comparators: If it is clear from the title or abstract that the study is not a RCT or non-randomized controlled trial that compares an intervention designed to improve any aspect of mental health during the COVID-19 pandemic to (1) any inactive control condition (e.g., no treatment, waitlist control) or to (2) another eligible intervention designed to mental health, then it will be excluded.

Include: study eligible to be included in full-text review.

Full-text Review:

Exclude: not original human data or a case study or case series. If the article is not an original report of primary data, but, for example, a letter, editorial, systematic review or meta-analysis, or it is a single case study or case series, then it is excluded. Studies reporting only on animal, cellular, or genetic data are also excluded. Conference abstracts are included.

Exclude: not a study of any population affected by the COVID-19 outbreak. Eligible studies must be initiated after China's first announcement to the WHO on December 31, 2019. If the study is not about any population affected by the COVID-19 outbreak, it is excluded. Studies that include fewer than 10 subjects, are excluded.

Exclude: intervention does not target mental health. If the study is not about an intervention or is an intervention, but the intervention does not primarily target mental health, then it will be excluded. Mental health must be the primary trial outcome if a primary outcome or outcomes are stated.

Exclude: not a randomized or non-randomized controlled trial (RCT) with eligible comparators: If the study is not a RCT or non-randomized controlled trial that compares an intervention designed to improve any aspect of mental health during the COVID-19 pandemic to (1) any inactive control condition (e.g., no treatment, waitlist control) or to (2) another eligible intervention designed to mental health, then it will be excluded.

Include: study eligible for inclusion in systematic review.

Additional Criteria for Present Report: (1) randomized controlled trial; (2) population hospitalized due to COVID-19.

Appendix C. Protocol amendments

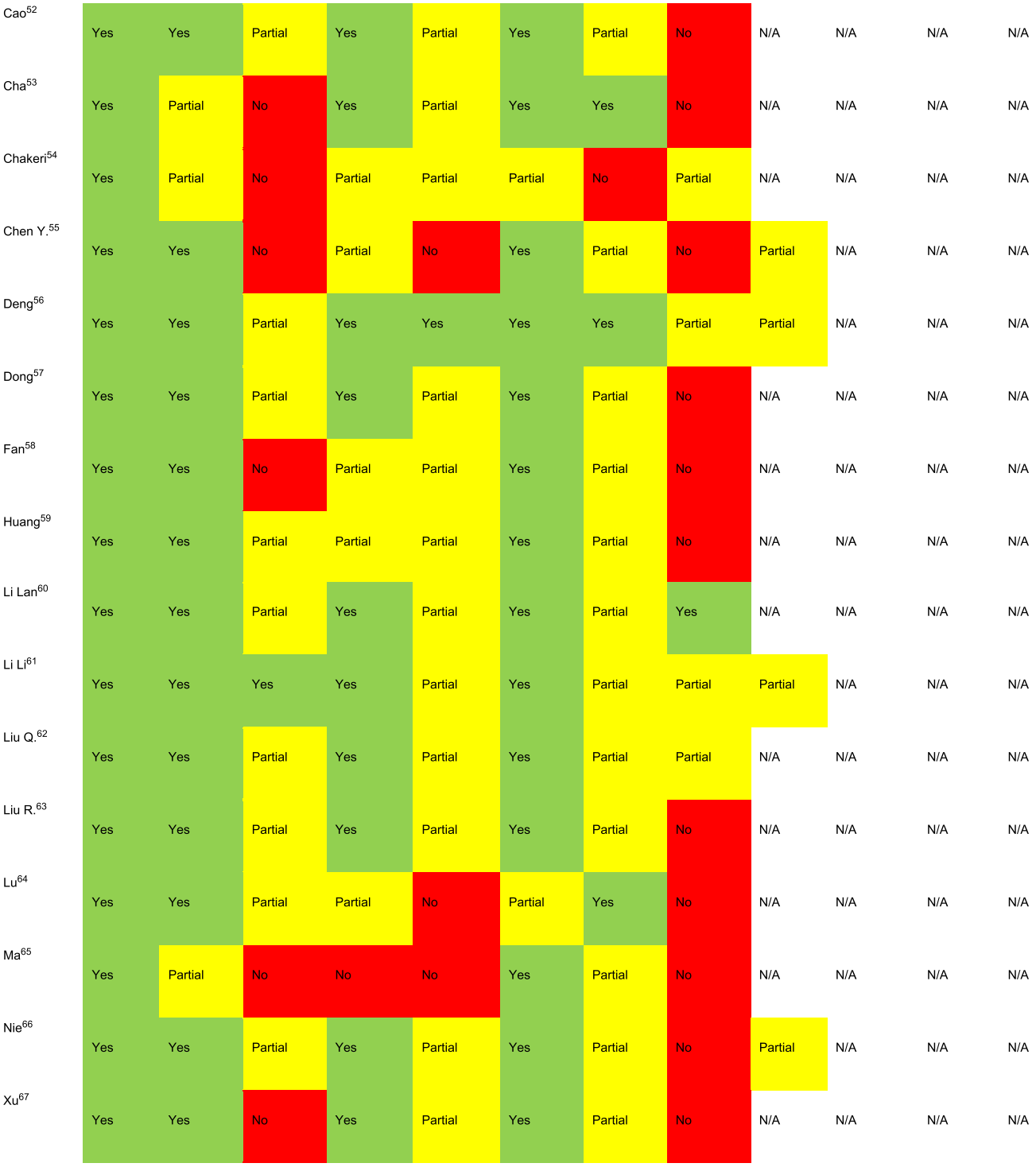
The series of living systematic reviews was designed and initiated quickly early in COVID-19, and several amendments were made that are relevant to the present sub-study. First, we changed the automatic daily search updates to weekly updates as of December 28, 2020 to allow for more efficient processing of studies. Second, on January 27, 2021 we made a change to the MEDLINE search strategy to include a new subject heading on physical distancing created for COVID-19. Third, we made several amendments to the Chinese-language search strategies to allow more efficient processing of studies (see Appendix A). Fourth, we added the TIDieR checklist to assess intervention reporting adequacy. Fifth, we clarified that we only included trials which began participant enrolment after December 31, 2019. Sixth, we did not include non-randomized trials. Such studies are highly prone to bias when intervention and control groups are self-selected or there is no control group. Results from pre-post analyses of non-randomized studies

without a control group are not possible to interpret unless there is a precise knowledge of the natural trajectory of symptoms or if one can safely assume that symptoms will not change over time without intervention. Even in normal times, however, this is not the case for mental health trials, and the Cochrane Collaboration discourages inclusion of evidence from non-randomized studies in systematic reviews when conducting trials is feasible [1]. Seventh, because we encountered many trial reports of poor quality with seemingly implausible results, some with unclear origin, we added the

First Author	Brief Name	Why	Materials	Procedures	Who Provided	How	Where	When and How Much	Tailoring	Modification	How well (planned)	How well (actual)
Psychological Interventions												
Ding[25]	Yes	Yes	Partial	Partial	Partial	Yes	Partial	No	N/A	N/A	N/A	N/A
Gharaati[26]	Yes	Yes	No	Partial	Yes	Partial	Yes	Yes	N/A	N/A	N/A	N/A
Gu[27]	Yes	Yes	Partial	Partial	Yes	Yes	Partial	Partial	N/A	N/A	N/A	N/A
Guo[28]	Yes	Yes	Partial	Yes	Partial	Yes	Partial	No	N/A	N/A	N/A	N/A
Hui[29]	Yes	Yes	Partial	Yes	Partial	Yes	Partial	Yes	N/A	N/A	N/A	N/A
Jiang[30]	Yes	Yes	No	No	Partial	Yes	Partial	No	N/A	N/A	N/A	N/A
Li J.[31]	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	N/A	N/A	No	N/A
Liu Ying[32]	Yes	Yes	Partial	Yes	Yes	Yes	Partial	Partial	N/A	N/A	N/A	N/A
Liu Yiwei[33]	Yes	Yes	Partial	Yes	Yes	Yes	Partial	Yes	N/A	N/A	N/A	N/A
Liu Z.[34]	Yes	Yes	Partial	Yes	Partial	Yes	Partial	Yes	N/A	N/A	N/A	N/A
Pan H.[35]	Yes	Yes	Partial	Yes	Partial	Yes	Yes	No	Partial	N/A	Partial	No
Pan R.[36]	Yes	Yes	Partial	Yes	Partial	Yes	No	No	N/A	N/A	N/A	N/A
Parizad[37]	Yes	Partial	Partial	Yes	Partial	Partial	Partial	Yes	N/A	N/A	N/A	N/A
Shaygan[38]	Yes	Yes	Partial	Yes	No	Yes	Yes	Yes	N/A	N/A	N/A	N/A

author verification process.

Shi Q.[39]	Yes	Yes	Partial	No	Partial	Yes	Yes	Partial	N/A	N/A	N/A	N/A
Shi Y.[40]	Yes	Yes	No	Partial	No	Yes	Yes	No	N/A	N/A	N/A	N/A
Wang M.[41]	Yes	Yes	No	Yes	Partial	Yes	Partial	Partial	N/A	N/A	N/A	N/A
Wang Y.[42]	Yes	Yes	Partial	Yes	Partial	Yes	Partial	Partial	N/A	N/A	Partial	Yes
Wei[43]	Yes	Yes	Partial	Partial	No	Yes	Partial	Yes	N/A	N/A	N/A	N/A
Zhang A.[44]	Yes	Yes	Partial	Yes	Yes	Yes	Partial	Partial	N/A	N/A	N/A	N/A
Zhu L.[45]	Yes	Yes	No	No	Yes	Yes	Partial	Yes	N/A	N/A	N/A	N/A
Total	21 Yes 0 Partial 0 No 0 N/A	20 Yes 1 Partial 0 No 0 N/A	1 Yes 15 Partial 5 No 0 N/A	12 Yes 5 Partial 4 No 0 N/A	7 Yes 11 Partial 3 No 0 N/A	19 Yes 2 Partial 0 No 0 N/A	6 Yes 14 Partial 1 No 0 N/A	9 Yes 6 Partial 6 No 0 N/A	0 Yes 1 Partial 0 No 20 N/A	0 Yes 0 Partial 0 No 21 N/A	0 Yes 2 Partial 1 No 18 N/A	1 Yes 0 Partial 1 No 19 N/A
Physical and Breathing Exercise Interventions												
Chen X.[46]	Yes	Partial	Partial	Yes	Yes	Yes	Partial	Yes	N/A	N/A	N/A	N/A
Liu K.[47]	Yes	Yes	Partial	Yes	Partial	No	Partial	Yes	N/A	N/A	N/A	N/A
Özlü[48]	Yes	Partial	Partial	Partial	No	Yes	Partial	Yes	N/A	N/A	N/A	N/A
Zhang Y.[49]	Yes	Yes	Partial	Yes	Partial	Yes	Partial	Yes	N/A	N/A	N/A	N/A
Zhu[50]	Yes	Yes	Partial	Yes	Yes	Yes	Partial	Partial	N/A	N/A	Partial	No
Total	5 Yes 0 Partial 0 No 0 N/A	3 Yes 2 Partial 0 No 0 N/A	0 Yes 5 Partial 0 No 0 N/A	4 Yes 1 Partial 0 No 0 N/A	2 Yes 2 Partial 1 No 0 N/A	4 Yes 0 Partial 1 No 0 N/A	0 Yes 5 Partial 0 No 0 N/A	4 Yes 1 Partial 0 No 0 N/A	0 Yes 0 Partial 0 No 5 N/A	0 Yes 0 Partial 0 No 5 N/A	0 Yes 1 Partial 0 No 4 N/A	0 Yes 0 Partial 1 No 4 N/A
Mixed Interventions												
Cai[51]	Yes	Yes	Partial	Yes	Partial	Yes	Partial	Partial	N/A	N/A	Partial	Yes


Cao[52] Yes Yes Partial Yes Partial Yes Partial No N/A N/A N/A N/A
Cha[53] Yes Partial No Yes Partial Yes Yes No N/A N/A N/A N/A
Chakeri[54] Yes Partial No Partial Partial Partial No Partial N/A N/A N/A N/A
Chen Y.[55] Yes Yes No Partial No Yes Partial No Partial N/A N/A N/A
Deng[56] Yes Yes Partial Yes Yes Yes Yes Partial Partial N/A N/A N/A
Dong[57] Yes Yes Partial Yes Partial Yes Partial No N/A N/A N/A N/A
Fan[58] Yes Yes No Partial Partial Yes Partial No N/A N/A N/A N/A
Huang[59] Yes Yes Partial Partial Partial Yes Partial No N/A N/A N/A N/A
Li Lan[60] Yes Yes Partial Yes Partial Yes Partial Yes N/A N/A N/A N/A
Li Li[61] Yes Yes Yes Yes Partial Yes Partial Partial Partial N/A N/A N/A
Liu Q.[62] Yes Yes Partial Yes Partial Yes Partial Partial N/A N/A N/A N/A
Liu R.[63] Yes Yes Partial Yes Partial Yes Partial No N/A N/A N/A N/A
Lu[64] Yes Yes Partial Partial No Partial Yes No N/A N/A N/A N/A
Ma[65] Yes Partial No No No Yes Partial No N/A N/A N/A N/A
Nie[66] Yes Yes Partial Yes Partial Yes Partial No Partial N/A N/A N/A
Xu[67] Yes Yes No Yes Partial Yes Partial No N/A N/A N/A N/A

Yang[68]	Yes	Yes	Partial	Yes	Partial	Yes	Partial	Partial	N/A	N/A	N/A	N/A
Zhang Y.[69]	Yes	Yes	Partial	Yes	Partial	Yes	Partial	Yes	Partial	N/A	N/A	N/A
Zheng C.[70]	Yes	Yes	Partial	Yes	Yes	Yes	Yes	Partial	Partial	N/A	Partial	Yes
Zheng Y.[71]	Yes	Yes	Partial	Partial	No	Yes	Partial	No	N/A	N/A	Partial	Yes
Total	21 Yes 0 Partial 0 No 0 N/A	18 Yes 3 Partial 0 No 0 N/A	1 Yes 14 Partial 6 No 0 N/A	14 Yes 6 Partial 1 No 0 N/A	2 Yes 15 Partial 4 No 0 N/A	19 Yes 2 Partial 0 No 0 N/A	4 Yes 16 Partial 1 No 0 N/A	2 Yes 7 Partial 12 No 0 N/A	0 Yes 6 Partial 0 No 15 N/A	0 Yes 0 Partial 0 No 21 N/A	0 Yes 3 Partial 0 No 18 N/A	3 Yes 0 Partial 0 No 18 N/A

Note: Not applicable (N/A).

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Appendix D. Adequacy of reporting of interventions based on TIDieR checklist

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