

SYSTEMATIC REVIEW

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Organizational interventions to support and promote the mental health of healthcare workers during pandemics and epidemics: a systematic review

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Abstract

Background Understanding organizational mechanisms that protect the mental health of the healthcare workforce during pandemics and epidemics is critical to support decision-making related to worker health and safety. This systematic review aimed to identify organizational-level factors, strategies or interventions that support the mental health of healthcare workers during pandemics or epidemics.

Methods A comprehensive search was used, including online databases, a grey literature review, and handsearching of reference lists. Studies were eligible for inclusion if they described implementing or testing organizational-level factors, strategies or interventions to support healthcare workers' mental health during pandemics or epidemics. There were no limitations by language, publication status, or publication date. Two reviewers independently conducted screening, data extraction, data analysis and quality appraisal, with conflicts resolved through discussion or third-party arbitration. Data analysis was guided by the Job Demands-Resources Model. A narrative synthesis is presented, given the high degree of heterogeneity across studies.

Results A total of 10,805 articles from database searches and 190 records from other sources were screened. The final review included 86 articles. Studies were of low ($n = 11$), moderate ($n = 39$), and high quality ($n = 36$). Regarding job demands, 40 studies explored high work pressure or heavy workload factors, with the majority investigating working hours ($n = 32$). Increased working hours may be associated with an increased risk of diverse mental health outcomes. Regarding job resources, leadership factors, strategies (support, appreciation, responsiveness; $n = 19$) and leadership interventions ($n = 3$) may be associated with decreased burnout, anxiety, stress, and increased well-being. The availability and adequacy of personal protective equipment ($n = 20$) may be associated with decreased burnout, anxiety, depression, and stress. Mixed findings were reported on associations between diverse mental health outcomes and training and education ($n = 28$) or peer support ($n = 3$). Results should be interpreted cautiously given the high heterogeneity among factors, strategies, and interventions assessed and outcomes measured.

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Conclusions Organizational-level mechanisms can critically influence the mental health of healthcare workers' during pandemics and epidemics. More focused attention is needed to explore and act on the integral role of leadership and the availability of protective equipment to support healthcare workers' mental health.

Keywords Mental health, Healthcare professionals, Organizational interventions, Systematic review, Pandemics, Epidemics

Background/introduction

There is abundant evidence that public health crises, specifically pandemics and epidemics, increase the risk of mental health challenges for frontline healthcare workers. The COVID-19 pandemic is no exception. Systematic reviews conducted in 2021 provide consistent evidence that anxiety, depression, post-traumatic stress disorder (PTSD), and burnout among other mental health issues, were prevalent among healthcare workers due to sustained and challenging working conditions [1–3]. In an umbrella review of 10 systematic reviews, including 169,157 healthcare workers across 100 unique studies, Fernandez et al. [4] reported prevalence rates of anxiety between 22.2% and 33% and depression ranging from 17.9 to 36%. A meta-analysis of 31 studies also demonstrated concerning rates of other mental health challenges; pooled prevalence was reported for post-traumatic stress (31.4%), acute stress (56.5%), and sleep disorders (44%) [3].

Related to this, reviews and studies validate the precarious and deleterious working conditions healthcare workers endured during the COVID-19 pandemic, compromising physical and psychological safety [5–8]. Healthcare professionals reported numerous challenges, including insufficient personal protective equipment (PPE), limited managerial support, experiences with difficult ethical situations in providing care, insufficient human resources to keep up with overwhelming workloads, and constant changes in policies, roles, and responsibilities [5]. Lack of appropriate training in infection control processes and safe use of PPE, as well as communication challenges (e.g., unclear or overwhelming amounts of information), were also reported to exacerbate levels of uncertainty, fear and anxiety [6]. Healthcare workers have reported that these concerning mental health trends and deteriorating organizational conditions have substantial implications on the provision of high quality and safe care for patients [6, 9]. Given this, there is a critical need to develop organizational level strategies to mitigate risks to the emotional and psychological health of the healthcare workforce during catastrophic public health crises such as pandemics.

In the healthcare literature, a growing body of research has examined how various factors, strategies, and interventions influenced the mental health of healthcare workers during pandemics and epidemics. However, much of this literature remains focused on individual

level approaches such as developing individual personal coping skills, personal empowerment, or resilience building rather than targeting change at the organization level that address systematic contributors to mental health challenges. In an earlier systematic review of 36 studies to identify effective interventions to support healthcare workers' mental health during and after a public health emergency, Neil-Sztramko et al. reported that most included studies described individual-level interventions which included psychoeducation, psychotherapy, and mind-body elements which generally demonstrated positive effects on mental health, with caveats for interpretation given some concerns on the quality of evidence [10]. Only three interventions focused on organization-level strategies, including various components such as engaged management, online training, and workload accommodations, were reported in the review, with heterogeneity across interventions and broadly positive effects on mental health and quality of life [10]. The authors emphasized the need for a future focus on developing, implementing, and evaluating organizational-level interventions to mitigate healthcare workers' mental health challenges during future public health emergencies.

In a review of 24 studies, which included literature until October 2020, Zace et al. [11] combined findings on both individual and organizational-based mental health interventions for healthcare providers during pandemics or epidemics into four main categories of support: (1) information (e.g., training), (2) instrumental (provision of protective equipment), (3) organization (e.g., facility reorganization), and (4) emotional and psychological (e.g., therapy). Informational interventions involved knowledge development around protection and infection control procedures, updating on the status of infected patients, treatment guidelines and patient procedures/protocols delivered by diverse channels (email, digital platforms). Instrumental support was provided through sufficient provision of equipment and supplies, primarily personal protective equipment. Organizational support involved system and unit planning to ensure physical reconfigurations, sufficient allocation of staff, and the establishment of supportive leadership, demonstrating a safe and healthy environment for healthcare staff. Emotional and psychological interventions were a primary focus of the findings and included support via psychoeducation and training on mental health symptoms, team-based and peer support and counselling, and digital

and telephone psychological support and resources. Only seven studies (29%) reported on the efficacy of diverse interventions involving training, therapy, online psychological support, and environmental adaptations for protection and safety, with primarily statistically significant findings demonstrating improvements in mental health outcomes such as increases in self-efficacy and coping, and decreases in stress, anxiety, and depression. From the presentation of results in the review by Zace et al. [11], it was unclear how organizational interventions performed relative to other categorized interventions.

To our knowledge, only one review has focused on organizational-level interventions in the context of pandemics and epidemics [12]. In the review, 41 relevant studies were identified, although based on quality, only seven were included in the final analysis. The author's findings indicated promising results on the positive effect of diverse multi-component programs that included varying elements of staffing workloads, safety, and psychological support on various mental health outcomes, although with very low-quality evidence [12]. A limitation of this review was that it did not synthesize commonalities across intervention characteristics to help identify supportive components. It was completed in 2021 during the pandemic's first wave, which may have predated the evaluation of emerging strategies or interventions implemented thereafter.

Absent from the literature is a current and deeper analysis of organizational-level factors, strategies, and interventions addressing the mental health of healthcare workers relevant to pandemics or epidemics. To this end, the primary objective of this review was to identify organizational-level factors, strategies, or interventions that promote or support the mental health of healthcare workers during pandemics or epidemics. The goal is to equip healthcare leaders with targeted, evidence-based insights to inform strategic decisions that prioritize workforce health and safety.

Methods

The protocol of this review was registered in PROSPERO #CRD42022342791 and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Search strategy

A comprehensive search strategy was developed in consultation with a health sciences librarian using (a) scientific databases (MEDLINE, PsychINFO, Embase, EMCARE, CINAHL, Sociological abstracts, Business Source Premier, Cochrane CENTRAL), (b) grey literature (the Canadian Agency for Drugs and Technologies in Health grey literature checklist), and (c) handsearching reference lists of included studies and primary studies

of relevant systematic reviews. Databases were searched from inception with search terms related to pandemic, epidemic or COVID-19, organizational interventions, mental health, and healthcare personnel. An initial search was completed on June 29, 2022, and a second search was re-run on January 29, 2023. An example of a search strategy is included in Additional file 1.

Inclusion and exclusion criteria

Eligible studies met the following criteria: (a) included a sample of healthcare workers in acute or community settings (i.e., hospital, primary care, home care, public health); (b) described the implementation or testing of organizational-level factors, strategies, or interventions to support or promote the mental health of healthcare workers during a pandemic or epidemic; and (c) utilized any quantitative, qualitative or mixed-methods design. For this review, organizational-level factors, strategies or interventions were defined as structures or processes that targeted organizational resources, the work environment, or work responsibilities/tasks, including but not limited to changes in workload, scheduling, operational practices, leadership models, communication strategies, establishing peer or social support systems, or training [13, 14]. Studies were excluded if they: (a) took place in the context of an ongoing crisis without an ending point (e.g., opioid epidemic), (b) included only individual-level strategies or interventions aimed at prevention or treatment of mental health issues (e.g., cognitive behavioural therapy, mindfulness, meditation), or (c) were commentaries, editorials, letters, opinion pieces, or reviews (systematic, scoping, review of reviews). There were no limitations by language, publication status, or publication date.

Screening, data extraction, and quality assessment

Using DistillerSR software, two independent reviewers screened each title and abstract, and relevant full texts. Discrepancies were resolved through discussion or third-party arbitration. Standardized forms were developed and pilot-tested on a sample of five studies for both the title and abstract level and full-text screening. For data extraction, a standardized form was pilot-tested on a sample of three studies. Data were extracted in duplicate on study aims, country, design, study sample (e.g., role/discipline), mental health outcomes, and factor/strategy characteristics or intervention components using the Template for Intervention Description and Replication (TIDieR) Checklist as applicable [15]. Conflicts were resolved through discussion or third-party arbitration. Quality assessment of individual studies was conducted in duplicate using Joanna Briggs Institute critical appraisal tools for the appropriate study design [16]. For each study, an overall quality assessment of

low, moderate, or high was determined based on a total score calculated by the number of domains rated as no, yes, or unclear using previously established criteria [17]. Conflicts were resolved through discussion or third-party arbitration.

Data analysis and synthesis

Given the substantial heterogeneity across factors, strategies, interventions and outcomes, results were reported through narrative synthesis as guided by the Cochrane Handbook of Systematic Reviews [18]. Study characteristics were summarized according to date, pandemic or epidemic event, country, design, setting, and sample. One reviewer coded each factor/strategy or intervention according to emergent categories guided by the Job Demands-Resources Model (JD-R) [19], which a second reviewer then checked for accuracy. The JD-R model identifies that across all occupations, regardless of the field, common factors can be labelled as job demands or job resources [19]. Within the model, job demands constitute job components (physical, organizational, psychological, or social) which necessitate ongoing effort or skills at a specific psychological or physical expense to an individual [19]. Examples include demanding workloads or schedules, work conflicts, and unfavourable physical or emotional environments. Job resources refer to any occupational element that supports goal achievement, facilitates professional growth, and helps to mitigate job demands. These elements may include autonomy, social or peer support, and positive relationships with leadership [19]. The JD-R model was selected given it is a seminal framework that has been widely tested and used across the existing literature, can be applied to diverse settings, and provides pragmatic and straightforward conceptual guidance for exploring relationships between workforce well-being and organizational factors [20].

Results

Screening

We identified 10,805 articles from systematic database searches and 190 records from other sources. After removing duplicates, title and abstract screening was completed on 7,119 database records and 132 records from other sources. After that, 912 full texts were retrieved and assessed for eligibility. Ultimately, 86 studies [21–106] were included in the final review. The PRISMA 2020 flow diagram can be found in Fig. 1.

Characteristics of included studies

The detailed characteristics of all included studies are tabulated in Additional file 2. Eighty-three studies [21–36, 39–71, 73–106] were conducted between 2020 and 2022 during the COVID-19 pandemic. Three studies [37, 38, 72] were conducted in 2003 during the SARS

pandemic. Included studies were either observational, using a cross-sectional ($n = 71$) [21, 23–31, 33–37, 39–45, 48, 49, 51–57, 59–61, 63–73, 75–80, 82–90, 92, 93, 97–100, 102–106], case-control ($n = 1$) [81] or cohort ($n = 4$) [22, 32, 94, 96] design, or experimental using a single group pre-test/post-test ($n = 6$) [38, 46, 47, 50, 62, 101], single group post-test only ($n = 3$) [58, 74, 91], or quasi-experimental ($n = 1$) [95] design. The largest number of studies were conducted in the United States ($n = 19$) [25, 31, 34, 40, 47, 50, 58, 59, 61, 73–76, 79, 85, 88, 89, 94, 98] and China ($n = 11$) [22, 62, 64, 65, 84, 93, 95, 102–105], along with studies in 28 other countries worldwide; three studies were conducted across multiple countries [28, 56, 78]. Overall, 133,088 participants were included, and the sample size of the included studies ranged from 10 to 26,174. The mean or median age among studies reporting it ($n = 38$) [21, 23, 24, 27, 28, 32, 33, 38, 39, 41, 42, 44, 45, 48, 51, 53, 57, 60, 62, 63, 68, 69, 81, 82, 85, 86, 88–90, 93, 95–99, 101, 103], ranged from 27.8 to 49.1 years. Among those that reported sex/gender distribution (78/86; $N = 121,808$) [21–36, 38–51, 53–57, 59, 60, 62–73, 75–77, 80–90, 92–106], 26,847 (22.1%) males and 94,570 (77.6%) females were included, while 391 (0.3%) participants were nonbinary or preferred not to answer. Fifty-one studies [22, 24, 31–33, 35, 37–41, 43–45, 47–52, 55, 58, 61, 62, 65–68, 70–74, 80, 82, 83, 86–89, 91, 93, 95, 96, 100, 101, 103–106] were conducted in a hospital setting, two studies [27, 90] were situated in primary care clinics, two studies [34, 59] were within public health units, and four studies [46, 53, 75, 102] took place in community centers. Nineteen studies [21, 23, 25, 42, 54, 57, 60, 63, 69, 76, 77, 79, 81, 85, 92, 94, 97–99] were conducted in other, or a mix of different types of healthcare institutions, while the rest [26, 28, 29, 36, 56, 64, 78, 84] did not report the study setting. While some studies included only physicians ($n = 8$) [36, 40, 43, 73, 80, 87, 91, 102], nurses ($n = 30$) [22, 24, 30, 33, 35, 38, 39, 44, 48, 50, 51, 58, 61–63, 67, 68, 75, 77, 82, 88, 89, 93, 95, 98, 100, 101, 103–105], paramedics ($n = 2$) [31, 92], or allied health professionals ($n = 2$) [59, 76], the remaining studies ($n = 44$) [21, 23, 25–29, 32, 34, 37, 41, 42, 45–47, 49, 52–57, 60, 64–66, 69–72, 74, 78, 79, 81, 83–86, 90, 94, 96, 97, 99, 106] included a mix of different types of healthcare workers.

Study design and methodological quality

The overall methodological quality of studies ranged from low to high. Of 71 cross-sectional studies, nine were low-quality [23, 52, 54, 55, 61, 65, 66, 73, 86], 28 were moderate quality [21, 25, 28, 29, 34, 36, 37, 40, 41, 45, 48, 51, 68–70, 78, 79, 83–85, 88, 92, 93, 99, 100, 102, 104, 106], and 34 were rated high quality [24, 26, 27, 30, 31, 33, 35, 39, 42–44, 49, 53, 56, 57, 59, 60, 63, 64, 67, 71, 72, 75–77, 80, 82, 87, 89, 90, 97, 98, 103, 105] (Additional File 3). The most common methodological limitations were related

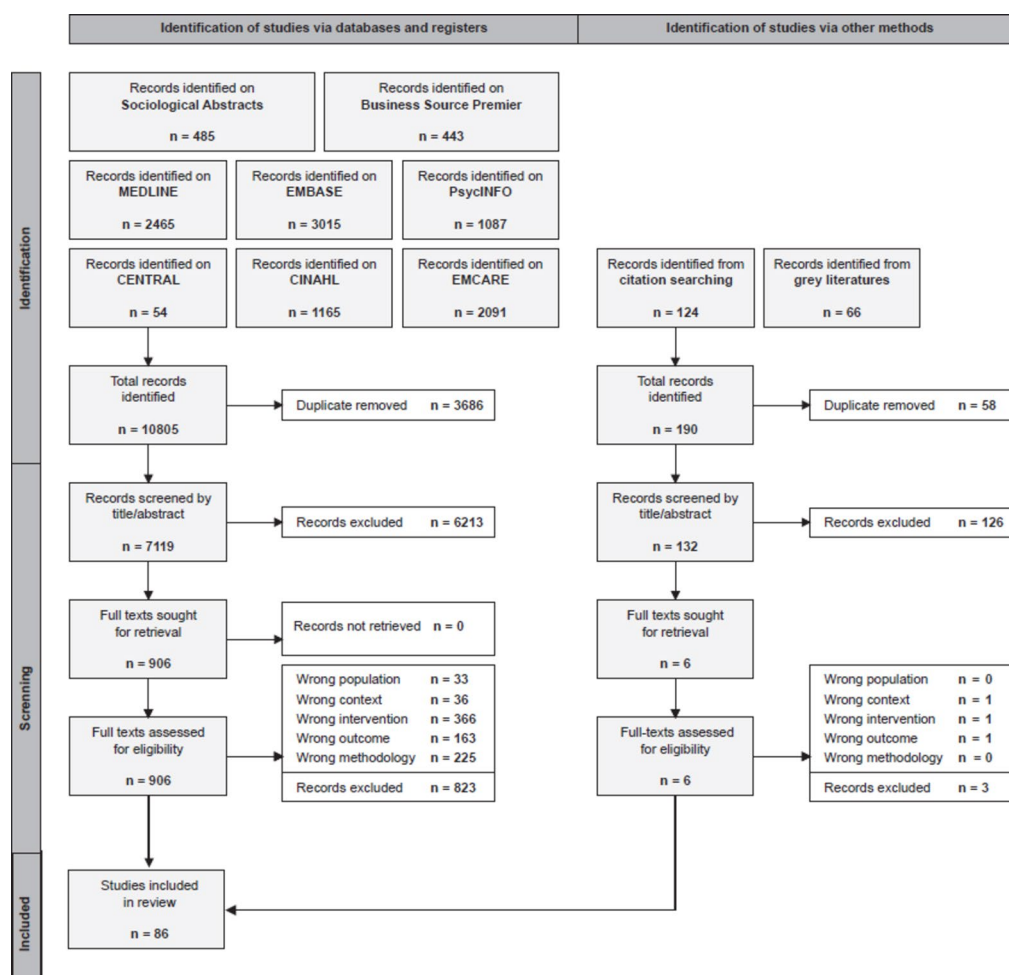


Fig. 1 PRISMA Flow Diagram

to confounding factors and strategies to address confounders, clear descriptions of the subjects and settings, valid and reliable measurement of exposure, and the use of appropriate statistical analyses (see Fig. 2). Across four cohort studies, one study was rated low quality [94], and three were moderate quality [22, 32, 96]. Domains related to the similarity of groups, groups/participants not having the outcome at study start, follow-up completion and description of loss to follow-up, utilization of strategies to address incomplete follow-up, and the use of appropriate statistical analyses, emerged as most problematic (See Fig. 3). Of 11 non-randomized/experimental studies, quality ratings were primarily moderate ($n = 8$), with few scoring high ($n = 2$) or low ($n = 1$). Domains linked to the similar treatment of participant comparison groups, the use of a control group, and multiple outcome measurements were of most concern (See Fig. 4).

Interventions

The effect of diverse organizational interventions on mental health outcomes was tested across 12 studies

relating to peer support ($n = 3$) [47, 74, 91], training ($n = 3$) [32, 62, 95], supportive leadership ($n = 3$) [46, 50, 58], and multiple components ($n = 3$) [38, 101, 106] (see Additional file 4).

Peer support

Three studies reported on peer support interventions [47, 74, 91]. Across all three interventions, peer support included structured and unstructured activities that generated positive feedback for assigned peer ‘buddies’ and opportunities to ‘check-in’ with one another in individual [47, 74] and group settings [91]. Virtual platforms (e.g., text messaging), phone, and in-person formats were used across interventions. Intervention duration ranged from 4 weeks to 4 months, and were provided in a hospital setting and with diverse audiences of physicians, nurses, and allied health workers. Mixed findings were reported across low to moderate quality studies related to diverse mental health outcomes. Two interventions relating to providing peer positive feedback and emotional support via online or in-person activities were associated

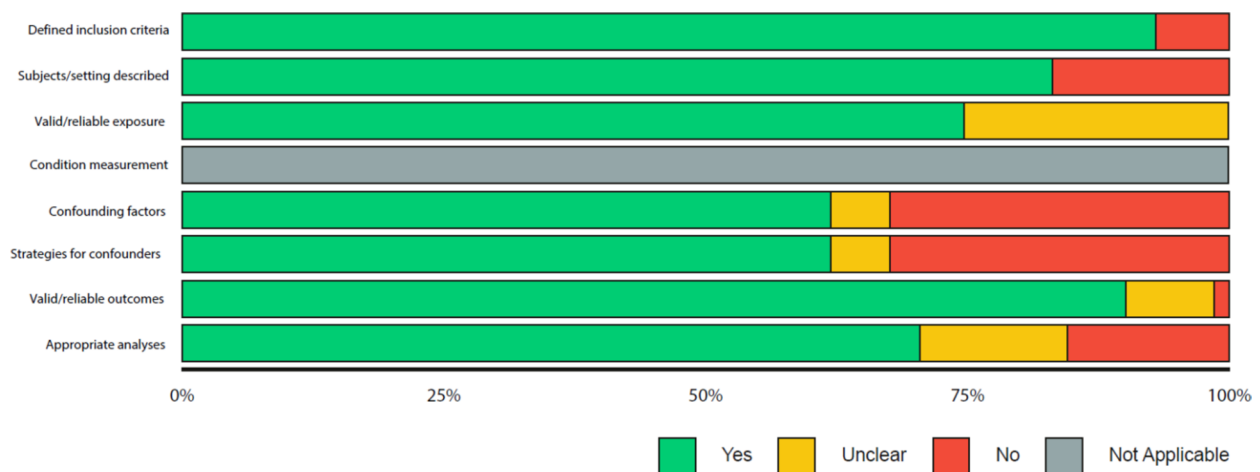


Fig. 2 Critical appraisal summary for cross-sectional studies ($n = 71$)

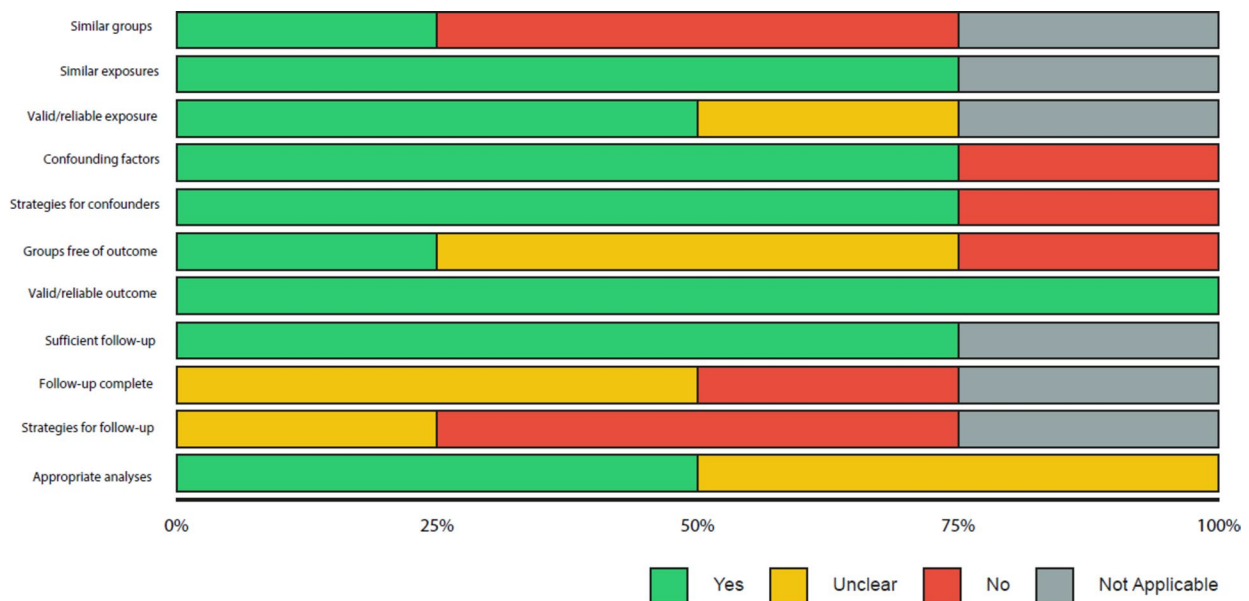


Fig. 3 Critical appraisal summary for cohort studies ($n = 4$)

with increased resilience, although mixed findings were reported relating to burnout, including no effect and an increase in burnout [47, 74]. Increases in emotional well-being were associated with another intervention related to formalized peer support groups, although this intervention was also associated with decreases in physical and mental well-being [91]. However, studies did not report the statistical significance of results, limiting the interpretation of findings.

Training

Across the three studies that assessed training to support healthcare workers' mental health, interventions addressed various content areas, including teamwork [32], PPE and infection control [62], time management

[95], and patient-provider relationships [95]. All interventions ($n = 3$) included various educational strategies such as classroom sessions, meetings, or educational resources (e.g., video), were instructor-led and used a hybrid format with both online and in-person components. Two interventions integrated simulation-based training [32, 62]. All training was conducted within a hospital context, with the target audience of exclusively nurses [62, 95] or nurses and physicians [32]. Intervention length varied from one [62] to 8 weeks [95], with training sessions lasting between 30 and 60 min. One study reported an intervention length of 25 total hours; however, it was unclear how these hours were dispersed across time [32].

Training interventions were significantly associated with decreases in anxiety and depression in two

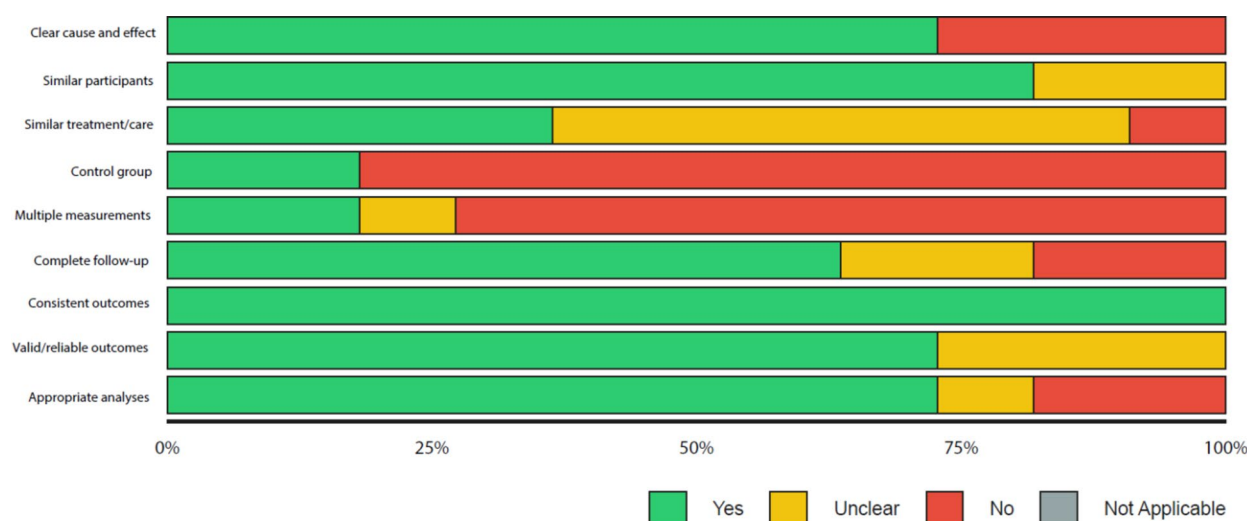


Fig. 4 Critical appraisal summary for non-randomized/experimental studies ($n = 11$)

high-quality studies [62, 95] and decreased stress and increased well-being in one high-quality study [95]. One moderate quality study reported mixed findings regarding a training intervention focused on team work and outcomes of anxiety, depression, and stress [32].

Supportive leadership

Interventions that discussed supportive leadership were reported in three studies [46, 50, 58]. One intervention included intensive leadership training to build leadership capacity by addressing diverse topics such as supportive relationships, accountability, and structure [46]. Two interventions focused on implementing supportive leadership practices, including enforcement of lunch break requirements, formal acknowledgement of employee work, individualized coaching to support growth and development, enacting social celebrations [58], allocating work space for downtime and structured debriefing after a crisis event [50]. Two interventions were provided in person [50, 58], while the leadership training intervention was provided virtually using Microsoft Teams and engaged participants using various strategies such as group reflection/discussion, supervision, and workshops [46]. Two interventions targeted specifically nurses in a hospital setting [50, 58], and one focused on healthcare workers in community settings [46]. Intervention duration ranged from 3 months to 15 weeks, with leadership activities ranging from 15-minute interactions to 2-hour leadership training sessions.

Studies reporting on leadership interventions were of moderate ($n = 2$) and high ($n = 1$) quality. Leadership activities were reported to be associated with increased resilience [46, 50], self-efficacy [46], and well-being [58], although the latter study did not state significance. Leadership interventions were also reported to be significantly

associated with decreased burnout for healthcare leaders [46], and decreased stress for leaders and staff [46, 50], although findings in one study were not significant [50], perhaps due to the small sample size.

Multi-component

Three studies reported on multi-component interventions [38, 101, 106], including elements related to training, physical restructuring of wards, establishment of safe workload practices, and peer support. All of the interventions were provided in a hospital setting, targeting solely nurses [38, 101] or a myriad of healthcare professionals [106], with interventions lasting between 3 months and 17 weeks. Two of the interventions included a training component offered in virtual or in-person formats focused on infection prevention and control and nursing care [38, 101]. The physical restructuring of wards was discussed in two studies for different purposes, such as infection prevention and control and to designate a relaxing space for workers to decompress at a wellness centre [101, 106]. The establishment of safe workload practices, such as limiting daily working hours, redirection of resources for adequate staffing and instituting rest periods and low nurse-patient ratios, was reported in two studies [38, 101]. Peer support was also discussed as a component of an established wellness centre in one study in which well-being buddies were designated to engage in 'active listening' to debrief about professional or personal issues or just for socialization purposes [106].

All three studies were of moderate quality. The various combinations of components and the small number of studies make it difficult to determine trends in findings. However, multi-component interventions that addressed safe staffing workloads and nurse-patient ratios reported significant associations with decreased anxiety,

depression, stress and increased sleep quality and quality of life [38, 101].

Associations from observational studies (Factors and Strategies)

Job demands

High pressure or heavy workload Close to half of the studies ($n = 40$; 47%) explored high work pressure or heavy workload. Across these studies, most reported on working hours ($n = 32$) and associations with burnout ($n = 18$), depression ($n = 11$), anxiety ($n = 10$), and to a lesser extent, other mental health outcomes such as post-traumatic stress disorder ($n = 5$), stress ($n = 4$), well-being ($n = 2$), suicidal ideation ($n = 2$), acute fatigue, resilience, insomnia, mental health symptoms, and inter shift recovery ($n = 1$ each) [26, 28, 29, 34, 39, 42, 43, 45, 48, 49, 51, 53, 57, 70, 71, 75–77, 80–82, 85–90, 92, 93, 99, 103, 105] (see Additional file 5). In many cases, multiple mental health outcomes were reported within a study. Working hours were measured inconsistently across all studies, according to daily, weekly, or monthly increments, or as diverse categorical (e.g., <40 vs. >40 h, <70 vs. >70) or continuous variables, resulting in challenges with identifying a threshold of working hours and an expected magnitude of effect.

Across 10 of 18 studies (56%) reporting burnout, higher working hours were significantly associated with higher scores for, prevalence of, and odds of burnout [26, 39, 43, 48, 76, 77, 81, 86, 99, 103]. Of these ten studies, study quality was primarily high ($n = 6$), with a few of moderate ($n = 3$) and low quality ($n = 1$). Three high-quality studies also reported positive but non-significant associations between higher working hours and burnout (17%) [42, 80, 87]. Five studies (28%; moderate to high quality) found no associations or inconsistent trends between increased working hours and burnout [45, 49, 70, 71, 88].

Seven out of 11 studies (64%) reporting on depression found significant positive associations between higher working hours and increased scores and prevalence ratios of depression [34, 39, 42, 75, 77, 80, 92]; the majority of these studies were of high quality ($n = 6$). Three additional studies of moderate to high quality found positive but non-significant associations between higher working hours and odds of burnout; studies included a mixture of hospital and community settings with varied workers, including physicians, nurses, and community health workers [53, 57, 90]. One study of high quality conducted among hospital pediatric nurses found higher working hours to be associated with decreased odds of depression, although this was not statistically significant [105].

Higher working hours were also associated with statistically significant increases in prevalence and scores of anxiety among five of 10 studies of moderate ($n = 3$) and high ($n = 2$) quality [34, 75, 77, 85, 92]. Two

studies sampling community, long-term care, and hospital healthcare workers (nurses, physicians, paramedics) also reported positive but not significant associations between anxiety and higher working hours [42, 90]. Three studies involving physicians [29] and nurses [93, 105] found no association or inconsistent trends between working hours and anxiety.

Regarding other high pressure or workload conditions, fewer studies reported on factors such as general increased workload [29, 68], ward type [44, 51, 72, 76, 87, 105], contact with COVID-19 or severe acute respiratory syndrome (SARS) patients [30, 61, 72, 76, 77, 99], patient load and adequate staffing [29, 33, 75, 76, 87, 105], inability to take regular breaks [56], lack of preparedness [41], and team lead role [105]. Studies differed in how factors were measured, which mental health outcomes were assessed, and had disparate results, resulting in inconclusive findings.

Inflexible or challenging work schedules Nineteen studies (22%) discussed various factors related to inflexible or challenging schedules [26, 48, 49, 53, 56, 71, 73, 77, 81, 84, 85, 88–90, 93, 94, 96, 99, 102]. Of these, ten studies (56%) reported specifically on relationships between shift type and burnout ($n = 7$), anxiety ($n = 2$), and other mental health outcomes to a lesser extent (e.g., insomnia, acute/chronic fatigue) [26, 48, 49, 77, 81, 88, 89, 93, 96, 102]. Across studies, shift type was measured in a variety of ways, including the use of multiple categories (e.g., day, night, rotating day and night, afternoon), dichotomous variables (yes/no to working night shift), or continuous variables (number of monthly night shifts).

Three of seven studies (moderate to high quality) determined that working night shifts was significantly associated with higher odds and mean scores of burnout [81, 96, 102]. Three additional studies with smaller sample sizes ($n < 400$) also found positive but non-significant associations between night shifts and increased burnout [48, 49, 107]. However, two studies of moderate and high quality found contradicting results; rotating day and night shifts, night shifts, and day shifts among physicians and nurses were associated with high and low burnout scores depending on the dimension of burnout being assessed within each study [26, 88].

Associations between shift type and other mental health outcomes were reported to a lesser extent, with varying results. Higher odds and scores of anxiety may be associated with working an increased number of night shifts [93] and fixed afternoon shifts [77] among nurses in varied settings. Night shifts may also be associated with higher post-traumatic stress, psychological distress, and insomnia [88]. Conversely, in two studies, night shifts were significantly associated with decreases in acute fatigue compared to day shifts, and day shifts

were associated with higher scores of chronic fatigue, but this was not significant [88, 89]. Rotating shifts (morning, afternoon, and night) may also be associated with increased emotional fatigue [77].

Very few studies reported other factors associated with inflexible or challenging work schedules, including shift length [88, 89], change in work schedules/intensity [73, 99], standard versus flexible scheduling [94], weekly or monthly working days [84, 85, 102], days off [71], shift system involvement [90], not taking regular breaks [56], overtime [53], and working on weekends [53], with varying results.

Unfavourable physical environments Seven studies (low to high quality) discussed factors related to equipment and supply challenges [30, 36, 41, 45, 56, 61, 80]. The prolonged use of personal protective equipment (PPE) [45] and lack of workplace equipment, supplies, or resources [30, 41, 56, 61, 80] may be associated with increased emotional exhaustion, burnout, moral distress, stress, anxiety, depression, or long-term mental health challenges. Lack of training on protective measures was also correlated with stress [36].

Other job demand factors Fewer studies reported on factors such as role conflict (fulfilling unauthorized roles and tasks, appointed tasks without appropriate resources) [68, 73], inadequate compensation [75], lack of contacts and social support from colleagues [45], scarcity of information [21], and heightened emotional demands (being confronted with death, suffering, and challenging patients) [41], which may be positively associated with emotional exhaustion, burnout [41, 45, 68], depression, anxiety, PTSD, suicidal ideation [75] and decreased well-being [21].

Job resources: supportive professional practice environment

Supportive leadership Leadership factors/strategies and styles were discussed in 19 studies (22%) [21, 22, 24, 28, 31, 35, 41, 52, 55, 60, 63, 67, 73, 75, 76, 79, 83, 96, 104]. Leadership was assessed in diverse ways, including perceptions about general support from leaders (e.g., I felt supported by supervisor) [21, 24, 28, 35, 60, 63, 75, 76, 79, 83], specific leadership characteristics such as appreciation/recognition [21, 41, 96], responsiveness [73], encouragement [83], communication [83], and specific leadership type/style (e.g., servant leadership) [22, 31, 52, 55, 67, 104].

Among eight of nine studies of moderate ($n = 3$) and high ($n = 5$) quality, general support from leaders was significantly associated with decreased burnout [24, 35, 76], anxiety [75, 83], depression [63, 75], PTSD [75], stress [21], risk for poor well-being [79], suicidal ideation [75] and increased resilience [79]. Contrary to this, two studies did not find significant associations between general

leadership support and mental health outcomes of burnout [63] and risk for poor well-being [28]. Regarding more specific leadership strategies, among three studies of moderate quality, the notion of feeling appreciated for one's work by managers or leaders was associated with decreased burnout [21, 41, 96], anxiety [96], and stress [21, 96]. Receiving encouragement and being listened to by leadership were associated with lowered anxiety [83], and leadership responsiveness was associated with lower burnout [73] and increased psychological well-being [60].

One study each explored associations between various mental health outcomes and a specific leadership type, including (a) transformational leadership, building capacity and confidence of workers [52]; (b) safety-specific transformational leadership, building employees' physical and psychological safety through intellectual stimulation, motivation, positive influence, and individualized context [55]; (c) servant leadership, prioritizing the needs of an organization and employees, emphasizing staff requirements and problem-solving to facilitate growth, with a focus on employee's well-being [67]; (d) inclusive leadership, openness, availability, and accessibility to employees [22, 104]; and (e) authentic leadership, self-awareness, transparency, ethical decision-making, and genuine behaviour [31]. Transformational, safety-specific transformational, and servant leadership, which commonly focus on employee capacity building and growth, were associated with increased individual and team resilience [52], psychological safety [67, 104], and well-being [55] among four studies of low to moderate quality. Among four studies of moderate to high quality, servant, inclusive, and authentic leadership styles, which reflect genuineness, openness, and availability, were associated with decreased workplace stress [31], psychological distress [22, 104], and burnout [67] (See Additional file 6).

Positive culture/climate and collaboration Five studies (low to high quality) explored factors related to a positive culture and workplace climate during pandemics/epidemics [37, 49, 60, 71, 73]. Facilitators such as mutual support, communication, and encouraging messages from colleagues and leaders, as well as sustained/improved psychological climate and peaceful interactions, were significantly associated with heightened psychological well-being [60] and lower odds of distress [37], PTSD [37], and burnout [49, 71, 73]. Three moderate to high-quality studies examined associations between workplace collaboration and mental health [24, 51, 96]. Teamwork (working well as a team) was significantly associated with decreased odds of stress, anxiety, burnout [96], and other mental health symptoms, although the findings were not significant [51]. In one study among hospital nurses, nurse-physician collegial relations were associated with increased burnout, although this was not significant [24].

Autonomy Across four low to moderate-quality studies, autonomy (inclusion and independence in decision-making) was significantly associated with decreased burnout [41, 68, 73, 86]. However, one high-quality study determined that participation in hospital affairs (decision-making, committee involvement) was associated with increased burnout, although this was not significant [24].

Safety Six moderate to high-quality studies examined the relationship between workplace safety strategies and mental health outcomes [36, 60, 71, 79, 100, 102]. Establishing COVID-19 safety protocols and policies to protect and contain the spread of infection (e.g., routine cleaning and disinfection; access to screening and disease specialists for infected nurses; remote conferencing/meetings) may be associated with reduced risk for poor well-being [79] or sustained well-being [60], lower stress [36, 100], decreased prevalence of burnout [71] and anxiety [102], although findings were not significant in one study [102]. One study that assessed the general implementation of measures to control the spread of COVID-19 (without identifying specific strategies) reported an association with increased stress among a small sample of nurses, however, this was not a significant finding [100].

Staffing adequacy Seven moderate ($n = 5$) to high ($n = 2$) quality studies [24, 41, 48, 51, 71, 79, 100] explored associations between staffing adequacy and mental health. Across the seven studies, perceived adequacy of staffing was associated with lowered risk to well-being [79], lower prevalence and scores of burnout [24, 41, 48], decreased stress [100] and physical/mental burden [71], and lower odds of mental health symptoms [51], although the latter three findings were not statistically significant.

Supportive scheduling Scheduling factors were reported across six (7%) moderate to high-quality studies [51, 59, 75, 88, 89, 98]. Two studies reported that having regular breaks was significantly associated with lower insomnia, burnout, and PTSD scores [88], as well as decreased fatigue [88, 89]. Across three studies, the ability to take scheduled time off was significantly associated with decreased prevalence of anxiety [59, 75], PTSD, and suicidal ideation [59], and odds of mental health symptoms [51]. Similarly, one study found that working fewer hours per week was significantly associated with lowered odds of anxiety [98]. Flexible working schedules were associated with a lower prevalence of anxiety [59], depression [75], PTSD [59, 75] and suicidal ideation [59, 75],

Job resources: organizational resources

Communication Eight studies (9%) of low ($n = 1$), moderate ($n = 4$), and high quality ($n = 3$) explored relationships between mental health and factors pertaining to organiza-

tional communication [21, 24, 37, 60, 61, 71, 79, 96]. Communication that was reciprocal, timely, and provided clear directives was associated with decreased burnout [24, 71, 96], PTSD [37], moral distress [37, 61], long-term mental health [61], stress [96] and increased well-being [60, 79] and resilience [79], although in some cases, these findings were not significant. Contrary to this, across two studies, access to information (e.g., policies) and ability to give and receive feedback were associated with increased odds of burnout [24] and PTSD [37], although these findings were not significant.

Interpersonal and social support from colleagues Five studies (6%) of moderate to high quality discussed associations between collegial support and mental health [28, 35, 41, 75, 79]. Social or emotional support from peers was associated with decreased burnout [35, 41], anxiety, depression, PTSD [75], suicidal ideation [75], and increased well-being [28, 79] and resilience [79], although findings were not significant across two studies [28, 41].

Equipment and materials Explorations of access to and adequacy of PPE and other equipment/materials were reported in 20 studies (23%) [21, 26, 28, 29, 36, 39–42, 54, 63, 65, 69, 78, 79, 86, 98, 100, 102, 105]. Eight of nine studies (low to moderate quality) reporting on burnout identified that adequate provision of PPE/other equipment was associated with decreased odds, risk, and scores of burnout [21, 26, 39–41, 63, 78, 86], although two studies reported non-significant findings [26, 41]. Two high-quality studies, which included a diverse sample of physicians, nurses, and allied health workers within varied clinical settings, reported contrary findings that adequate PPE was associated with higher odds or scores of burnout [26, 42]. Availability and adequacy of PPE were also associated with decreased anxiety across five studies (low to moderate quality) [29, 42, 65, 102, 105], although findings were not significant in one study [42]. Five out of six studies of primarily high quality ($n = 3$) noted that decreased odds and depression scores were associated with the availability and accessibility of PPE and other protective equipment [39, 40, 63, 65, 105], although two studies reported non-significant findings [39, 63]. One high-quality study of nurses in varied clinical settings reported contradictory findings that having at least one PPE shortage was associated with decreased odds of depression [98]. Four out of five moderate ($n = 3$) and high quality ($n = 1$) studies determined an association between PPE availability and decreased stress [21, 69, 100, 105], although this was not significant in one study [69]. One study involving a sample of primarily paramedics, reported that having sufficient PPE was associated with increased stress, although this was not significant [54]. The availability of PCR tests was statistically associated with decreased stress [36]. Suf-

ficient PPE provision was also reported to be associated with reduced risk for poor well-being [28, 79] and with mixed findings pertaining to insomnia [65, 98] (see Additional file 7).

Opportunity: training and education Twenty-five studies (29%) reported on factors related to training and education opportunities and their associations with various mental health outcomes [21, 24, 27, 30, 39, 41, 42, 44, 54, 56, 57, 63–65, 69, 71, 78, 79, 90, 93, 97, 99, 100, 102, 105]. Many of these studies explored training and education that generally focused on COVID-19 content (e.g., caring for COVID-19 positive patients; $n = 16$) [21, 27, 42, 44, 57, 63–65, 69, 78, 79, 90, 97, 99, 102, 105] and infection control/PPE practices ($n = 5$) [30, 54, 56, 71, 93], while the remaining studies explored access to general professional development growth opportunities [24, 41, 100] and training on workplace violence [39].

Ten studies reported on associations between training/education and burnout [21, 24, 27, 39, 41, 42, 63, 71, 78, 99]. Six of the ten studies of moderate ($n = 3$) and high quality ($n = 3$) reported that various education/training opportunities (e.g., COVID-19 infection control, PPE, workplace violence) were associated with decreased burnout [21, 39, 41, 63, 71, 78], although findings were not significant in three of these studies [42, 63, 78]. One study reported mixed findings [27], and three studies with smaller sample sizes of nurses and physicians reported non-significant associations between professional development opportunities and increased burnout [24, 42, 99]. Associations between training/education and anxiety were reported across ten studies [30, 39, 42, 44, 56, 65, 90, 93, 102, 105]. Six of these ten low to high quality studies reported that training/education was associated with decreased odds, prevalence, and anxiety scores [30, 42, 65, 93, 102, 105]. However, two of these studies reported non-significant findings [42, 93]. Across the remaining four studies, a lack of training/educational opportunities was associated with increased anxiety (significant and non-significant results) [39, 44, 90] or reported no association [56]. Nine studies of high ($n = 8$) and low quality ($n = 1$) reported on relationships between depression and training/education [30, 39, 42, 56, 57, 63, 65, 90, 97]. Five of these studies reported that training related to COVID-19, infection control, or workplace violence was associated with decreased odds, prevalence or scores of depression [42, 57, 63, 65, 97], with one study of these studies reporting non-significant findings [57]. The remaining studies found mixed, non-significant associations with depression [30, 39, 56, 90]. Fewer studies reported on associations between training/education and outcomes of stress [30, 54, 69, 90, 100], PTSD [42], insomnia [65, 99], functional impairment [99], minor psychological disorder [57], risk to well-being

[79], resilience [64], and self-efficacy [44] (see Additional file 8).

Salary, compensation, and benefits Nine studies (10%) of high ($n = 8$) and moderate quality ($n = 1$) examined diverse factors and strategies relating to salary and compensation [30, 39, 60, 63, 100], general reward systems for job performance [39, 53], mental health or EAP workplace supports [75, 90], and paid time off [59]. Appropriate salary/compensation was associated with decreased odds and scores of depression [39, 63], burnout (significant and non-significant findings) [39, 63], stress [100], and increased well-being [60]. Conversely, unsatisfactory income was associated with increased stress and anxiety [30]. General reward systems for good performance may be associated with decreased burnout [39] and depression [39, 53] scores, with one study reporting non-significant findings [53]. Two studies reported on workplace supports (mental health, EAP) with mixed significant and non-significant findings [78, 90] relating to various mental health outcomes. Only one study reported significant associations between paid time off and decreased prevalence of depression, PTSD, anxiety, and suicidal ideation [59].

Supportive physical environment and facilities Five studies (6%) investigated relationships between the physical characteristics of participants' workplaces and various mental health outcomes [56, 63, 71, 100, 102]. Inconsistent findings on associations between physical restructuring (e.g., creation of isolation wards, modification of ward layouts) [63, 71, 100, 102] or provisions of rest/food facilities [56] and various mental health outcomes were reported.

Multi-component factors Among a small number of studies ($n = 7$) exploring multi-component factors (≥ 2 factors), findings reported were similar to trends found among studies exploring single factors. Studies were of various quality (low: $n = 2$; moderate: $n = 2$; high: $n = 3$). Four studies reported associations between the combination of two factors and various mental health outcomes [24, 25, 68, 72]. The combination of supportive leadership and interpersonal/social support was associated with decreased burnout [68]. Training and equipment/material availability may be associated with decreases in burnout, PTSD, and psychological distress (non-significant finding) as reported by one study [72]. One study reported an association between the combination of collaboration and communication with decreases in burnout [25]. Two studies that reported on the combination of staffing adequacy and equipment/material availability reported inconsistent associations with burnout [24, 68]. Two studies reported various combinations of three-component factors [23, 66], including supportive leadership, safety, staffing adequacy, interpersonal and social support, training, and pay/com-

pensation/benefits. Generally, different combinations of these factors demonstrated an association with decreased burnout, psychological distress, stress, and anxiety. Only one study reported the association between a combination of five factors (supportive leadership, collaboration, safety, staffing adequacy, clear communication, and policies/protocols) and decreased burnout [33].

Discussion

This systematic review provides a synthesis of the current evidence on organizational factors, strategies, and interventions that may influence the mental health of healthcare professionals during public health crises such as pandemics and epidemics. Both observational and intervention studies were included in this review given there is limited experimental research and as such, the exploration of observational findings offers potential areas of future exploration. Findings demonstrate extensive diversity across how factors, strategies or interventions were defined and the varying ways mental health outcomes were measured, limiting our ability to meta-analyze findings and draw definitive conclusions across similarly categorized factors, strategies, or interventions in many instances. Challenges with study design and intervention heterogeneity have been similarly described in other reviews exploring protective strategies for the mental health of healthcare workers [12, 108].

Job demands: workloads and scheduling

Within included studies, high pressure or heavy workloads and higher working hours were generally associated with poorer mental health outcomes. These results are consistent with other reviews conducted earlier during the COVID-19 pandemic, which report experiences of deleterious working conditions marred by increased workloads, hours, and shifts amidst critical staffing shortages impacting the psychosocial well-being of healthcare professionals [5, 6, 9]. While an earlier mixed-methods review, including data from three studies published up to October 2020, found that increased frequency of night shifts was associated with decreased mental health [109], our review, including studies up to 2023, found that the association between scheduling types (e.g., night, day, rotating shifts) and mental health in the context of pandemics or epidemics are less definitive. The heterogeneity of findings may be partly due to the varied way these factors were measured. Qualitative findings from the earlier mixed-methods review provide context, highlighting the importance of ensuring that the establishment of workloads and shift schedules incorporate a humanistic component of engaging healthcare professionals in clear communication and decision-making processes regarding work arrangements [109]. Our review

validates these qualitative findings, as two included studies reported that flexible working schedules may be associated with a lower prevalence of anxiety, depression, and suicidal ideation [59, 75].

Leadership

Leadership emerged as a prominent theme across the included observational ($n = 19$) and experimental ($n = 3$) studies. In the observational studies, general leadership support (e.g., I am supported by my leader) seemed to be associated with lower burnout, anxiety, and depression. Different leadership styles, such as authentic, transformational, or servant leadership, were also associated with fewer adverse mental health outcomes, although they were examined in only a few studies. Given the small number of studies assessing the effectiveness of more complex leadership interventions ($n = 3$), it is difficult to ascertain what type of leadership intervention and the specific duration or intensity that may be most effective in supporting the mental health of healthcare workers during public health crises. Findings from observational studies can set the foundation for future research, providing guidance on which strategies might be most strongly associated with outcomes for future intervention design. Leadership results from our review were aligned with two other previous reviews, with one focused only on physicians [110] and another including earlier literature until October 2020 [111].

A key challenge in interpreting the findings for application to organizational settings is the variation in the definition of leadership. Most studies assessed the concept of “supportive leadership” through one self-report item, and few studies reported on specific characteristics (e.g., responsiveness, encouragement, appreciation) or actions enacted by leaders to support mental health. While the potential impact of effective leadership is promising in the unique context of a pandemic/epidemic, the heterogeneity of how leadership was defined or enacted precludes us from understanding standard components that comprise effective leadership, warranting further research in this domain. An important consideration when implementing leadership strategies or interventions is the investment in leadership capacity building and training. The evidence base on this is also limited; our review only yielded one study that explored the effect of leadership training on healthcare workers’ mental health during public health crises [46]. Additionally, given resource-limited circumstances and competing roles and responsibilities for leaders during challenging situations of public health emergencies, it would be important to implement ongoing leadership development that builds skills for crisis debriefing or personal

coaching and development, and integrate positive leadership practices within work processes and policies so that they are embedded within the everyday working environment and not simply an afterthought during times of crisis.

Equipment/materials

Adequate provision of PPE and other equipment may be associated with decreased burnout, anxiety, depression, and stress. These results coincide with an evidence synthesis conducted early on in the pandemic of 28 reviews on interventions to facilitate positive mental health recovery for frontline healthcare workers following the COVID-19 pandemic; adequate provision of PPE was identified as a critical strategy to ease the stress associated with potential COVID-19 infection and the risk of transmission to others [112]. The importance of ensuring physical safety and protection against infection was also underscored in another review, which included literature until October 2020 and summarized interventions to address the mental health of healthcare workers during disease outbreaks [11]. In addition to the provision of sufficient protective equipment, it is also imperative to provide adequate training on donning and removal procedures, which may also contribute to alleviating anxiety and depression symptoms [11]. Organizational attention toward securing and disseminating PPE is of utmost importance, given that healthcare professionals across diverse pandemic and epidemic contexts have reported grave concerns and emotional distress about the fear of being infected or transmitting the infection to loved ones, patients, and colleagues [6, 7]. While healthcare employers have an essential role in providing adequate safety equipment and ensuring considerations are embedded in emergency preparedness and response plans, their ability to address these needs relies heavily upon larger system actors who influence the supply chain.

Training and education

Our study reported mixed findings on associations between varied mental health outcomes and training/education factors ($n = 25$ studies) or interventions ($n = 3$ studies). Training content was generally related to COVID-19 information and infection control/PPE practices. Training/education was explored in two previous systematic reviews that explored interventions to support healthcare workers' mental health during infectious disease outbreaks, pandemics, or epidemics [11, 107] but which included literature only up until 2020 or the earlier waves of the COVID-19 pandemic. In a review by Zace et al., training/education interventions were described across nine studies as including the

provision of 'informational support' such as patient treatment guidelines, protection/isolation procedures, and knowledge development on safe practices in the use of PPE equipment [11]. Three training/education interventions were also reported in a 2020 review [107], with the training content generally focused on preparing staff to work in epidemic/pandemic situations and psychological first aid. Even with our review reporting on a larger amount of training/education studies, similar findings were found across this current and earlier reviews; mixed findings and a lack of reporting on intervention effectiveness were seen across included studies. Overall, specificities around training content and delivery (dose, format, structure) and effectiveness are lacking across the existing literature, creating challenges concerning educational strategy development and implementation. During epidemics/pandemics, healthcare professionals experience many workplace challenges, such as redeployment and assuming new and unfamiliar roles in an ever-changing and high-stress healthcare environment [7, 113]. Because of this, it is crucial to focus on robust training/educational preparation. Across a scoping review of 161 studies, healthcare workers reported their experiences during the COVID-19 pandemic [5]. They described how the absence of training compromised quality and their confidence in providing patient care. They emphasized a need for tailored training and specialized knowledge in emergency preparedness and response, as well as the use of PPE and infection control, to strengthen self-efficacy and a sense of agency in public health emergencies [5].

Peer support

Few identified studies reported on factors associated with interpersonal and social support from colleagues ($n = 5$) and peer support interventions ($n = 3$). Broadly, social or emotional support may be associated with decreased burnout, anxiety and depression, PTSD, suicidal ideation and increased well-being and resilience. Peer support interventions varied in format, duration, and setting, potentially contributing to variability in findings. Peer support also appears consistently in several other older systematic reviews [11, 111, 112, 114], which acknowledge that generally, formal or informal peer support structures can play integral roles in facilitating the positive mental health of healthcare workers during pandemics or outbreaks. Findings from these reviews also describe peer support with great diversity; peer-based models were used to increase social activities or interactions, to provide emotional support systems, or as resources for work-related needs or professional development [11, 111, 112, 114]. The use of peer support is commonly discussed within the literature as it relates to 1:1 strategies that are individually focused and include personal empowerment

and resilience building, counselling, and psychological first aid among healthcare worker colleagues [12, 112, 113, 115]. Across the literature, peer support has been less explored as it relates to socially oriented formal or informal structures in which the premise of peer interaction is focused on developing team culture, a strong organizational climate, and social connectedness or belonging. Peer-based models require further investigation on their effectiveness in emergency preparedness and response capacity building or other learning need areas during pandemics and epidemics.

Multi-component interventions

Only three studies in our review reported on multi-component interventions [29, 35, 98], which included a combination of elements related to training, physical restructuring of wards, establishment of safe workload practices, and peer support. While the heterogeneity and small number of multi-component interventions preclude us from identifying the most effective combinations, interventions that address safe staffing workloads appear to mitigate negative effects on varied mental health outcomes and are associated with increased sleep quality and quality of life. In an earlier review by Nikolakis et al. [12], multi-component interventions were reported to be associated with decreased anxiety and depression or increased quality of the working environment for healthcare workers, with elements of safe staffing workloads and PPE provision and infection prevention and control noted across the multi-faceted interventions. However, findings were limited by the low quality of evidence, less rigorous designs, and the lack of description of contextual considerations and detailed information on intervention characteristics and implementation processes [12]. Further and more robust research is required to understand the specific elements of multi-faceted interventions that provide cumulative benefits to healthcare workers' mental health during a public health crisis.

Limitations

While this study adds to the emerging literature on organizational mechanisms for healthcare workforce mental health during pandemics and epidemics, there are a few limitations to consider. First, the substantial heterogeneity and ambiguous nature with which factors, strategies, and interventions were defined across included studies provided challenges in combining results. The use of the Job Demands-Resources Model provides a useful guiding framework to synthesize commonalities across studies despite heterogeneity. Second, the lack of detail on factors, strategies, and interventions made it difficult to determine what key ingredients may have been most influential in

supporting the mental health of healthcare workers. Third, most of the included studies were cross-sectional, meaning that the interpretation of results is based primarily on associations with a limited understanding of intervention effects and the potential of reverse causality and uncontrolled confounding within univariate and multivariate analyses. However, the existing literature provides us with a beginning understanding of potential factors or strategies that can be integrated into interventions for more rigorous evaluation or testing.

Conclusion

The existing literature on organizational factors, strategies, and interventions to support the mental health of healthcare workers during pandemics and epidemics is largely diverse. Among these studies, there is a large amount of heterogeneity with respect to how factors/strategies and interventions are defined and how diverse outcomes are measured. Most studies in this review explored organizational factors and strategies through cross-sectional studies, with a few included studies evaluating formal organizational interventions. More rigorous research is needed to further our understanding of organizational interventions, their specific components, and their potential effect on diverse mental health outcomes. Specifically, more attention can be directed toward evaluating the promising use of strategies and interventions that focus on positive and supportive leadership, the availability and sufficiency of personal protective equipment, and complex, multi-component interventions using experimental designs, to mitigate risks to mental health during challenging working environments in pandemics and epidemics.

Abbreviations

COVID-19	Coronavirus disease
PPE	Personal protective equipment
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PTSD	Post-traumatic stress disorder
SARS	Severe acute respiratory syndrome

Supplementary Information

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Supplementary Material 1.
Supplementary Material 2.
Supplementary Material 3.
Supplementary Material 4.
Supplementary Material 5.
Supplementary Material 6.
Supplementary Material 7.
Supplementary Material 8.

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Authors' contributions

EB, SNS, MD, SB, JC, SMJ, GWC, CN contributed to the study design. EB and LB developed the search strategy. CS, OZ, COZ, EB, completed screening, data extraction, and critical appraisal. EB, SNS conducted data analysis. EB, CS, OZ developed the first manuscript. All authors read and approved the final manuscript.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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