

Original Articles: Systematic Review, Meta-Analysis, Integrative Review, Scoping Review

**MINDFULNESS-BASED APPROACHES IN NURSING: A COMPREHENSIVE
SYSTEMATIC REVIEW**

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Abstract

Introduction: Nurses have encountered significant stress, especially during the COVID-19 pandemic. While previous meta-analyses evidenced the efficacy of mindfulness in addressing negative mental states among nurses, the positive effects remain less clear.

Objective: This study aims to systematically review previous literature on mindfulness interventions and examine their impact on stress, burnout, mental health, and quality of life among nurses.

Design: Systematic literature review following PRISMA guidelines.

Data Sources: Seven databases (Web of Science, MEDLINE, Science Direct, CINAHL, Cochrane, Ichu-shi, J-STAGE) were searched for randomized control trials (RCTs), non-RCTs, and qualitative studies published before October 2021 in English or Japanese.

Review Methods: The review protocol was registered in PROSPERO (CRD42021269307). Studies were screened, selected, and appraised for quality using Joanna Briggs Institute checklists. Data were extracted and synthesized narratively.

Results: Sixty studies met the inclusion criteria. Interventions were heterogeneous in format, duration, and delivery. While overall study quality was moderate, results showed significant correlations with psychological variables. Both positive (e.g., well-being, self-compassion) and negative (e.g., stress, burnout) outcomes were reported.

Conclusions: Mindfulness interventions offer potential benefits for nurses, though further research with standardized designs and outcomes is needed. Qualified instructors and structured implementation are essential to ensure effectiveness and safety.

INTRODUCTION

The World Health Organization (World Health Organization, 2020) reported that the low nursing density in the world population is expected to increase the work burden for individual nurses. In addition, the increasing prevalence of the coronavirus disease 2019 (COVID-19) has had a significant global impact. Beyond the physical symptoms of the infection, a noticeable psychological impact has been observed owing to increased anxiety regarding quarantine policies, infection control measures, and uncertainty (Santomauro et al., 2021). Consequently, frontline COVID-19 healthcare workers have experienced psychological damage (Maqballi et al., 2021; Rezaei et al., 2022). In contrast to the general population, a higher suicide rate has been noted among nurses, which indicates the psychological burden of their work (Davis et al., 2021). Moreover, the spread of COVID-19 further augments anxiety and depression (Sahebi et al., 2021).

Nurses have to maintain their physical and mental health in this work environment. However, nurses encounter disrupted rhythms of life caused by night shifts, physical and mental fatigue, and excessive pressure from responsibilities based on the nature of their profession. Consequently, nurses are prone to anxiety and depression (Letvak et al., 2012; Maharaj et al., 2019). In addition, the suicide rate of nurses is higher than that of the general population without COVID-19 infection (Davidson et al., 2020). Therefore, nurses are expected to maintain their physical and mental health through self-care. Researchers have recommended various interventions to support the mental health of vulnerable nurses (Mao et al., 2021), including mindfulness interventions.

Mindfulness refers to intentionally paying attention in the present moment to the unfolding experiences of each moment without judgment (Kabat-Zinn, 2003). Mindfulness interventions have yielded a wide range of outcomes, including those pertaining to mental and physical health (Ludwig & Kabat-Zinn, 2008) and cognitive, emotional, and interpersonal outcomes (Brown et al., 2015).

Mindfulness interventions have increasingly been integrated into institutional settings with various targets, including the military (Marchand et al., 2021), clinical treatment facilities (Cherkin et al., 2016), schools (Caldwell et al., 2019), and other workplaces (Jamieson & Tuckey, 2017). Furthermore, a growing number of studies have been conducted on the role of mindfulness in healthcare settings (van der Riet et al., 2018).

Mindfulness interventions targeting nurses include Mindfulness-Based Stress Reduction (MBSR), mindfulness meditation (Green & Kinchen, 2021; Smith, 2014), and mindfulness training (Suleiman-Martos et al., 2020). In particular, mindfulness interventions reduce burnout (Suleiman-Martos et al., 2020; Zhang et al., 2020) and nurse distress (Ghawadra et al., 2020). Several studies have examined mindfulness interventions for nurses. However, these interventions are not uniform in terms of the intervention content and the outcomes they evaluate. Consequently, comparing the results of different studies remains a challenge. In addition, the results of meta-analyses conducted previously have been limited to negative psychological outcomes. To support working nurses, the positive psychological outcomes of mindfulness interventions ought to be clarified. Therefore, this study aimed

to appraise the results of extant studies and identify future mindfulness intervention methods, outcomes, participants, and research directions.

This systematic review aims to evaluate existing evidence on mindfulness interventions for nurses and propose future research directions. A conceptual framework underpinning this review is the stress-coping model by Lazarus and Folkman (1984), which suggests that mindfulness may enhance adaptive coping in high-stress environments.

METHODS

Design

This is a systematic literature review based on PRISMA guidelines, covering RCTs, non-RCTs, and qualitative studies.

Search Methods

Data were retrieved from Web of Science, MEDLINE (PubMed), Science Direct (Elsevier), CINAHL (EBSCO), Cochrane (CENTRAL), Ichu-shi, and J-STAGE, which provided reports in English or Japanese that were published before October 2021. Japanese studies have been included as Japanese is the first language of the authors, and these studies may provide a broader scope of ideas. The English search terms used were nurse/nurses for “nurse” and mindfulness for “mindfulness,” and similar search terms were created in Japanese. The current protocol was registered in the PROSPERO database (CRD42021269307) before commencing the review. This study followed the guidelines on the Preferred Reporting Items for Systematic reviews and Meta-Analyses (Page et al., 2021).

Search Outcome

After removing the duplicate studies using Rayyan (Rayyan Systems, Inc., Cambridge) and researchers’ assessments, the selected papers were screened based on the title and abstract according to the inclusion and exclusion criteria by two independent reviewers. The inclusion criteria comprised studies that: a) were published in English or Japanese, b) only reported data of nurses or healthcare professionals, and c) conducted mindfulness intervention(s). Studies were excluded if they: a) were published in languages other than English and Japanese, b) reported data from the general population or other occupations, and c) conducted other interventions.

Quality Appraisal

Articles were screened using Rayyan, then evaluated by three reviewers. Disagreements were resolved through discussion. Methodological quality was assessed using JBI checklists.

Data Abstraction

After the full-text screening, articles underwent data extraction and risk of bias testing. The Joanna Briggs Institute checklists were used in this study (The Joanna Briggs Institute, 2017), which were developed to assess the methodological quality and determine the extent to which a study addressed the possibility of bias in its design, conduct, and analysis. The quality of each study was also checked.

Data Analysis/ Synthesis

Data were synthesized narratively and presented using tables and schematic diagrams.

RESULTS**Study selection**

The database searches identified 563 articles after removing duplicates. The flow of studies through the review is summarized in Fig 1. Of the 563 articles, 60 studies were included in this review. An overview of the articles reviewed in this study is presented in Table 1, which includes participant information and interventions in each study. The studies included RCT (n = 10), non-RCT with a control group (n = 14), non-RCT without a control group (n = 32), and qualitative studies (n = 4). Of the studies included, 32 were conducted in the United States—only a few were conducted outside the United States (e.g., Canada and China).

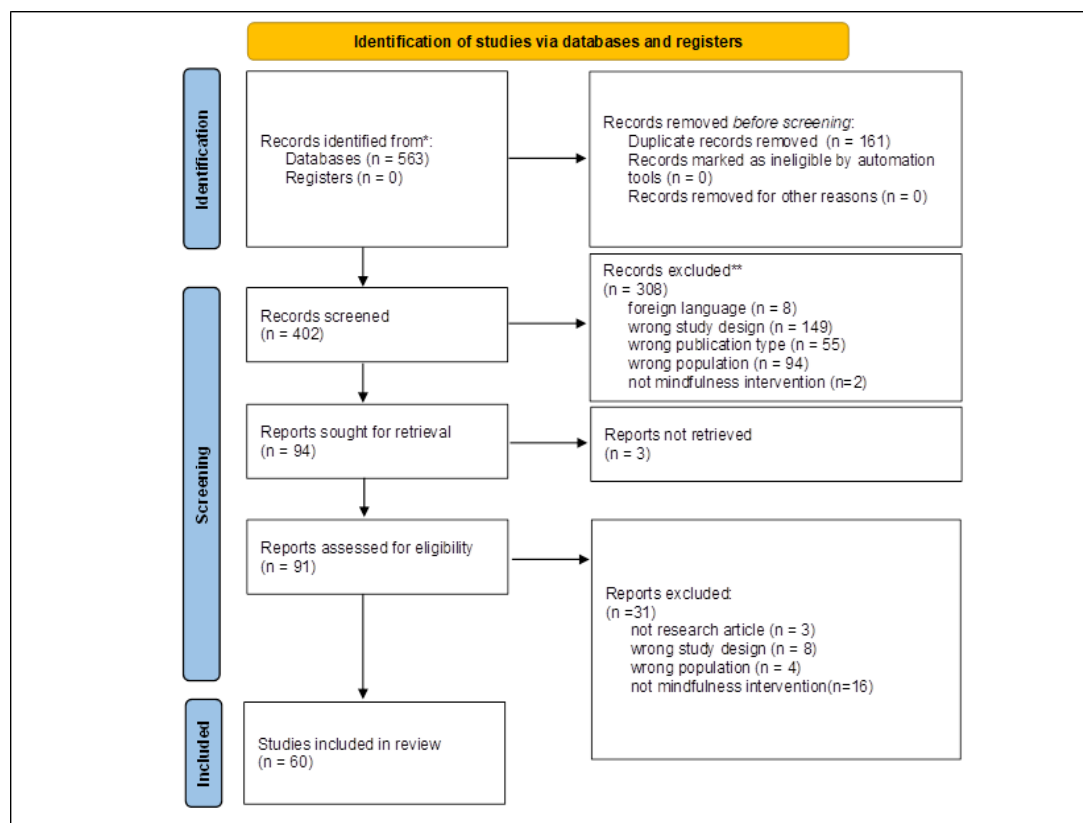


Fig 1. Flow diagram

Table1-1. Summary table of this systematic review (RCT & non-RCT with control group)

	Research Design	Author (year)	Country	Participants (Sample size)	Intervention				
					Duration	Follow-up	Number of session	Characteristics	Program instructor
1	RCT	Watanabe et al (2019)	Japan	Nurses (80)	1 week	13, 26, 52 weeks	4 times/whole duration	MBSR	Advanced practice nurse with 7 hours of training
19		Hilcove et al (2021)	US	Nurses (80)	2 weeks	6 weeks	3 to 5 times/week	MBYoga	No information
24		Verdes-Montenegro-Atalaya et al (2021)	Spain	Nurses (18)	4 or 8 weeks	6 weeks	1 time/week	MBSR	Instructors with university accreditation
54		Yang et al (2018)	China	Nurses (100)	3 months	No follow-up	8 times/whole duration	MBSR	No information
56		Daigle et al (2018)	Canada	Nurses (70)	No information	3 months	8 times/whole duration	MBSR	No information
57		Pipe et al (2009)	US	Nurse leaders (33)	4 weeks	No follow-up	5 times/whole duration	MBSR	An experienced MBSR teacher who has led patient and professional groups
58		Ghawadra et al (2020)	Malaysia	Nurses (249)	4 weeks	8 weeks	1 times/whole duration	MBSR	Author
59		Lin et al (2019)	China	Nurses (110)	8 weeks	3 months	8 times/whole duration	MBSR	MBSR instructor
60		Cohen-Katz et al (2005)	US	Nurses (25)	8 weeks	No follow-up	1 times/week	MBSR	No information
61		Nourian et al (2021)	Iran	Nurses in COVID-19 care units (41)	7 weeks	No follow-up	6 times/week	MBSR	The first and second researchers
11	Non-RCT (with control group)	Moody et al (2013)	US & Israel	Nurses, physicians, social workers (47)	8 weeks	No follow-up	8 times/whole duration	MBC	Licensed clinicians (MBSR)
12		Duarte et al (2017)	Portugal	Nurses (48)	6 weeks	No follow-up	6 times/whole duration	MBSR	One of the authors with experience in mindfulness practice
15		Franco et al (2021)	US	Pediatric nurses (48)	1 day	3 months	6 times/whole duration	1-day MSC program	No information
17		Wang et al (2017)	Taiwan	Nurses (31)	8 weeks	6 months	9 times/whole duration	MBSR	Qualified psychologist with 2 years of teaching experience
22		Dunham et al (2019)	US	Trauma center nurses & physicians (57)	228 days	2 months	4 times/whole duration	No information	No information
26		King et al (2019)	US	Nurses (164)	No information	No follow-up	No information	No information	No information
28		Slatyer et al (2018)	Australia	Nurses (91)	12 weeks	6 months	7 times/whole duration	MSCR	Clinical psychologist with experience in running the intervention
32		Xie et al (2020)	China	Nurses (91)	8 weeks	1 months	8 times/whole duration	MBIB (Mindfulness based intervention)	A counsellor with 3 years of experience
33		Duarte et al (2016)	Portugal	Oncology nurses (94)	6 weeks	3 months	6 times/whole duration	MBIB (Mindfulness based intervention)	Practicing mindfulness for 6 years
35		Wyke et al (2017)	US	Nurses (95)	4 weeks	8 weeks	7 times/whole duration	MBCT	A trained Buddhist priest
36	Non-RCT (with control group)	Zeller et al (2021)	US	Nurses & nursing students (20)	8 weeks	3 months	9 times/whole duration	MBSR	No information
53		Mackenzie et al (2006)	Canada	Nurses & nurse aids (30)	4 weeks	No follow-up	4 times/whole duration	A shortened version of the traditional MBSR program	No information
62		Monroe et al (2021)	US	Nursing units (6)	NA	No follow-up	NA	Mindfulness Pledge®	No information
63		Janice et al (2014)	US	Nursing units (2)	10 weeks	No follow-up	10 times/whole duration	Breathing as a primary mindfulness tool	No information

Table1-2. Summary table of this systematic review (non-RCT without control group)

	Research Design	Author (year)	Country	Participants (Sample size)	Intervention				
					Duration	Follow-up	Number of session	Characteristics	Program instructor
2	Non-RCT (without control group)	dos Santos et al (2016)	Brazil	Nursing professions, technicians, nursing assistants (13)	6 weeks	6 weeks	24 times/whole duration	Stress reduction program	No information
3		Anderson N (2020)	UK	Nurses (25)	8 weeks	4 months	2 times/all duration	MBSR	A trained Zenways Zen meditation teacher, who was self-employed and had 3 years of mindfulness teaching experience and had experience providing mindfulness training in NHS and private organizations
4		Knill et al (2021)	US	Nurses & nursing practitioners (86)	3 months	No follow-up	Everyday	Headspace (app)	NA
5		Montanari et al (2019)	UK	Nurses (32)	6 weeks	6 weeks	6 times/whole duration	Mindful moment	No information
6		Wong et al (2021)	US	Healthcare providers (69)	3 months	No follow-up	No information	Body scan, stretching, gratitude affirmation practice, etc	Trained physicians and nurses who worked in the PED
7		Abeni et al (2014)	Italy	Care givers, hematologists, nurses (34)	No information	1 year	30 times/whole duration	Ballant group method	No information
8		Patronis et al (2021)	US	Nurses (47)	8 weeks	No follow-up	1-5 times/week	Mindful moment	Author (yoga instructor) and other instructors
9		Cunningham et al (2021)	US	Nurses, nurse practitioners, health professionals (106)	1 day	No follow-up	10 times/whole duration	Resilience retreat (include MBSR: mindful eating & walking)	Nurse or social workers who had undergone training in 1 or more contemplative practices (yoga, meditation, MBSR or massage therapy)
10		Wright EM (2018)	US	Midwives (10)	4 weeks	No follow-up	4 times/week	MBSR	NA
18		Best et al (2020)	US	Military nurses (4)	4 weeks	No follow-up	Everyday	MBSR	Author
20		Lopes et al (2019)	Brazil	Nurses (84)	20 weeks	20 weeks	8 times/whole duration	MBI	No information
23		Wong et al (2018)	Singapore	Nurses (36)	8 weeks	3 months	8 times/whole duration	MBT	No information
25		Varkey (2021)	US	Nurses (18)	6 weeks	No follow-up	6 times/whole duration	MBSR	No information
27		Dearholt & Sandra (2020)	US	Nurses? (12)	6 weeks	No follow-up	6 times/whole duration	MBIs	No information
34		Wampole et al (2020)	US	Nurses (5)	12 weeks	2 weeks	12 times/whole duration	Social work lead mindfulness-based intervention	No information
37		Sarazine et al (2021)	US	Nurses (52)	1 day	1 or 6 months	1 times/whole duration	MBSR	Received training from Center for Mindfulness at the University of Massachusetts
38		Kulka et al (2018)	US	Newly graduated nurses (40)	8 weeks	8 weeks	8 times/whole duration	MBSR	No information
39		Vaclavik et al (2018)	US	Oncology nurses (56)	6 weeks	No follow-up	No information	MBSR	The psychosocial oncology director trained in MBSR
40		Mahon et al (2017)	Ireland	Nurses (90)	6 or 8 weeks	6 or 8 weeks	1 times/week	Mindfulness meditation intervention	The qualified mindfulness instructor
41		Foley & Taylor (2021)	US	SRNA (71)	10 days	No follow-up	10 times/whole duration	A guided mindfulness meditation application for smart phones	NA
42		Saban et al (2021)	Israel	Nurses & patients (68)	6 months	No follow-up	6 times/whole duration	The mindfulness-based time-out intervention	First author with experience in emergency nursing implemented the MBTI
43		Ceravolo et al (2019)	US	Nursing managers (12)	8 weeks	3 months	8 times/whole duration	MBSR	A mindfulness expert
44		Bruette et al (2020)	US	Nurse residents (32)	1 day	6 weeks	1 times/whole duration	Nurse residency program	No information
45		Bianchini et al (2021)	US	Nurses (86)	2 days	13 weeks	2 times/whole duration	MBIs	An NP with more than 20 years of experience in teaching MBIs for patients and healthcare organization employees
46		Gauthier et al (2015)	US	PICU nurses (104)	30 days	1 month	4 times/whole duration	MBSR (5-minute mindfulness meditation)	Zen Buddhist priest
47		Foureur et al (2013)	Australia	Nurses & midwives (40)	8 weeks	8 weeks	Everyday	A modified MBSR intervention	One of the researchers
48		Penque (2009)	US	Nurses (61)	7 weeks	3 months	1 time/week	MBSR	One instructor taught all of the classes. The instructor was a licensed marriage and family therapist for 24 years and a founder of a mindfulness practice center in Minneapolis, Minnesota. The instructor has taught MBSR for over 16 years and was trained professionally with Kabat-Zinn in 1993
49		Rush (2018)	US	Psychiatric nurses (22)	4 weeks	4 weeks	4 times/whole duration	The 4-week mindfulness program included online content with specific mindfulness	No information
50		Hee Kim Lan et al (2014)	Malaysia	Nurses (41)	5 weeks	5 weeks	5 times/whole duration	b-MBCT	The instructor had conducted more than fifteen batches of similar trainings in Malaysia, and has personal mindfulness practice, which is essential for quality experiential training
52		Bronson et al (2017)	US	Nurses in high intensity settings (18)	4 weeks	No follow-up	3 times/whole duration	A shortened version of the MBSR	A nurse practitioner employed by the VAMC who has taught mindfulness based programs for 20 years
55		Pan et al (2019)	China	Nurses (20)	6 weeks	1 week	6 times/whole duration	MLWS Intervention (Based on a multifactorial consideration of the MBSR and MAP protocol)	No information
64		Khalid et al (2021)	US	Nurses leaders (11)	6 weeks	No follow-up	Everyday	Uclaapp	NA

Table1-3. Summary table of this systematic review (Qualitative)

	Research Design	Author (year)	Country	Participants (Sample size)	Intervention				
					Duration	Follow up	Number of session	Characteristics	Program instructor
13	Qualitative	Stacey et al (2020)	UK	Nurses (266)	1 year	No follow-up	6 times/year	RBCS based on MBSR	Nurse who received 1-day master's program delivered by this author
16		Terry et al (2020)	Australia	Nurses (32)	No information	No follow-up	2 times/whole duration	MSCR	Developer of the program
29		Slatyer et al (2018)	Australia	Nurses (16)	12 weeks	12 weeks	2 times/whole duration	MSCR	Clinical psychologist with experience in running the intervention
51		Cohen-Katz et al. (2005)	US	Nurses (25)	8 weeks	No follow-up	1 times/week	MBSR	The first 2 authors

Characteristics of RCT Studies

RCT studies included 10 studies. Table 1 compiles studies according to the study design. For example, it matched the aim of the study regarding the outcome measurements, statistical analysis, and trial design. According to our quality assessment, the majority of studies were of high quality. Five studies were introduced to an intention-to-treat (ITT) analysis; these studies were completely randomized and had similar control groups at the baseline. None of the RCT studies were blinded to their intervention or control group allocation. Additionally, the intervention providers were not blinded to the intervention assignments due to the nature of the mindfulness intervention. This is because complete blinding for allocation concealment, participating in this intervention, evaluating the outcomes, and practicing intervention by professional providers would inform participants and providers of the mindfulness implementation.

Characteristics of non-RCT studies

The non-RCT studies with a control group were of high quality, as were the RCT studies. However, some non-RCTs without a control group had some issues; for example, they were not analyzed statistically. In addition, the sample sizes were generally small; in 13 studies, the sample size was less than 30.

Details of the mindfulness intervention

In Table 1, details of the interventions are shown. The review showed that mindfulness interventions are complex and multifarious. However, some of these studies followed a typical MBSR program.

Duration and number of interventions

The duration of the interventions ranged from 1–228 days, with 4–8 weeks being the most common. The frequency of sessions ranged from 1–4 times per week. Some of these were introduced daily.

Intervention components

The components of interventions were distinguished into three categories.

- 1) Practice: meditations, yoga exercises, guided practice, etc.
- 2) Education: reading files about the nature of mindfulness and its benefits, listening to the speeches delivered by professionals related to mind exercise meditation, etc.
- 3) Thought: dialogues around participants' observations of their feelings, thoughts, and body sensations during practice.

Less than half of the studies reported the license of intervention providers.

Online interventions

There were two main patterns of intervention: in-person and online. The number of online methods has rapidly increased over the past decade. However, the interventions used were not uniform. Some studies developed Apps, CDs, videos, etc. whereas other studies utilized default functions (e.g., email or messaging functions, reminders).

Homework

Some of the studies had set homework for their participants, whereas others did not. The number of articles with homework was 8 of 10 in RCTs, 7 of 14 in non-RCTs with a control group, 11 of 32 in non-RCTs without a control group, and 3 of 4 in qualitative studies.

Participants' characteristics

The participants in the included studies were nurses without limited qualification consideration ($n = 47$). However, some of the studies were specific (see Table 2); 13 studies included nursing managers, oncology nurses, midwives, pediatric nurses, and psychiatric nurses. Eleven studies targeted nurses and other healthcare workers.

Table 2. Details of participants, excluding studies involving only Generally Nurses

Author (year)	Type of Nurses	Specific Occupation
Franco et al. (2021)	Pediatric	
Best et al. (2020)	Military	
Kulka et al. (2018)	Newly graduated	
Foley & Taylor (2021)	SRNA	
Gauthier et al. (2015)	PICU	
Rush (2018)	Psychiatric	
Bronson et al. (2017)	High intensity setting	
Nourian et al. (2021)	COVID-19 care units	
Duarte et al. (2016)	Oncology	
Vaclavik et al. (2018)		
Ceravolo et al. (2019)		
Pipe et al. (2009)	Managers	
Wright (2018)	Midwives	
dos Santos et al. (2016)	Mixed	Nursing professions, technicians, nursing assistants
Knill et al. (2021)		Nurses & nursing practitioners
Wong et al. (2021)		Healthcare providers
Abeni et al. (2014)		Care givers, hematologists, nurses
Cunningham et al. (2021)		Nurses, nurse practitioners, health professionals
Moody et al. (2013)		Nurses, physicians, social workers
Dunham et al. (2019)		Trauma center nurses & physicians
Zeller et al. (2021)		Nurses & nursing students
Saban et al. (2021)		Nurses & patients
Foureur et al. (2013)		Nurses & midwives
Mackenzie et al. (2006)		Nurses & nurse aids
Monroe et al. (2021)	Units	

Outcomes

Some of the outcomes were extracted from the studies included. The most commonly used negative elements were 1) stress, 2) burnout, 3) depression, and 4) anxiety. By contrast, the positive elements were 1) quality of life (QOL), 2) well-being, 3) self-compassion, and 4) satisfaction with life, as described in Table 3. Other indicators such as engagement, resiliency, and self-efficiency were also evaluated.

One of the studies focused on the effects of the unit's intervention. In this study, the outcomes were job satisfaction and teamwork (Monroe et al., 2021) . The study design allowed for a comprehensive unit evaluation by providing interventions to the entire team.

The outcomes, job satisfaction, and teamwork were an evaluation of the change in the entire unit rather than individuals.

Table3. List of specific outcome indicators

	Indicator	Study No.
Positive elements	1) Quality of life	1,2,12,20
	2) well-being	2,4,22
	3) self compassion	2,12,15,20, 28,40,46,48
	4) satisfaction with life	3, 33,53
	5) mindfulness	3,12,15,17,18,19,20,32,37,42,44, 46,48,50,55,58,60,63
	6) self-efficacy	9
	7) acceptance	12,32
	8) resiliency	15,28,59
	9) job engagement	15
	10) sense of coherence	47
	11) empathy	48
	12) serenity	19,48
	13) relaxation	53
	14) teamwork	62
	15) job climate	7
Negative elements	1) stress	2,3,5,6,8,11,12,15,17,19,33, 35, 37,38,40,41,46,50,52,54,55,57,58 ,59,60,64
	2) burnout	1,2,4,5,8,11,12,15,19,32,34, 35,37,43,45,46,52,53,55,58,60
	3) depression	1,2,11,12,15,20,33,41,47,50,54,5 5,58
	4) anxiety	1,2,9,12,15,20,33,41,47,50,54,55, 56
	5) compassion fatigue	12,18, 35
	6) moral distress	39
Neutral elements	1) sleep	19,61
	2) performance	36
	3) diurnal salivary cortisol	19
	4) blood pressure	19
	5) musculoskeletal complaints	20
	6) general health	47

Qualitative studies

The qualitative studies included four studies, most of which aimed at evaluating mindfulness interventions (Table 1). They describe the challenges and benefits of participating in the MBSR program and the impact of MBSR on relationships.

DISCUSSION

Summary of study results

The purpose of this study was to evaluate the results of extant studies and to propose future methods, outcomes, participants, and research directions for mindfulness interventions. We surveyed different kinds of studies (e.g., RCTs, non-RCTs, and qualitative studies). Notably, while some studies included only nurses as participants, many included multiple kinds of professionals. Intervention methods varied, with a few studies using mindfulness programs (e.g., MBSR) and the rest developed or simplified by researchers. Outcomes were often related to psychological factors; some studies measured positive and negative concepts. Research on mindfulness interventions for nurses is still in its infancy and inconsistent, but it may be effective and should be considered.

Details of mindfulness practice and targets

This study provided a comprehensive overview that allowed us to confirm the details of the intervention's targets and practices. Several characteristics of nurses' intervention practices have been identified. Previous studies implemented mindfulness interventions for healthcare professionals and found them to be effective (Suleiman-Martos et al., 2020; Zhang et al., 2020) . Some studies also included non-nursing healthcare professionals (e.g., dos Santos et al., 2016) . Furthermore, previous studies have demonstrated positive psychological outcomes, such as an increase in nurses' health and well-being (Sarazine et al., 2021) . The present study encompasses practical studies of nurses in various departments and roles, such as ward nurses, outpatient nurses, nursing managers working in psychiatric wards, and other nurses from various backgrounds. The diversity of intervention practices is attributed to the diverse roles and working conditions required by different nursing specialties and departments.

The United States was the only country where mindfulness was implemented in 32 cases, with fewer cases in other countries. This may be because the MBSR was developed in the United States (Kabat-Zinn, 2003) , making it easier to apply there. In addition, different countries may provide mindfulness training to qualified personnel in different ways and religious and cultural backgrounds may also play a role in the outcomes. However, in light of the recent expansion of mindfulness development, it is likely to spread outside the United States in the future.

The interventions used can be divided into two patterns: those using a general program called MBSR and those constructed independently by the researchers. MBSR is an eight-week mindfulness intervention initially developed for people with chronic pain and stress (Bigelow, 2017). It has proven effective for stress and burnout (Hunter & Lecturer, 2016 (Monroe et al., 2021; Pan et al., 2019)) and is used in medical and educational institutions. MBSR participants are expected to practice mindfulness

daily, not only when attending the course but also at home and elsewhere (Bigelow, 2017) . The effectiveness of the MBSR depends on participant adherence. In this study, participants' adherence was not adequately assessed. We suggest that a distinction should be made between the evaluation of intervention practices and participant adherence.

In each study, the duration of the intervention varied widely, with the longest study lasting 228 days and some lasting only one day. Most studies were made up of 4- or 8-week programs, as specified in the MBSR. Work environment factors, including work structure and culture, may contribute to this difference in duration. For nurses with rotating work shifts, participation in the entire course of a program, such as MBSR, is influenced by individual adherence and work environment factors (e.g., supervisor and peer considerations and work hour adjustments). Previous studies of nurses and other healthcare professionals have found that low numbers of participants (Chmielewski et al., 2021) , high dropout rates (Duarte & Pinto-Gouveia, 2017; Wong, S., et al., 2018) , and participant adherence (Suleiman-Martos et al., 2020) have been identified problematic. Several studies have used shortened versions of MBSR or mindfulness interventions, in combination with other educational programs, to reduce participant burden.

To reduce the burden of participation, interventions conducted during work hours and online interventions have been implemented, with the number of online interventions increasing rapidly in recent years. This is appropriate for nurses who work shifts and may contribute to improved adherence. However, online interventions are still being developed (Ahmad et al., 2017) . For example, online intervention content and delivery methods are in their nascent stage, and their effectiveness remains unclear. In addition, approximately 80% of mindfulness interventions report at least one or more meditation-related side effects (Britton et al., 2021) . In one review, less than 1% of the studies observed meditation adverse events (Wong, KF., et al., 2018) . While consideration of participants' safety is essential, reporting is inconsistent. None of the studies in this review reported adverse meditation events. Furthermore, qualified instructors must implement interventions to prevent meditation adverse events. However, only half of the studies were conducted by qualified instructors. Future studies should establish an intervention method conducted by trained mindfulness instructors to maintain the safety of the participants.

Types of outcomes

Several studies focused on negative concepts, such as stress and burnout (Chmielewski et al., 2021) . Some studies focused on positive psychological outcomes such as well-being (Dearholt, 2019) . Positive factors, such as self-compassion, are effective in primordial prevention and improving resiliency and the quality of nursing care for patients, which suggests the need for proactive interventions (Green & Kinchen, 2021; Hilcove et al., 2021; Morone et al., 2012; Terry et al., 2020; Wright, 2018) . Thus, further research on the effects of mindfulness interventions on positive factors is necessary to accumulate relevant findings. One study also demonstrated the improvement of teamwork at the ward level. Previous mindfulness interventions have generally targeted individuals; none have

targeted an entire organization. This study suggests that mindfulness interventions may positively impact individuals and organizations; however, further research is required.

Limitations

This study did not conduct a meta-analysis; therefore, mentioning the effect size of the outcome may not be possible. The studies we selected were not appropriate for statistical analysis, given the significant heterogeneity in general characteristics and intervention methods. In addition, although this is an international comparison, the literature search was conducted in English and Japanese; thus, we might have missed European studies written in another language than English. In terms of study design, there were few RCTs, and most studies were conducted without a comparison group. Many RCT studies have been conducted using the MBSR package, and the home practice implementation rate can be linked to implementing a packaged program. Future studies should consider the impact of home practice on the effectiveness of mindfulness interventions; however, few studies have explored this topic.

Meta-analyses have been conducted for reviews reporting negative concepts but not those reporting positive concepts (Sulosaari et al., 2022). Future intervention studies should focus on positive concepts and organizational improvements to ensure sample size and homogeneity. This study revealed that various intervention methods and outcomes are also under consideration, which will be an essential resource for future intervention methods.

CONCLUSION

We found that most existing studies on mindfulness practices with nurses are non-RCTs with no control group and are of low quality. In addition, the content, duration, target, and means of delivery (online intervention) of the interventions were inconsistent. However, mindfulness interventions proved important due to the characteristics of the nursing profession, including diverse work styles (e.g., night shift work) and a high psychological burden, and were practiced using a variety of methods. Practice using more sophisticated methods and outcomes is desirable. In addition, although many studies have shown that mindfulness interventions affect negative psychological concepts, few studies have considered positive concepts. Accordingly, scholars would do well to investigate both the positive and negative aspects of the psychological outcomes of mindfulness interventions.

AUTHOR CONTRIBUTION

Atsumi Iikura: Conception, design, data analysis and interpretation.

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CONFLICT OF INTEREST

Related to conflict of interest that arise when conducting research.

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