Original Article

Effect of Mindfulness-Based Stress Reduction on burnout among nurses: A systematic review and meta-analysis of randomized controlled trials

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Abstract

Burnout is highly prevalent among nurses, characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment, and is associated with adverse impacts on mental health, professional performance, and quality of patient care. Mindfulness-Based Stress Reduction (MBSR) has been proposed as a potential intervention; however, evidence regarding its effectiveness across burnout dimensions remains inconsistent. The aim of this study was to systematically evaluate and quantify the effects of MBSR on burnout among nurses across the three Maslach Burnout Inventory (MBI) dimensions. A systematic search of PubMed, ScienceDirect, and the Cochrane Library was conducted up to October 2025. Eligible studies evaluated MBSR among nurses, with burnout outcomes measured using the MBI subscales: emotional exhaustion, depersonalization, and personal accomplishment. Meta-analyses were performed using inverse-variance random-effects model, with heterogeneity assessed using the I^2 statistic. Outcomes were categorized by follow-up duration: short-term (0–4 weeks), medium-term (>1–6 months), and long-term (>6 months). A total of seven RCTs were included in the meta-analysis. MBSR was associated with a significant reduction in emotional exhaustion overall (mean difference (MD): −5.80, 95% confidence interval (95%CI): −7.77 to −3.84; I^2=26%), with the strongest effects observed in the short term (MD: −7.00), which attenuated in the medium term (MD: −5.03) and were not sustained at long-term follow-up. Depersonalization showed a modest overall reduction (MD: −2.71, 95%CI: −4.25 to −1.16), although heterogeneity was substantial (I^2=70%) and effects were not maintained over time. No significant improvement was observed for personal accomplishment (MD: −0.53, 95%CI: −2.95 to 1.88; I^2=88%). Risk of bias across studies was generally low to moderate, and no evidence of publication bias was identified. MBSR appears to provide short-term reductions in emotional exhaustion and may offer transient benefits for depersonalization; however, these effects diminish over time and no significant improvement is observed in personal accomplishment. These findings suggest that MBSR may function primarily as a short-term supportive intervention, and sustained reductions in burnout likely require integration with organizational strategies and ongoing support.

Keywords: Nurse burnout, Mindfulness-Based Stress Reduction, Maslach Burnout Inventory, emotional exhaustion, depersonalization

Introduction

Burnout among nurses is a critical occupational health issue with wide-ranging consequences for mental well-being, professional performance, and the overall quality of healthcare services

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[1]. It is characterized by emotional exhaustion, depersonalization, and reduced personal accomplishment, all of which may lead to decreased job satisfaction and increased turnover intention [2]. Globally, the prevalence of burnout among nurses is estimated to exceed 11%, although it varies across regions and healthcare settings [2-3]. Several demographic and occupational factors, including nationality, work unit, education level, work experience, and social support, have been reported to influence burnout levels [4].

Nurse burnout has received considerable attention because of its detrimental effects on both healthcare systems and patient outcomes. Evidence from a large-scale systematic review and meta-analysis involving more than 288,000 nurses across 32 countries showed that burnout was significantly associated with compromised patient safety and reduced quality of care [2]. In particular, burnout has been linked to increased rates of healthcare-associated infections, patient falls, medication errors, and missed nursing care. It has also been associated with lower patient satisfaction, poorer service quality, musculoskeletal disorders, and recurrent absenteeism among nurses [5]. Nurses are especially vulnerable to burnout because of the high intensity of their interactions with patients, families, and colleagues. In addition, excessive workload, unfavorable work environments, and low compensation further contribute to burnout in this population [6].

The high prevalence of burnout among nurses highlights the urgent need for effective management strategies. One widely adopted approach is Mindfulness-Based Stress Reduction (MBSR), which was developed by Dr. Jon Kabat-Zinn in 1979. MBSR was originally designed for stress management but is now broadly applied in treating various health conditions in patients, such as patients with anxiety, depression, chronic pain, hypertension, and diabetes. The program combines mindfulness meditation, gentle stretching, and body awareness exercises over eight weeks to help individuals reduce physical and psychological distress [4]. A previous study in 2020 demonstrated that MBSR effectively reduces stress, anxiety, and depression while enhancing self-compassion among healthcare professionals, though its effects on burnout and resilience remain limited [7-8].

Burnout is most commonly assessed using the Maslach Burnout Inventory (MBI), a standardized and widely validated instrument that measures three core dimensions: emotional exhaustion, depersonalization, and personal accomplishment [6-7]. The MBI consists of 22 items distributed across these subscales, allowing for multidimensional assessment of burnout severity. The use of MBI in clinical trials provides a consistent framework for evaluating intervention effects across studies [8]. In randomized controlled trials (RCTs), the use of standardized outcome measures is essential to ensure comparability and interpretability of results. The MBI enables dimension-specific analysis, allowing researchers to determine whether an intervention selectively reduces emotional exhaustion or depersonalization, or improves personal accomplishment. Restricting inclusion to studies using MBI in this meta-analysis was intended to minimize measurement heterogeneity and enhance the validity of pooled estimates [7-8].

Therefore, the aim of this study was to systematically evaluate and quantitatively synthesize the effects of MBSR on burnout among nurses, with outcomes assessed using the MBI. It was hypothesized that MBSR would reduce emotional exhaustion and depersonalization, with limited effects on personal accomplishment.

Methods

Registration

This systematic review and meta-analysis were registered in PROSPERO (CRD420251180629) and conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and the Cochrane Handbook for Systematic Reviews of Interventions, version 6.3, 2022 [8].

Search strategy

The systematic literature search and study selection process were carried out independently by three investigators (AT, RK and OJ) between November 1 and 5, 2025. A systematic search was conducted across three major databases, PubMed, ScienceDirect, and Cochrane Library. The search strategy incorporated key terms related to mindfulness interventions, nursing population,

burnout outcomes, and study methodology. The search strategy combined key concepts and their synonyms, including terms such as “mindfulness-based stress reduction,” “MBSR,” “mindfulness intervention,” “nurse,” “nurses,” “nursing staff,” “burnout,” “occupational stress,” “emotional exhaustion,” “Maslach Burnout Inventory,” “MBI,” “randomized controlled trial,” “randomized,” and “RCT.”

Eligibility criteria

Prior to initiating the literature search, pre-defined eligibility criteria were established to guide study selection. The review specifically considered RCTs involving registered nurses, licensed practical nurses, or nursing students in clinical practice settings. To qualify for inclusion, studies must have evaluated structured mindfulness-based interventions (including standard MBSR programs or adapted versions) against control conditions such as waitlist controls, usual care protocols, or active comparator interventions. All included trials were required to report burnout outcomes using the three primary subscales of the MBI: emotional exhaustion, defined as feelings of being emotionally overextended and depleted of emotional resources; depersonalization, referring to an unfeeling and impersonal response toward recipients of care; and personal accomplishment, which reflects feelings of competence and successful achievement in one’s work. The search was limited to English-language publications available through October 2025. Several publication types were explicitly excluded from consideration, including systematic reviews, pre-print articles, grey literature, access-restricted publications, studies with unclassified designs, and articles containing non-extractable data.

Data extraction and analysis

All chosen studies were imported into the Rayyan systematic review management tool (https://rayyan.ai/) for deduplication, screening, and data extraction. The process was conducted independently by two reviewers (AT and RK) [10]. After extraction, the profiles and outcomes of the selected studies were independently summarized in a spreadsheet, and all three reviewers (AT, RK, and OJ) evaluated their precision. Following this, the data was analyzed and reported. Any disagreements arising during screening and extraction were resolved through discussions.

Quality of the included study

The risk of bias for the included studies was assessed using the Revised Tool Risk of Bias (RoB) 2.0 [11]. Three reviewers (AT, RK and OJ) conducted the assessment, with disagreements resolved through discussion or by a third reviewer (OJ). The tool evaluates six key domains, including selection bias, performance bias, detection bias, attrition bias, reporting bias, and other potential sources of bias. Study quality was categorized into three levels: low, unclear, or high risk of bias. The results were visualized as a traffic plot and weighted bar plot using RevMan. The results were visualized as a traffic light plot and weighted bar plot using Review Manager (RevMan) software (https://revman.cochrane.org/).

Risk of bias assessment

The assessment of publication bias among the included studies involved visually inspecting the funnel plot to identify any asymmetry. This was done by examining the distribution of included studies on the graph in relation to the mean difference (MD) and the standard error (SE) of log(MD). The funnel plot was constructed using depersonalization data, as this outcome had the most complete and comparable data across studies, whereas emotional exhaustion and personal accomplishment were not suitable for funnel plot analysis due to limited or heterogeneous reporting.

Statistical analysis

The meta-analysis was conducted utilizing Review Manager 5.4.1 (Nordic Cochrane Center, Cochrane Collaboration, Copenhagen), where data on emotional exhaustion, personal accomplishment, and depersonalization were evaluated as continuous outcomes using mean difference (MD) and standard deviation (SD), with a 95% confidence interval (95%CI). The statistical method employed was the inverse variance model, and a random-effect model was utilized for outcome analysis. Heterogeneity was assessed using the I^2 statistic, with values of 0%,

25%, 50%, and 75% representing no heterogeneity, low heterogeneity, moderate heterogeneity, and high heterogeneity, respectively. A *p*-value of <0.05 was considered indicative of statistically significant heterogeneity.

Studies were grouped into three follow-up categories based on the time of outcome measurement post-baseline to assess the effectiveness of MBSR across different timeframes: (1) short-term (measurements taken 0–4 weeks after the end of the intervention); (2) medium-term (measurements taken from >1 month to 6 months post-intervention); and (3) long-term (measurements taken >6 months post-intervention).

For studies reporting multiple measurements within the same category, only the measurement closest to the end of the category's timeframe was included to ensure statistical independence of data points. A test for significance among subgroups was also carried out to evaluate the significance of the subgroup analysis, where $p<0.05$ was considered significant.

Results

Study selection and identification

A total of 3,316 records were identified from five databases: PubMed (n=1,121), ScienceDirect (n=1,778), Cochrane Library (n=252), ProQuest (n=131), and Scopus (n=34) (**Figure 1**). Prior to screening, 2,891 records were excluded based on publication year and study design, and 65 non-English articles were removed. After these exclusions, 360 records remained for screening. Of these, 284 duplicate records were identified and removed, leaving studies to be screened based on title and abstract. A total of 76 reports were sought for retrieval, of which 18 could not be retrieved. Subsequently, 58 full-text articles were assessed for eligibility. Among these, 50 reports were excluded for the following reasons: different intervention (n=24), different outcome (n=18), different population (n=7), and protocol only (n=1). Finally, eight studies met the inclusion criteria and were included in the systematic review and meta-analysis. PRISMA flowchart was presented in **Figure 1**.

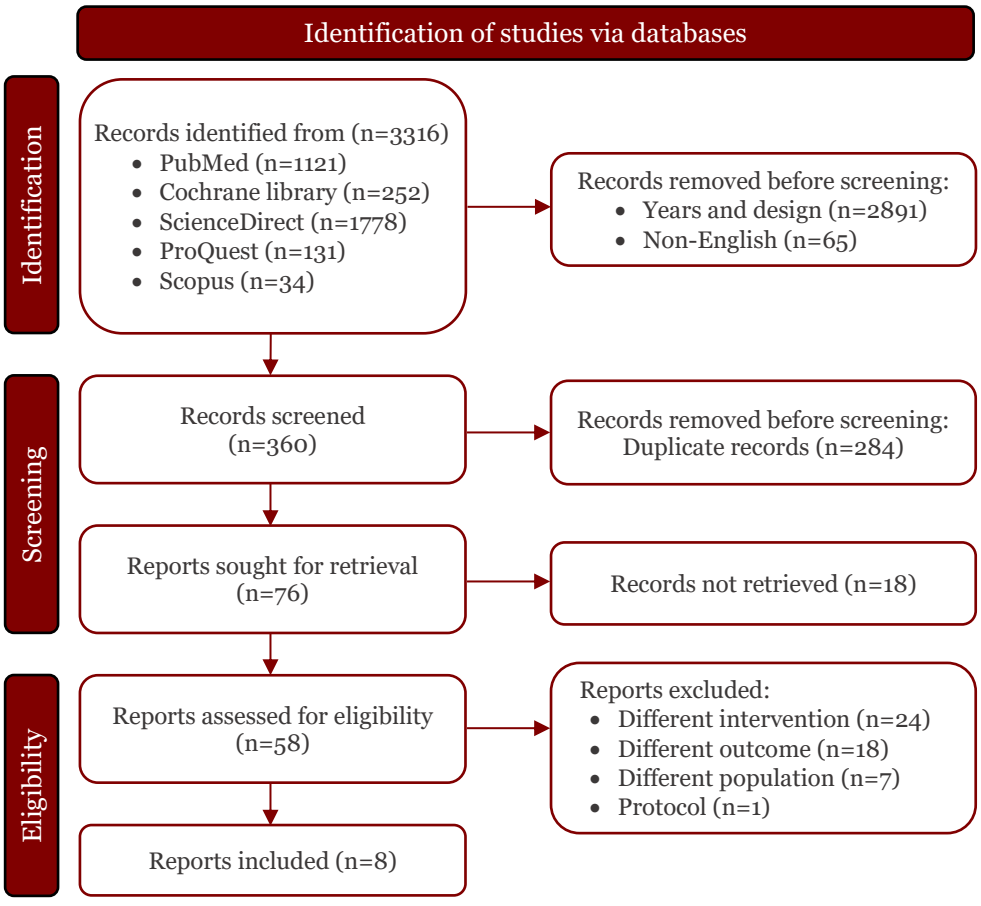

Figure 1. PRISMA flowchart showing the study selection process.

Risk of bias assessment

The included studies demonstrated mixed but generally acceptable methodological quality. A total of three studies [12-14] had a low overall risk of bias, while four others [15-18] presented some concerns (**Figure 2**). The last study [19] had a high risk of bias due to methodological issues. The most common limitations involved unclear randomization methods, making it difficult to judge whether allocation was truly unbiased [15-16,18-19]. Some studies also showed deviations from the intended interventions, though their impact on outcomes was uncertain [16-19] (**Figure 2**). Blinding of outcome assessors was often not clearly reported, raising the possibility of measurement bias [18]. Despite these issues, the use of objective outcome measures across studies helped maintain the overall reliability of the evidence, which was considered acceptable for synthesis.

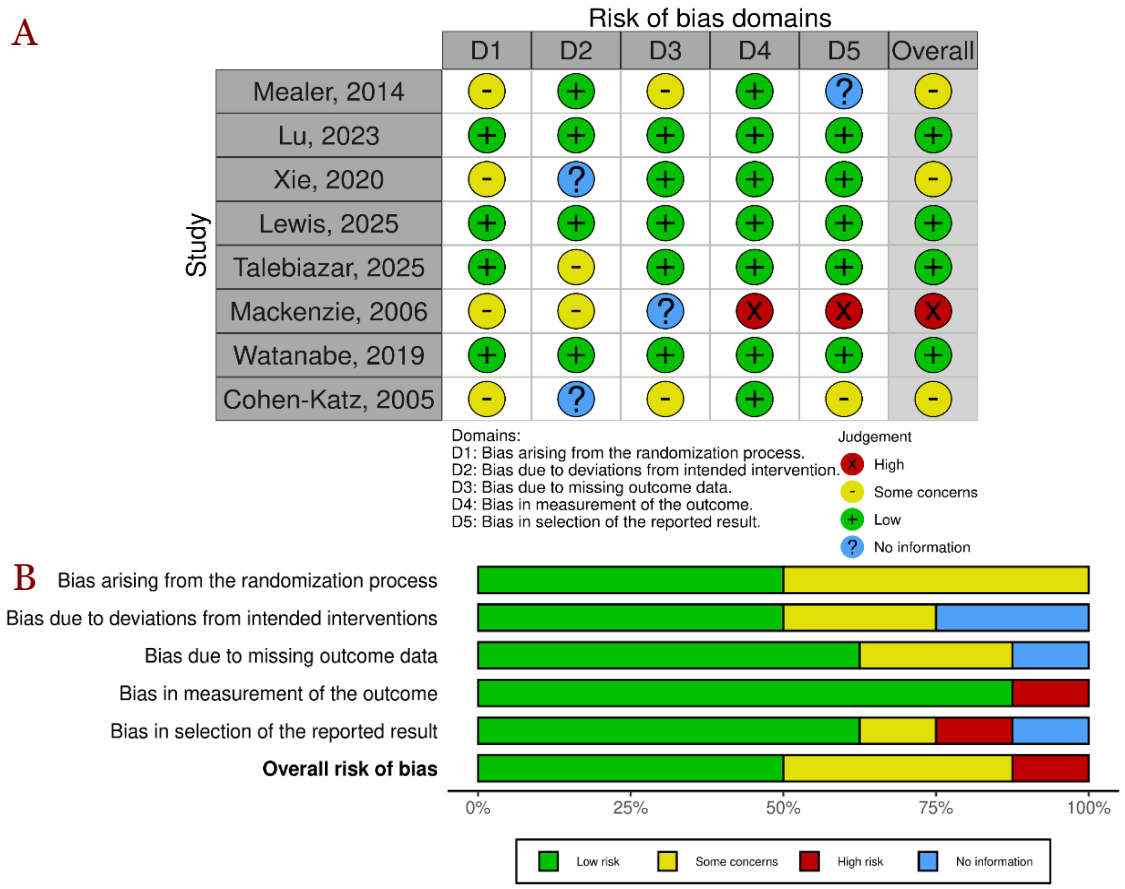

Figure 2. Visual summary of risk of bias: (A) traffic light plot and (B) weighted bar plot.

Summaries of the included studies

This systematic review and meta-analysis incorporated eight randomized controlled trials published between 2005 and 2025, with a cumulative sample size of 468 participants. The key characteristics of the included studies are delineated in **Table 1**. The studies were conducted across six countries: three in the United States [13,15,18], two in China [12,16], and one each in Japan [14], Canada [19], and Iran [17]. The participant populations were predominantly nurses, including those working in intensive care units (n=3) [12,15-16], emergency departments (n=1) [17], and general hospital settings (n=2) [13-14]. Two studies enrolled mixed cohorts of nurses or allied health staff [18-19].

The intervention in seven studies was based on the MBSR protocol. The primary outcome, burnout, was assessed using the MBI. One study evaluated a hybrid intervention integrating MBSR with psilocybin-assisted psychotherapy [13], while another implemented a tailored mindfulness program derived from MBSR, Mindfulness-Based Cognitive Therapy, and Acceptance and Commitment Therapy. The intervention duration varied considerably, ranging from 4 weeks [12,19] to 52 weeks [14], although the 8-week model was most frequently employed [13,16-17]. The standard delivery format consisted of facilitator-led, in-person group sessions, typically supplemented with recommended daily home practice.

Table 1. Summaries of the included studies

Author, year	Country	I (n)	C (n)	Population setting	Mean age±SD (I/C)	Female (%)	Intervention type	Frequency	Duration	Delivery method	Comparator	Outcome measures
Mealer, 2014 [15]	USA	13	14	ICU nurses	NI/NI	92/86	MBSR, CBT, expressive writing, exercise, counselling	MBSR ≥3×/week (15 min); Exercise ≥3×/week (30–45 min); Weekly writing	12 weeks	In-person 2-day workshop + ongoing home practice + REDCap monitoring	Waitlist (no intervention)	MBI-HSS
Lu, 2023 [12]	China	40	30	ICU nurses	27.79±3.38	92.2	MBSR	2×/week	4 weeks	Face-to-face group sessions led by trained MBSR facilitator	Psycho-educational group (WeChat health promotion)	CES-D; FFMQ; MBI-HSS; PANAS; SAS; SWLS
Xie, 2020 [16]	China	53	53	ICU nurses	27.96±4.9/ 27.4±3.9	100	Mindfulness-Based Intervention for Burnout (MBIB; based on MBSR, MBCT, ACT, loving-kindness, compassion meditation)	1×/week + home practice 5×/week	8 weeks	In-person group sessions led by trained counsellor (>5 years of experience)	Education-Based (EB) group	AAQ-II; MAAS; MBI;
Lewis, 2025 [13]	USA	13	12	Physicians and nurses	47.4 ±10.9/ 40.4 ±8.4	92/50	MBSR + Psilocybin-assisted psychotherapy (PAP)	1×/week	8 weeks	Group format; certified MBSR instructor + therapist-supported psilocybin dosing (25 mg)	MBSR-only	DS-II; MBI-HSS-MP; PCL-5; QIDS-SR-16; WCS
Talebiazar, 2025 [17]	Iran	30	30	Emergency room nurses	30.73±5.98/ 29.03±4.13	53.3/50	MBSR	1×/week	8 weeks	Group-based, in-person (2–2.5 h/session), educational materials + home practice compact disk	Usual care	MBI; NSS
Mackenzie, 2006 [19]	Canada	16	14	Nurses & nurse aides	48.6±6.5/ 44.8±8.2	93.8/100	MBSR	1×/week	4 weeks	Group-based; 4×30-min sessions; guided meditation, psychoeducation,	Waitlist	JSS; MBI; SRDI; SOC; SWLS;

Author, year	Country	I (n)	C (n)	Population setting	Mean age±SD (I/C)	Female (%)	Intervention type	Frequency	Duration	Delivery method	Comparator	Outcome measures
										daily home practice (10 min/day, 5 days/week) using CD/manual		
Watanabe, 2019 [14]	Japan	40	40	Junior hospital nurses	30.2±9.0/ 30.0±7.9	100	Brief Mindfulness-Based Stress Management Program (adapted from MBSR)	1×/week	52 weeks	Individual sessions with senior nurses trained in the manual; real-world hospital setting	Psychoeducation leaflet	EQ-5D; GAD-7; HADS; ISI; MBI; PHQ; WHO-HPQ
Cohen-Katz, 2005 [18]	USA	12	13	Nurses and allied healthcare staff	Mean age 46 years (range 32–60)	100	MBSR	1x/week + home practice 5x/week	8 weeks	Group, in-person; 2.5-h sessions weekly + 6-h day retreat; daily home practice (6 days/week) with guided CD	Wait-list control	BSI; MAAS; MBI

ACT: Acceptance and Commitment Therapy; BSI: Brief Symptom Inventory; C: Control group; CBT: Cognitive Behavioral Therapy; CES-D: Center for Epidemiologic Studies Depression Scale; DASS: Depression Anxiety Stress Scales; DS-II: Beck Depression Inventory-II; EQ-5D: EuroQol 5-Dimension; FFMQ: Five Facet Mindfulness Questionnaire; GAD-7: Generalized Anxiety Disorder-7; HADS: Hospital Anxiety and Depression Scale; I: Intervention group; I/C: Intervention/control group; ISI: Insomnia Severity Index; JSS: Job Satisfaction Scale; MAAS: Mindful Attention Awareness Scale; MBI: Maslach Burnout Inventory; MBI-HSS: Maslach Burnout Inventory–Human Services Survey; MBI-HSS-MP: Maslach Burnout Inventory–Human Services Survey for Medical Personnel; MBCT: Mindfulness-Based Cognitive Therapy; MBSR: Mindfulness-Based Stress Reduction; NSS: Nursing Stress Scale; PANAS: Positive and Negative Affect Schedule; PCL-5: PTSD Checklist for DSM-5; PHQ: Patient Health Questionnaire; QIDS-SR-16: Quick Inventory of Depressive Symptomatology–Self-Report; SAS: Self-Rating Anxiety Scale; SOC: Sense of Coherence Scale; SRDI: Smith Relaxation Dispositions Inventory; SWLS: Satisfaction With Life Scale; WCS: Workplace Compassion Scale; WHO-HPQ: World Health Organization Health and Work Performance Questionnaire.

The timing of outcome assessment demonstrated significant heterogeneity. Follow-up measurements were conducted at various time points post-intervention, ranging from as early as 2 weeks to as long as 52 weeks (one year). Several studies employed multiple follow-up assessments; for instance, measurements were commonly taken at the end of the intervention (e.g., 4 or 8 weeks), with subsequent evaluations at 3 months, 6 months, and in one case, 12 months [13]. This design provides valuable longitudinal data on the trajectory of intervention effects.

Comparator groups were similarly heterogeneous. Four studies utilized a waitlist control or usual care [15,17-19], two employed active controls (psycho-educational or education-based groups) [12,16], one provided a mental health leaflet [13], and one used a standard MBSR group as a control for a novel intervention [13].

Effect of mindfulness-based intervention on emotional exhaustion

The efficacy of mindfulness-based interventions in reducing emotional exhaustion among nurses was found to be significant yet time-dependent. The most substantial and consistent benefits were observed in the short term. Analysis of four trials within eight weeks post-intervention demonstrated a strong reduction in exhaustion (MD: -7.00, 95%CI: -8.92 to -5.07), with no heterogeneity (I^2=0%), indicating a robust and uniform effect across diverse settings immediately following the programs (**Figure 3**).

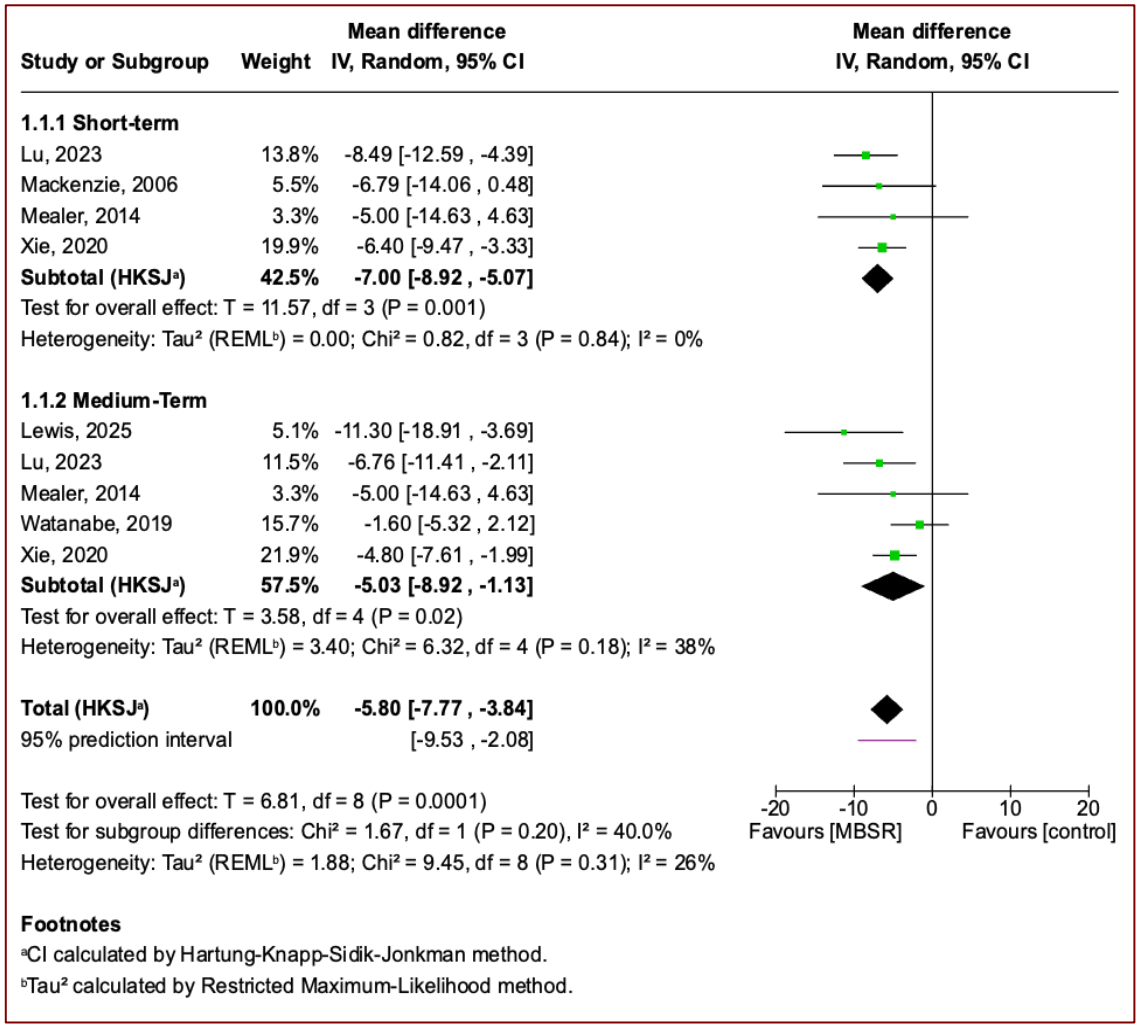

Figure 3. Forest plot of the short-, medium-, and long-term effects of mindfulness-based interventions on emotional exhaustion among nurses, expressed as pooled mean differences with 95% confidence intervals. Negative mean differences favor the intervention group, indicating lower emotional exhaustion scores compared with the control group.

This effect, however, showed a predictable attenuation over time. At the medium-term follow-up (13 weeks to 6 months), the pooled results from five studies confirmed a significant but diminished benefit (MD: -5.03, 95%CI: -8.92 to -1.13) (**Figure 3**). The emergence of moderate heterogeneity (I^2=38%) at this stage suggests that the longer-term sustainability of these improvements is more variable, likely influenced by contextual factors such as workplace support or individual adherence to practice.

On the other hand, the long-term trajectory for emotional exhaustion shows a clear pattern of diminishing returns. In one trial, the intervention group's emotional exhaustion scores worsened from a baseline of 21.7 to 24.3 at 26 weeks, while the control group's scores remained relatively stable.[13] By the 52-week follow-up, the scores in both groups converged (22.6 for intervention vs. 22.8 for control). This pattern indicates that without maintenance strategies, even initial improvements in emotional exhaustion are unlikely to be preserved long-term.

Consequently, the overall analysis confirmed a clinically meaningful net effect (MD: -5.80, 95%CI: -7.77 to -3.84) (**Figure 3**). The low overall heterogeneity (I^2=26%) reinforces that mindfulness-based interventions are a generally effective approach for mitigating EE, even as the magnitude of the benefit evolves over time.

Effect of mindfulness-based intervention on depersonalization

Mindfulness-based interventions significantly reduced depersonalization among nurses overall (MD: -2.71, 95%CI: -4.25 to -1.16) (**Figure 4**). However, this benefit was inconsistent across studies, as evidenced by substantial heterogeneity (I^2=70%) and a prediction interval crossing the null (-7.35, 1.93). The effect varied considerably over time. Immediate-term results (2 to 4 weeks) showed a strong but non-significant trend (MD: -3.23, 95%CI: -7.12 to 0.65). By medium-term follow-up (13 weeks to 6 months), the effect remained uncertain (MD: -2.71, 95%CI: -6.05 to 0.64; I^2=83%). Most importantly, all long-term studies (26 to 52 weeks) consistently showed no sustained benefit (MD: -1.35, 95%CI: -6.51 to 3.81; I^2=0%). This pattern shows that while mindfulness interventions can initially reduce depersonalization, these effects are inconsistent across different programs and do not appear to be maintained over time (**Figure 4**).

Effect of mindfulness-based intervention on personal accomplishment

In contrast to the clear benefits observed for emotional exhaustion, mindfulness-based interventions demonstrated no significant overall effect on personal accomplishment (MD: -0.53, 95%CI: -2.95 to 1.88) (**Figure 5**). This null finding was compounded by extreme heterogeneity (I^2=88%). This inconsistency was evident across all timeframes. In the immediate term (2 to 4 weeks), the overall effect was non-significant and highly variable (MD: 1.52, 95%CI: -4.62 to 7.67; I^2: 75%). The medium-term (8 weeks to 6 months) results further reinforced this pattern, showing no clear effect (MD: -2.47, 95%CI: -7.01 to 2.07; I^2=90%). By the long-term (26 to 52 weeks), the data consistently converged on a null effect (MD: 0.22, 95%CI: -7.36 to 7.80), confirming the absence of any sustained benefit. The progression from highly variable short-term results to a consistent long-term null effect, without significant subgroup differences (p=0.26), indicates that mindfulness training does not reliably enhance nurses' sense of personal achievement, regardless of the intervention duration or follow-up timing (**Figure 5**).

Publication bias

The funnel plot shows no significant publication bias for depersonalization outcomes. Study points are distributed symmetrically around the null effect line (MD=0), with no obvious gaps or asymmetry. This pattern holds true across all follow-up periods - short, medium, and long-term. The symmetrical distribution suggests all relevant studies, including those with non-significant results, are likely included in this meta-analysis. Therefore, the conclusion that the intervention has no significant effect on depersonalization appears reliable and not substantially influenced by publication bias (**Figure 6**).

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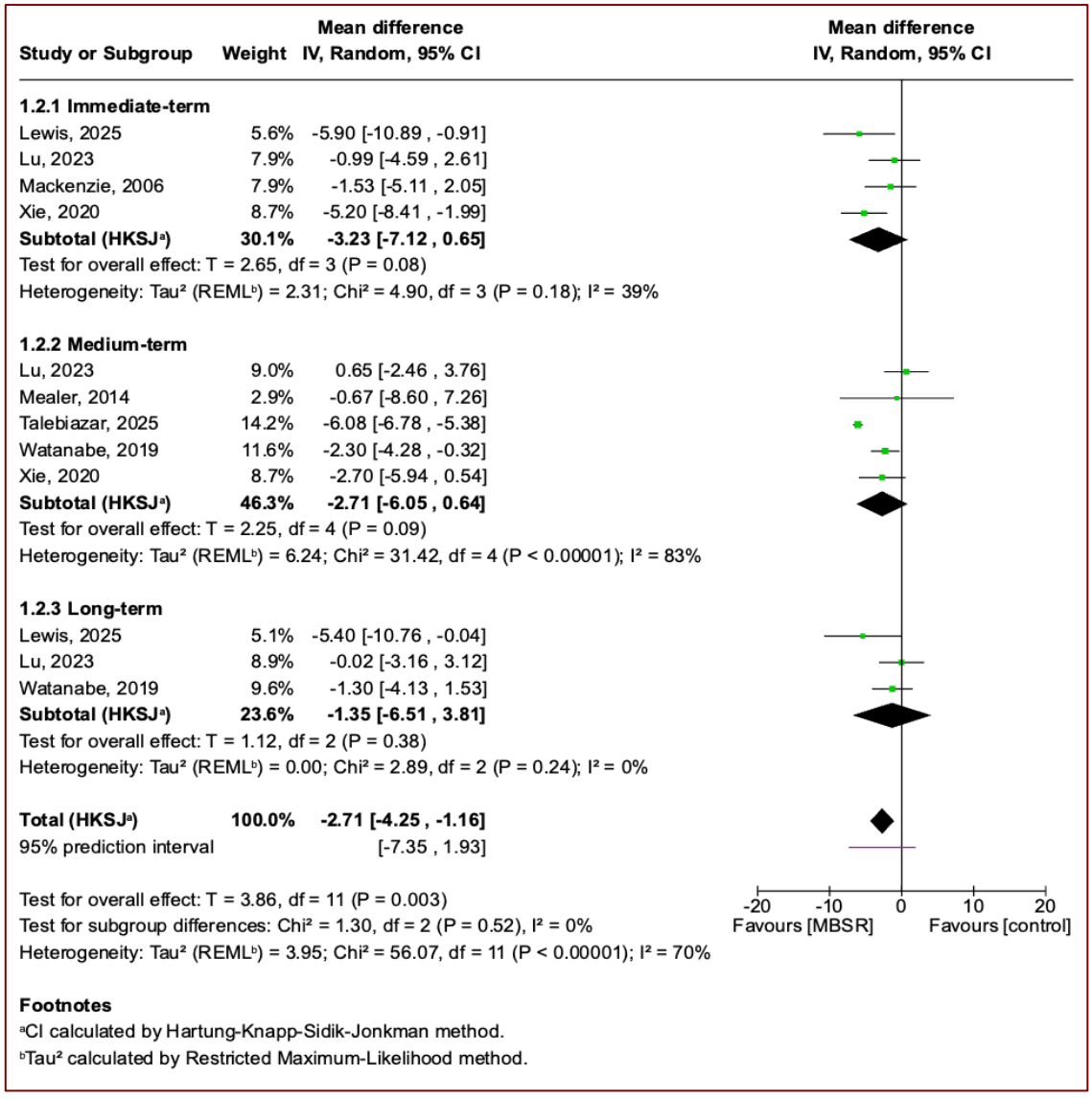

Figure 4. Forest plot of the short-, medium-, and long-term effects of mindfulness-based interventions on depersonalization among nurses, expressed as pooled mean differences with 95% confidence intervals. Negative mean differences favor the intervention group, indicating lower depersonalization scores compared with the control group.

Discussion

This systematic review provides evidence that mindfulness-based interventions, particularly MBSR, demonstrate significant but dimension-specific effectiveness in reducing burnout among nurses compared with control conditions. The observed pattern of effects—strongest for emotional exhaustion, moderate for depersonalization, and minimal for personal accomplishment—aligns with the broader literature suggesting that mindfulness primarily targets affective and stress-related components of burnout rather than cognitive-evaluative domains of professional efficacy [20-21].

The most consistent and clinically meaningful effect was observed for emotional exhaustion. The pooled reduction (MD: -5.80) supports prior meta-analytic findings that mindfulness interventions are particularly effective in alleviating emotional fatigue among healthcare professionals [22-23,24]. This effect is likely mediated through improved emotional regulation,

attentional control, and stress reactivity, as demonstrated in workplace-based mindfulness research [25-26]. Moreover, the superiority of MBSR over various control conditions suggests that its benefits extend beyond non-specific effects such as social interaction or general support [27]. Similar findings have been reported across diverse healthcare populations, reinforcing the role of mindfulness as a targeted intervention for emotional depletion [28-29]. The consistency of these findings strengthens the argument that emotional exhaustion is the most responsive burnout dimension to mindfulness-based approaches [30-31].

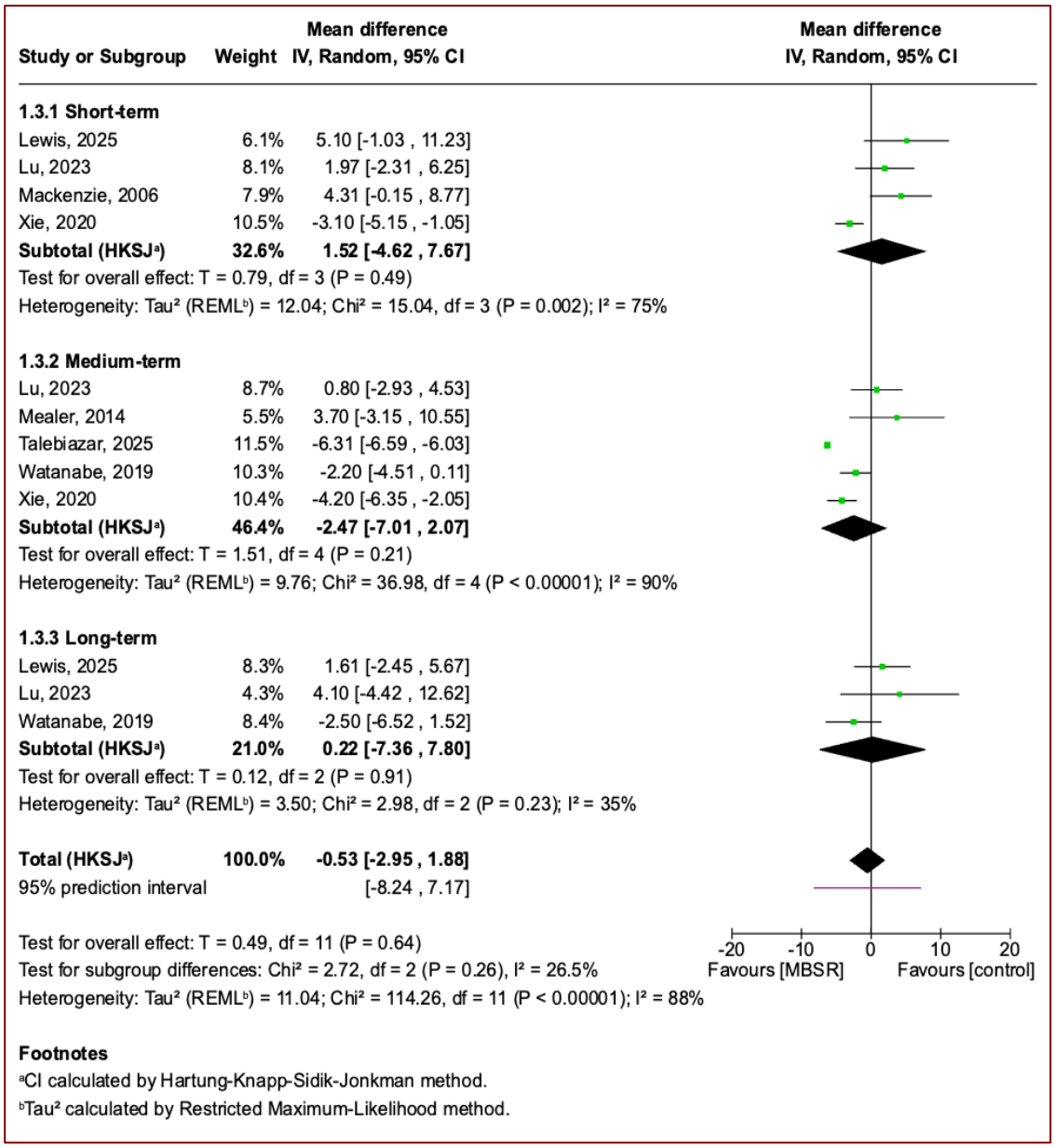

Figure 5. Forest plot of the short-, medium-, and long-term effects of mindfulness-based interventions on personal accomplishment among nurses, expressed as pooled mean differences with 95% confidence intervals. Positive mean differences favor the intervention group, indicating higher personal accomplishment scores compared with the control group.

In contrast, the effect of mindfulness interventions on depersonalization was more modest and heterogeneous. While overall reductions were observed, the variability across studies suggests that depersonalization may be influenced by additional contextual and interpersonal factors beyond individual psychological regulation. Previous reviews have similarly reported smaller and less consistent effects of mindfulness on depersonalization compared with emotional exhaustion [23,27]. One plausible explanation is that depersonalization reflects relational and organizational dynamics, such as patient load, workplace culture, and interpersonal stressors,

which may not be fully addressed by individual-level interventions alone [27]. Nevertheless, mindfulness may still contribute indirectly by enhancing empathy and compassion, particularly when interventions incorporate compassion-focused components [29].

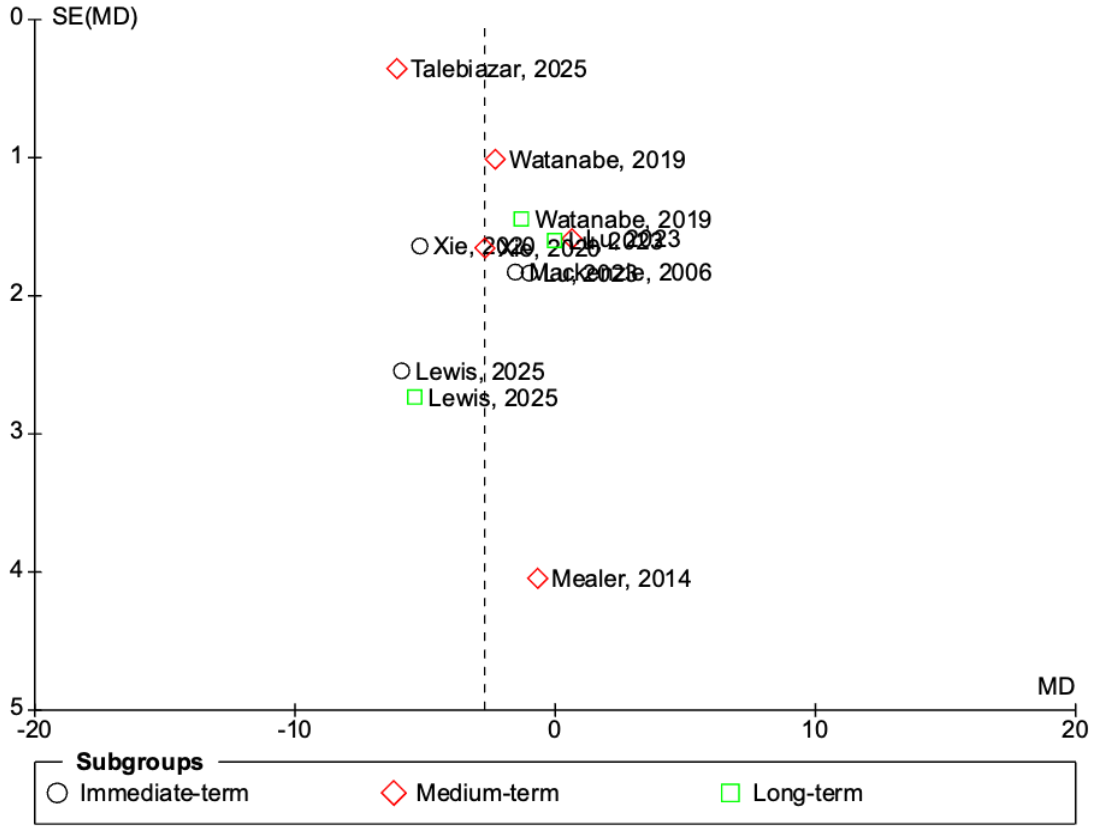

Figure 6. Funnel plot assessing publication bias for depersonalization outcomes among nurses receiving mindfulness-based interventions. Each point represents an individual study plotted according to its mean difference (MD) on the horizontal axis and standard error (SE) on the vertical axis. Studies are stratified by follow-up period: immediate-term (circles), medium-term (diamonds), and long-term (squares). The vertical dashed line indicates the pooled effect estimate. Symmetry of the plot suggests the absence of substantial publication bias, whereas asymmetry may indicate potential small-study effects or reporting bias.

Regarding personal accomplishment, the absence of a significant effect highlights a critical limitation of mindfulness-based interventions. This finding is consistent with previous meta-analyses and systematic reviews demonstrating that improvements in professional efficacy are less responsive to mindfulness training [20,26]. Personal accomplishment is more closely associated with structural and organizational factors, including recognition, career development, and workplace autonomy, rather than individual stress management alone [30]. Therefore, while mindfulness may improve internal coping mechanisms, it does not necessarily translate into enhanced perceptions of professional success without concurrent organizational support. This reinforces the need for multi-level interventions that integrate both individual and system-level strategies to address burnout comprehensively. The type of control group emerged as an important determinant of effect size. Studies utilizing passive controls, such as waitlist groups, tended to report larger effects, whereas those employing active controls showed more conservative estimates. This pattern is consistent with previous meta-analytic findings in mindfulness research, where the magnitude of intervention effects is influenced by the rigor of the comparator condition [23,25]. Importantly, the persistence of significant effects for emotional exhaustion even against active controls provides strong evidence for the specific therapeutic benefits of mindfulness interventions beyond placebo or attention effects.

Intervention characteristics also played a crucial role in determining effectiveness. Standardized MBSR programs, typically delivered over 8 weeks with structured group sessions and home practice, consistently demonstrated stronger outcomes compared with abbreviated or

less structured formats. This finding is supported by prior literature emphasizing the importance of intervention fidelity, adherence, and adequate dosage in achieving meaningful outcomes [22,30]. Additionally, interventions incorporating broader psychological components, such as acceptance and compassion, may enhance effectiveness, particularly for more complex dimensions of burnout [29,33]. Conversely, shorter or less intensive interventions, while more feasible in clinical settings, may yield diminished effects, as suggested by previous studies on brief mindfulness practices [34-35].

A key finding of this review is the temporal decline in intervention effectiveness. While significant short-term improvements were observed, particularly for emotional exhaustion, these effects attenuated over time and were largely absent at long-term follow-up. This pattern is consistent with existing evidence suggesting that the benefits of mindfulness interventions may not be sustained without ongoing practice or reinforcement [33,34]. The transient nature of these effects indicates that MBSR may function more effectively as an acute intervention rather than a long-term solution unless supported by maintenance strategies such as booster sessions or integration into routine clinical practice. Previous studies have similarly highlighted the importance of continued engagement and organizational support in sustaining mindfulness-related benefits [31,35]. From a broader perspective, the findings of this review are consistent with the growing body of evidence supporting mindfulness as an effective intervention for improving psychological well-being and reducing stress among healthcare professionals [23,26,27]. However, they also highlight important limitations in its scope, particularly in addressing structural determinants of burnout. As such, mindfulness should be viewed as one component of a comprehensive burnout management strategy rather than a standalone solution.

Despite these strengths, several limitations should be acknowledged. First, the relatively small number of included studies limits the statistical power of subgroup analyses and the detection of publication bias. Second, substantial heterogeneity, particularly for depersonalization and personal accomplishment, may reflect differences in intervention design, duration, and study populations. Third, the reliance on self-reported measures, primarily the Maslach Burnout Inventory, introduces the potential for reporting bias. Fourth, variations in intervention fidelity and adherence across studies may have influenced outcomes, as highlighted in previous methodological reviews. The limited availability of long-term follow-up data restricts conclusions regarding the durability of mindfulness effects, underscoring the need for future research with extended evaluation periods and standardized intervention protocols.

Conclusion

Mindfulness-based interventions, particularly MBSR, provide a potent solution to nurse burnout. They offer a robust and reliable short-term reduction in emotional exhaustion, a more variable effect on depersonalization, and no significant impact on personal accomplishment. Critically, these benefits are often not sustained, indicating that while mindfulness is an effective acute intervention, it cannot be a standalone long-term strategy. To achieve lasting impact, structured mindfulness programs must be integrated with systemic workplace reforms and ongoing support systems that address the root organizational causes of burnout.

Ethics approval

Not required.

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Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

Derived data supporting the findings of this study are available from the corresponding author on request.

Declaration of artificial intelligence use

This study used artificial intelligence (AI) tools solely for manuscript writing support. An AI-based language model (ChatGPT) was employed to assist with language refinement, including improving grammar, clarity, and readability. In addition, Rayyan (https://rayyan.ai/) was used as a web-based systematic review management tool for study selection and screening; however, it does not involve AI-generated content in the manuscript. All intellectual content, data analysis, interpretation of results, and conclusions were performed entirely by the authors.

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