Police Practice and Research
An International Journal

ISSN: 1561-4263 (Print) 1477-271X (Online) Journal homepage: www.tandfonline.com/journals/gppr20

The effect of mindfulness-based interventions on stress and mental health outcomes among police officers: a systematic review and meta-analysis

Jennifer Gaskin, Wendy Wen Li, Liza van Eijk & Zoltan Sarnyai

To cite this article: Jennifer Gaskin, Wendy Wen Li, Liza van Eijk & Zoltan Sarnyai (2026) The effect of mindfulness-based interventions on stress and mental health outcomes among police officers: a systematic review and meta-analysis, Police Practice and Research, 27:1, 131-163, DOI: 10.1080/15614263.2025.2506647

To link to this article: https://doi.org/10.1080/15614263.2025.2506647

POLICE PRACTICE AND RESEARCH
2026, VOL. 27, NO. 1, 131–163
https://doi.org/10.1080/15614263.2025.2506647

Routledge
Taylor & Francis Group

REVIEW ARTICLE

OPEN ACCESS Check for updates

The effect of mindfulness-based interventions on stress and mental health outcomes among police officers: a systematic review and meta-analysis

Jennifer Gaskin [a*], Wendy Wen Li [a*], Liza van Eijk [a*] and Zoltan Sarnyai [b*]

[a]College of Healthcare Sciences, James Cook University, Townsville, Australia; [b]College of Medicine and Dentistry, James Cook University, Townsville, Australia

ABSTRACT

The high demands of policing frequently result in stress, negatively impacting police officers' mental health. Mindfulness-Based Interventions (MBIs) have been increasingly recognised as effective for reducing stress in police. The aim of this systematic review and meta-analysis was to evaluate the effectiveness of MBIs on stress and mental health outcomes in police. Eleven studies were included, with a total of 967 participants. Both within- and between-group analyses demonstrated small to moderate effects of MBIs for reducing overall stress and improving mental health at post-intervention. These effects endured at follow-up for within-group comparisons. Between-group analyses showed MBIs had a small effect on overall mental health at follow-up in comparison to the control groups, however no significant effects on overall stress were detected at follow-up. MBIs may have a positive cumulative impact on stress and mental health, providing preliminary support for policing organisations to integrate MBIs into existing occupational health policy frameworks.

ARTICLE HISTORY
Received 22 January 2025
Accepted 10 May 2025

KEYWORDS
Police; stress; mental health; mindfulness interventions; meta-analysis; systematic review

Introduction

Policing is an inherently stressful occupation, where cumulative exposure to acute and chronic stressors can have significant and adverse psychological impacts on those who serve in the profession. Beyond exposure to traumatic and critical incidents, studies indicate that operational and organisational factors, such as shift work, fatigue, public scrutiny, organisational culture, and administrative pressures contribute to stress experienced by officers (Carleton et al., 2020; Drew & Williamson, 2024; Purba & Demou, 2019). As a result, police officers experience persistently higher stress levels compared to other first responders and the general population (Kyron et al., 2022; Syed et al., 2020).

Stress occurs when the body's internal stability, referred to as homeostasis, is disrupted or challenged by an actual or perceived threat, triggering the stress response (Hendry et al., 2024;

CONTACT Jennifer Gaskin jennifer.gaskin@my.jcu.edu.au College of Healthcare Sciences, James Cook University, 1 James Cook Drive, Townsville QLD 4814, Australia

*My present affiliation is Margaret Roderick Centre for Mental Health Research, James Cook University, Australia.

Supplemental data for this article can be accessed online at https://doi.org/10.1080/15614263.2025.2506647

Lu et al., 2021). While acute stress promotes adaption and is essential for successful coping, chronic stress, caused by prolonged exposure to stressors, is known to exacerbate pathogenic processes of disease (Creswell & Lindsay, 2014; Hendry et al., 2024), and is well associated with the onset of various mental health issues including depression, anxiety, post-traumatic stress disorder (PTSD), sleep disturbances, and increased alcohol use (Finlay et al., 2022; McEwen, 2017).

Empirical evidence among policing samples has demonstrated strong links between stress and psychological disorders, including anxiety, depression, and PTSD (Gershon et al., 2009; Gullon-Scott & Longstaff, 2024; Violanti et al., 2017; Zuiden et al., 2019). Increased alcohol consumption (Chopko et al., 2013; Ménard & Arter, 2013) and sleep disturbances (Garbarino et al., 2019; Violanti et al., 2017) also frequently present as comorbid conditions alongside high levels of stress among police. Stress from the daily work environment is more strongly associated with mental distress, sleep disturbances, and PTSD symptoms than exposure to traumatic and critical incidents (Drew & Williamson, 2024; Grupe, McGehee, et al., 2021). While stress can have a detrimental impact on the individual officer's psychological health and functioning, the consequences of chronic stress also permeate to policing organisations, resulting in increased absenteeism (Magnavita et al., 2013), use of excessive force (Christopher et al., 2024; Violanti et al., 2017), and premature resignation and retirement (Gullon-Scott & Longstaff, 2024), placing the organisation and community at risk. Providing officers with skills to cope with organisational and operational stressors is crucial for improving stress-related outcomes among police. Recognition of chronic stress and its detrimental impacts on the mental health of officers have prompted many policing organisations globally to prioritise and integrate interventions which are designed to reduce stress, and alleviate mental health symptoms in officers (Carleton et al., 2020; Moreno et al., 2024; Purba & Demou, 2019).

Mindfulness-based interventions (MBIs) have garnered significant scholarly attention for their potential to reduce stress and enhance mental health outcomes across various populations (Fendel et al., 2021; Gaskin et al. (in press); Li, McIntyre, et al. (2024); Ong et al. (2024); Qin et al. (2024); Sun et al. (2021); Xunlin et al. (2020). Mindfulness involves directing purposeful attention to the present moment without judgment, fostering awareness and acceptance (Kabat-Zinn, 1982, 2013). Mindfulness can be cultivated through meditation, which can reduce negative affect and reactivity (Creswell & Lindsay, 2014, Nagy et al., 2020), in turn encouraging enhanced emotional regulation and promoting adaptive coping strategies towards stressful events (Crane et al., 2017; Kabat-Zinn, 2013, 2015; Li et al., 2023). First-generation MBIs are teacher-led programs involving structured training in both formal and informal meditation practices. These interventions have been extensively researched, providing the most robust evidence in the field of stress and mental health (Crane et al., 2017). In their meta-analytic review of randomised control trials (RCTs) in a population of active military personnel and veterans, Sun et al. (2021) found a small significant effect of MBIs for reducing military-related PTSD symptoms in comparison to controls. A meta-analysis examining the effects of MBIs on the mental health of nurses revealed medium-large effects on stress, and symptoms of depression, and anxiety, in comparison to control groups (Ong et al., 2024). The effects observed in doctors, however, were small and not significant (Ong et al., 2024), suggesting the effects of MBIs may vary in different populations, and by the nature of the stressors experienced. The effectiveness of MBIs may vary significantly when applied to policing populations compared to other groups due to the unique

demands and culture of police work. Policing involves continuous exposure to traumatic, stressful, and complex situations (Phythian et al., 2023), contributing to higher rates and severity of mental health challenges than seen in the general population (Kyron et al., 2022; Syed et al., 2020). Furthermore, the occupational culture of policing, characterised by stigma towards mental health, an emphasis on stoicism, and a strong professional identity tied to high-stakes decision-making (Drew & Martin, 2021), may influence the effectiveness of MBIs (Grupe, Smith, et al., 2021). Additionally, police training often reinforces suppression and desensitisation of trauma and stress, which may present specific challenges for the integration of mindfulness practices (Grupe, Smith, et al., 2021). These factors, distinct to the policing profession, suggest the potential for heterogeneity in outcomes when comparing the impact of MBIs on police to the effects in other populations. Therefore, it is crucial to advance the understanding of the effectiveness of MBIs specifically among policing samples.

The positive effects of MBIs on stress and mental health outcomes has prompted researchers to investigate the mechanisms underlying mindfulness. Self-awareness, emotion regulation, and attention have been proposed as key psychological mechanisms underscoring the effects of MBIs (Hölzel et al., 2011; Shapiro et al., 2018; Tang et al., 2015). From a neurobiological perspective, MBIs have been shown to alter brain structure and networks, mediating the positive effects on stress and mental health. Magnetic resonance imaging (MRI) studies have demonstrated increases in grey matter concentrations across various brain regions in participants post-MBI training compared to controls (Hölzel et al., 2011; Tang et al., 2015). This suggests that the effects of meditation may involve extensive brain networks. Specifically, focused attention meditation practices are believed to engage brain regions involved in attentional control, self-regulation (Ganesan et al., 2022; Hölzel et al., 2011; Tang et al., 2015), threat and stress responses, anxiety, and other mental health symptoms (Creswell & Lindsay, 2014; Eysenck et al., 2007; Williams et al., 2024). Among the policing population, MBIs have been shown to enhance attention (Hoeve et al., 2021, Navarrete et al., 2022), and non-reactivity as well (Christopher et al., 2016, 2018). Research also suggests that MBIs can be effective for reducing physiological stress reactivity across several interrelated physiological pathways associated with chronic stress (Gallistl et al., 2020; Gamaiunova et al., 2022; Rogerson et al., 2024), including modulating activity in the hypothalamic-pituitary-adrenal (HPA) axis, the body's primary stress response system responsible for detecting stressors, releasing hormones, and facilitating both the management and recovery from stressful situations. Given the well-established link between pathological functioning of stress symptoms and adverse psychological outcomes (Finlay et al., 2022; McEwen, 2017), understanding changes in physiological stress reactivity and biomarkers of stress is an important topic of enquiry among police. Findings from a recent meta-analytic review (Rogerson et al., 2024) indicated mindfulness and meditation-based interventions were effective for altering cortisol levels (Hedge's $g = .345$, $p < .001$) in other populations. Additionally, the findings of Grasmann et al. (2023) meta-analysis assessing the effects of MBIs on biomarkers of stress in psychiatric, stressed, and healthy adults demonstrated MBIs ameliorated biological markers of stress at post-intervention, with the magnitude of effects increasing at follow-up. Biological measures of stress have been incorporated into studies to provide complimentary data for the impacts of MBIs on stress in police, with studies reporting increased short- and long-term heart rate variability (HRV; Krick

& Felfe, 2020), and significantly lower cortisol awakening response (CAR) relative to waitlist controls at three month follow-up (Grupe, Stoller, et al., 2021). The results, however, have been inconsistent, with some research indicating no significant effects of MBIs on changes in CAR (Christopher et al., 2016, 2018), hair cortisol concentrations (HCC; Grupe, Stoller, et al., 2021), or heart rate (Krick & Felfe, 2020).

A range of first-generation MBIs (Crane et al., 2017) have begun to be utilised among samples of police to examine the effects of MBIs on stress and mental health outcomes. The clinically standardised Mindfulness-Based Stress Reduction (MBSR) program (Kabat-Zinn, 1982) is a non-trauma focused group treatment which is delivered over eight weeks. Throughout the program, participants learn to attend to the present moment through a combination of didactic and experiential methods, somatic exercises, and meditation practices (Kabat-Zinn, 1982, 2013). Mindfulness-Based Resilience Training (MBRT; Christopher et al., 2016) places emphasis on normalising the effect of stress and trauma inherent to police work and integrates the context of policing and policing culture into a group-based mindfulness program. Mindfulness-based Cognitive Therapy (MBCT; Segal et al., 2002) a program which focuses on re-evaluating maladaptive thought patterns to reduce symptoms of anxiety, and depression, and other variants of MBIs have also been utilised within policing samples. Studies within policing populations have shown significant reductions in perceived, operational, and organisational stress, anxiety, depression, PTSD, and sleep disturbances following MBIs (Christopher et al., 2018; Grupe, McGehee, et al., 2021; Khatib et al., 2022; Márquez et al., 2021; Navarrete et al., 2022; Trombka et al., 2021). However, the findings across studies involving police are mixed. Christopher et al. (2018) found no significant effects of MBIs for reducing operational stress, anxiety or depression at post-intervention or follow-up relative to controls. Other studies have reported no significant reductions in organisational, and perceived stress, sleep disturbances, depression (Grupe, Stoller, et al., 2021), and alcohol use (Christopher et al., 2018) at post-intervention, as well as organisational stress, and sleep disturbances at follow-up (Christopher et al., 2018; Grupe, Stoller, et al., 2021).

While a growing number of studies have explored the effects of MBIs on stress and mental health outcomes in police, this research is still at an early stage. Moreover, the findings of the studies lack consistency, exemplifying the need to systematically examine this emergent field of research. Variability in results can be attributed to several factors, including the specific MBI protocol employed, such as duration, delivery format, or components, which can may influence outcomes (Melis et al., 2022; Moyes et al., 2022). The country of study also plays a crucial role, as cultural, societal, and systemic differences – such as attitudes toward mental health, accessibility of support services, and police organisational norms – may shape the impact of MBIs on policing populations (Grupe, Smith, et al., 2021; Kabat-Zinn, 2019). Additionally, the measures used in studies and the timing of the study can impact the results (APA, 2020). These considerations underscore the importance of context in understanding the effectiveness of MBIs among police. On this basis, this study will explore whether the effect differs across MBI protocols, country, and scales used to assess outcomes to identify potential moderators of the effect of MBIs on police stress and mental health.

There are limited reviews which provide a clear and comprehensive synthesis of the available literature. A search in Cochrane, PROSPERO and eight databases (CINAHL, Medline, PsychINFO, PubMed, EMCARE, Web of Science, SCOPUS, and Criminal

Justice Database) located one meta-analysis (Withrow et al., 2024) and one systematic review (Vadvilavičius et al., 2023) evaluating the effectiveness of MBIs among police officers. Vadvilavičius et al. (2023) systematic review suggests MBIs are useful for reducing perceived stress, and improving mental health outcomes among police, however, no meta-analysis was undertaken to quantify the effectiveness of the programs. The findings of Withrow et al. (2024) meta-analysis indicated moderate post-intervention effects of MBIs on depression (*SMD* =.56, CI 95% [.94, .19], $p = .003$), and small post-intervention effects on anxiety (*SMD* =.32, 95% CI [.64, .00], $p = .05$). The meta-analysis reported effects sizes for the outcomes of depression and anxiety, however the data utilised in the analyses was measured in the original study utilising the Negative Affect Scale, and the Psychological Strain Scale. These scales do not exclusively measure the outcomes of depression and anxiety, therefore the effects observed in the meta-analysis may not accurately reflect the effect of MBIs on depression and anxiety specifically. Moreover, the study did not quantify the effects of MBIs on officer perceived stress, nor did it extend its evaluation to the effects of MBIs on other highly prevalent mental health conditions among police, including PTSD, and alcohol use (Chopko et al., 2013; Kyron et al., 2022). Neither Vadvilavičius et al. (2023) or Withrow et al. (2024) study quantified the effect of MBIs on biological measures of stress across studies involving police. Lastly, the two existing studies did not quantify the medium- and long-term effectiveness of MBIs on stress and mental health outcomes – an essential factor in assessing the sustained efficacy and feasibility of MBIs among police. A comprehensive assessment of the effects of MBIs for attenuating stress and improving mental health in police is needed to advance and guide future research, practice and policy.

The aim of this systematic review and meta-analysis is to address these literary gaps, and to evaluate whether MBIs are effective for reducing stress (police-specific organisational and operational stress, and general perceived stress) and improving mental health outcomes (anxiety, depression, PTSD, sleep disturbances, and alcohol use) in police officers. In addition to examining the effects of MBIs on individual stress and mental health outcomes in police officers, this study also considers the complex and interconnected nature of these issues by evaluating the combined effects of MBIs on stress and mental health overall. By pooling outcomes, this approach reflects the real-world complexity of stress and mental health challenges experienced by police.

As such, the current study will answer the following research questions (RQ):

RQ1: Are mindfulness-based interventions effective for reducing stress in police officers?

RQ2: Are mindfulness-based interventions effective for reducing mental health symptoms in police officers?

Method

This systematic review and meta-analysis was registered in PROSPERO under the registration number CRD42024538639 and adhered to the PRISMA guidelines

(Preferred Reporting Items for Systematic Reviews and Meta-Analyses).

Inclusion and exclusion criteria

Inclusion criteria for the current study were quantitative studies investigating the effectiveness of mindfulness-based interventions on stress and/or mental health outcomes of depression, anxiety, PTSD, alcohol use, and sleep disturbance among sworn police officers. In regard to outcomes, restrictions were imposed to ensure the accuracy and consistency of this meta-analysis findings. Firstly, the measurement tools used in the included studies needed to specifically measure the intended outcome (Deeks et al., 2024; Murad et al., 2019). For instance, to be eligible under the outcome of depression, the measurement scale needed to be explicitly designed to assess depression, such as the Beck Depression Inventory (BDI) or the Patient Health Questionnaire-9 (PHQ-9). Secondly, the included studies were restricted to those that measured outcomes at a continuous or interval level, providing detailed and precise measurements. This approach allowed us to standardise and pool the data effectively, thereby facilitating comparability across studies (Borenstein et al., 2019; Deeks et al., 2024). Studies were also eligible for inclusion if they were published in peer-reviewed English language journals and comprise random controlled trials (RCTs), non-random controlled trials (NRCT), and single arm studies. First-generation MBIs represent the most robust evidence in the field, therefore this systematic review and meta-analysis considered studies which implemented teacher-led first-generation MBIs supporting the sustained and systematic training of mindfulness meditation practices.

The exclusion criteria were studies: 1) involving retired police or unsworn civilian employees where separate data for sworn police were not available; 2) studies which did not employ a teacher-led first wave MBI (e.g., self-paced online program/app, mindfulness-informed treatment, unstructured mindfulness programs or practices; 3) without full text; 4) case studies, thesis submissions, systematic and meta-analytic reviews, book chapters, conference presentations, and non-empirical articles (e.g., editorials, opinion pieces, reviews).

Search strategy

Eight online databases (Medline, EMCARE, Cochrane, CINAHL, PsychINFO, PubMed, SCOPUS, and Web of Science) were independently searched by JG and WL between 5th and 8th of April 2024 for articles published from the inception of each database to April 2024. The search was repeated by JG on 15 November 2024. No new articles which met inclusion criteria were identified. In addition, a search of Criminal Justice Database (ProQuest) was conducted by JG on 23 March 2025 for articles published from database inception to March 2025. No new articles meeting inclusion criteria were located in the search. Medical Subject Heading (MeSH), keywords and suggested subject terms were utilised during the search. The full search strategy utilising Cochrane's PICO search tool (Higgins et al., 2022) is presented in Tables S1-S4 of the Supplementary Materials.

Study selection

Following the removal of duplicates, the remaining articles underwent review and double screening by the first two authors. The first stage of study selection involved title and abstract screening against exclusion and inclusion criteria. All title and abstracts were independently reviewed by JG and WL and were coded using 'yes', 'no' and 'maybe'. Studies coded unanimously as 'yes', or 'maybe' were included for full text review, and studies coded unanimously as 'no' were excluded. Articles which received a nonunanimous coding were reviewed and discussed until an agreement was achieved for full-text assessment (Fisher et al., 2023; Leow et al., 2024). Each eligible full-text article was then reviewed against inclusion and exclusion criteria, and coded 'yes', 'no' and 'maybe' by both JG and WL independently. Studies unanimously coded as 'yes' were included for further assessment, and studies coded unanimously as 'no' were excluded. Articles which received a non-unanimous coding or a 'maybe' were discussed until an agreement was achieved for either inclusion or exclusion (Fisher et al., 2023; Leow et al., 2024).

The second stage of selection involved the methodological appraisal of the full text of each included article utilising the Mixed Methods Appraisal Tool (MMAT) Version 18 (Hong et al., 2019). Each full text article was appraised and coded by both JG and WL independently. The MMAT includes a set of criteria and screening questions to assess the quality of empirical studies, providing an overall quality score. Two initial questions determine if the study is empirical and suitable for appraisal using the MMAT. Two reviewers then asses the study's quality against five specific criteria. Each criterion is coded as 'Yes' (criterion met), 'No' (criterion not met), or 'Can't tell' (insufficient information). Cohen's Kappa (k) was used to identify the inter-rater agreement indices, where values of k represented poor agreement ($k < .20$), fair agreement ($k = .40$), moderate agreement ($k = .60$), substantial agreement ($k > .80$), and perfect agreement (Cohen, 1968). Studies rated as > .40 were automatically included (Landis & Koch, 1977; M. Li et al., 2023; McHugh, 2012). As suggested by the manual of MMAT (Hong et al., 2018), studies with low methodological quality were not automatically removed, they instead were discussed and re-evaluated. Two studies (Khatib et al., 2022; Krick & Felfe, 2020) received inter-rater agreement value $k < .40$. After discussion between JG and WL, it was agreed that both studies would be included for data extraction. Table S5 in the Supplementary Materials displays the results of the MMAT and inter-rater agreement indices.

Data extraction

Data was extracted from eligible studies utilising an Excel spreadsheet to extract first author, citation, publishing year, country of the study, sample size, demographics, study design, MBI protocol, control protocol, measures and findings of subjective stress, biological stress, and mental health variables. Study data was extracted independently by JG and WL and then reviewed by each other to assess the accuracy of data extraction. Any inaccuracies were discussed and rectified between JG and WL.

The extracted data was assessed and coded independently by JG and WL to evaluate if the interpretation of the findings presented in the study was supported by the results of the statistical analysis. Coding of 'unsupported'(= 0), 'credible'(= .5), or 'unequivocal'

(= 1) was used. An agreement index for each article was then calculated ($(N_{unequivocal} + N_{credible})/N_{reviewers}$). Articles were eligible for data synthesis if the agreement index was higher than 0.80 (Astridge et al., 2023; Freedman et al., 2024; Li, Nannestad, et al., 2024). All studies achieved agreement indices higher than 0.80 therefore all studies were included in the meta-analysis.

Data synthesis

Meta-analysis and narrative synthesis were utilised to synthesise the data. Meta-analysis was performed utilising Comprehensive Meta-Analysis v4 (CMA v4; Borenstein et al., 2019).

Individual effect sizes were calculated using Hedge's *g* in CMA. Hedges' g was utilised for this study due to its ability to correct for small sample sizes and its robustness in handling heterogeneity in both sample characteristics and measurement scales, ensuring accurate and standardised effect size estimates (Cohen, 1977; Hedges, 2019). To calculate the overall effect size across studies, a random effects model was used (Borenstein et al., 2021; Hedges, 2019). Included studies reported data on several outcome variables based on the same participants, therefore, pooled effect sizes were calculated using a multiple outcomes model, accounting for correlations between different outcomes within the same study in the modelling approach (Borenstein, 2019; Borenstein et al., 2021). The correlations between different outcomes within the same study were accounted for by assuming a correlation of $r = 0.5$ (Wampold et al., 1997; White et al., 2019; Wood et al., 2023).

Within-group comparisons included data of the MBI intervention group of included studies. Within-group mean differences were calculated by deducting the baseline means from post-intervention and follow-up means. Hedges' *g* was calculated using CMA, which automatically computed the effect sizes based on the input means, standard deviations, and sample sizes.

While within-group comparisons have limitations, due to the infancy of research on MBIs for police officers, within-group comparisons were conducted and included in this study. Conducting RCTs in policing is often challenging due to high costs and logistical complexities which may not be feasible in all settings and countries. Within-group comparisons provide valuable evidence for future studies using single-arm designs, crucial for extending the evidence base for MBIs' feasibility and effectiveness across different countries and police subpopulations. These comparisons allow for examining intervention efficacy in real-world contexts where control groups may not be ethical or feasible. Given the infancy of MBI research in policing, within-group comparisons offer valuable preliminary evidence, helping to build a foundation for future, more extensive RCTs. This approach ensures that even in the absence of RCTs, valuable insights can be gained, by allowing the assessment of changes over time within the same group (Deeks et al., 2024; Evans, 2010).

For between-group analyses RCTs and NCRTs were included to provide a comprehensive assessment of the available evidence, where an MBI intervention group and an inactive control group (waitlist [WL] or treatment as usual) were employed. Incorporating both RCTs and NRCTs enhances the generalisability findings and allowed sensitivity analyses to be performed to assess the robustness of the results (Borenstein et al., 2021; Mei et al., 2024). The group differences were calculated by deducting the mean

scores of the outcome variable of the control group at post-intervention and follow up, from the mean scores of the MBI intervention group. Individual effect sizes were first calculated using Hedge's *g* in CMA, and then a random effects model was used to pool effect size across studies. Two studies (Grupe, McGehee, et al., 2021, 2021) reported multiple effect sizes for sleep outcomes (disturbances and quality), which were not independent, therefore a two-level meta-analysis was utilised (Li, Nannestad, et al., 2024). First, employing a fixed effect model, a synthetic effect size was computed for the studies (Tables S6-S9). Next, the synthetic effect was input into the main meta-analysis to compute the overall effect size across studies using the random effects model (Borenstein et al., 2021; Hedges, 2019).

To report pooled effect sizes, Hedges' *g* with 95% confidence interval (95% CI) was utilised, with values of 0.20, 0.50, and 0.80 representing small, medium, and large effect sizes, respectively. Between study heterogeneity was assessed with I^2 statistic. The magnitude of heterogeneity was categorised as low, medium, and high represented by $I^2 = 25$, 50, and 75 or greater (Borenstein, 2019). If medium or high heterogeneity was detected, meta-regression was administered to determine which factors contributed to the heterogeneity. Publication bias was evaluated using multiple methods, including Egger's regression test (Egger et al., 1997), which indicated bias when significant p-values were observed (Borenstein, 2019). Additionally, Rosenthal's failsafe N (Rosenthal, 1979), Duval and Tweedie's trim-and-fill method (Duval & Tweedie, 2000), and the visual inspection of funnel plots were employed to further assess publication bias and to identify missing studies.

Assessing risk of bias in included studies

An assessment of the risk of bias (ROB) was performed independently by JG and WL using the MMAT, where 'yes' was coded as 1, 'can't tell' coded as 0.5, and 'no' coded as 0 (Emary et al., 2022) for each of the seven MMAT assessment items. The maximum score for each article in this study was 14 (two raters; JG and WL). The ROB index was calculated as a percentage of the maximum score, where > 0.80 = low risk, 0.40–0.79 = medium risk, and <0.40 = high risk (Wigg et al., 2024). For all included studies, the overall risk of bias was rated as low.

Results

As shown in the PRISMA diagram (Figure 1), 11 studies were included in the systematic review, and ten studies in the meta-analysis. Four articles (Imhoff-Smith & Grupe, 2023; Kaplan et al., 2020; Rehder et al., 2021; Ribeiro et al., 2020) were secondary analyses of two primary studies (Christopher et al., 2018; Grupe, Stoller, et al., 2021) utilising the same participants and outcome variables as the primary studies, therefore were regarded as the same study. Study data were requested from the authors of three studies (Christopher et al., 2024; Grupe, Stoller, et al., 2021; Khatib et al., 2022) for inclusion in the meta-analysis.

Summary of included studies

Of the included studies, six were conducted in the U.S.A. ($n = 6$), Spain ($n = 2$), Netherlands ($n = 1$), Germany ($n = 1$), and Brazil ($n = 1$). The combined sample size

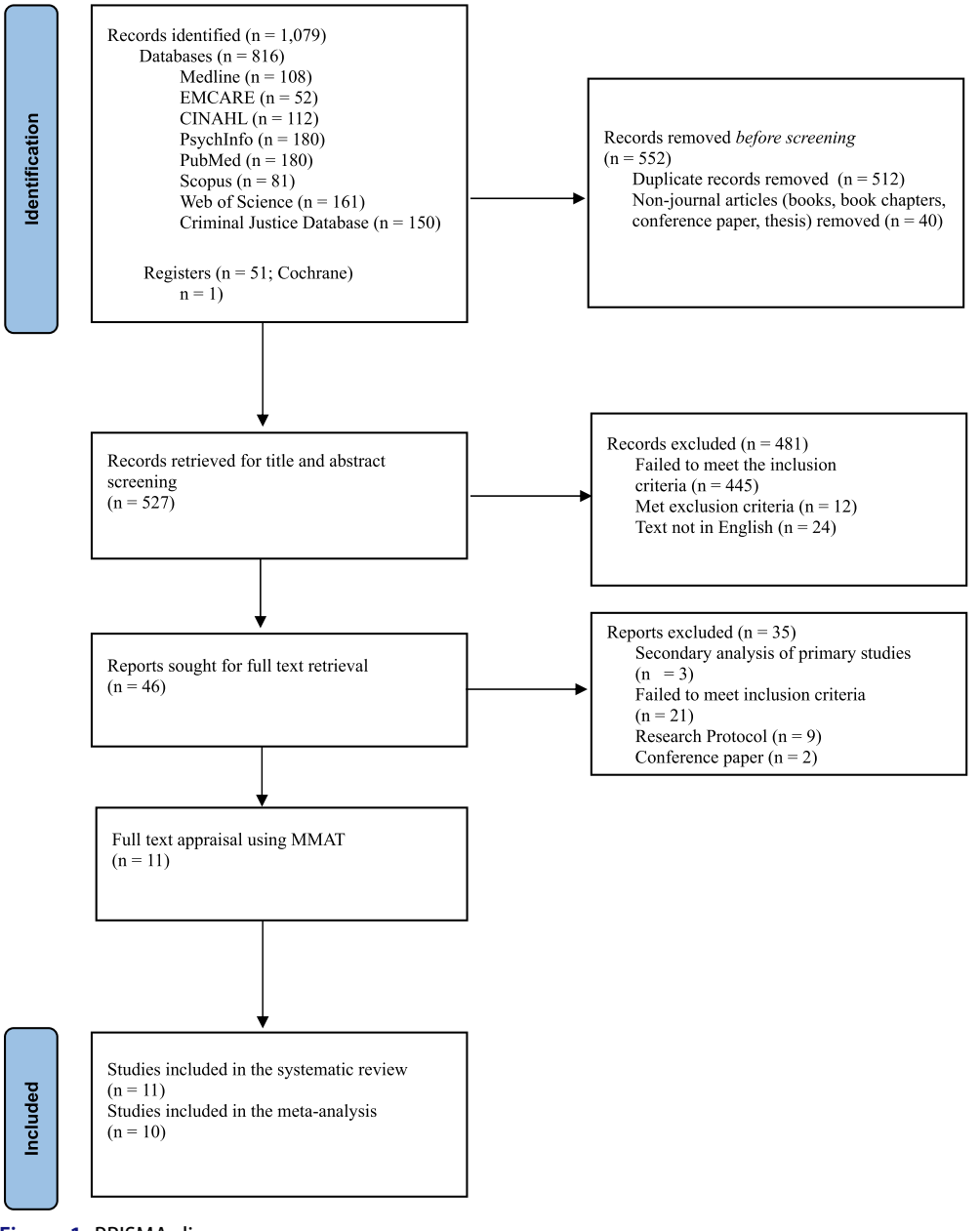


Figure 1. PRISMA diagram.

included 967 participants, with sample sizes of individual studies ranging from 20 to 267. Male participants made up 61% ($n = 609$), and sample age ranged from 18 to 65 years.

Of the included studies, one study employed clinically standardised MBSR (Khatib et al., 2022), three implemented MBRT (Christopher et al., 2016, 2018; Khatib et al., 2022), two utilised a low-dose MBSR protocol (Krick & Felfe, 2020; Márquez et al., 2021), and the remaining delivered other MBI variants (Christopher et al., 2024; Grupe, McGehee, et al., 2021; Grupe, Stoller, et al.,

2021; Hoeve et al., 2021; Khatib et al., 2022; Navarrete et al., 2022; Trombka et al., 2021). Two studies reported the MBI was delivered online (Christopher et al., 2024; Khatib et al., 2022). A summary of the characteristics of the included studies is presented in Table 1.

Analysis of RQ1

RQ1: Are mindfulness-based interventions effective for reducing stress in police officers?

Between-group effects comparing MBI and control groups at post-intervention

The forest plot of the analysis is displayed in Figure 2. A small significant effect of MBIs on overall stress favouring treatment groups compared to the control groups was found (Hedge's $g = -.198$, 95% CI [−.353, −.043], $p = .012$). Small to moderate effects of MBIs for individual stress outcomes of operational stress (Hedge's $g = -.104$, 95% CI [−.398, .190], $p = .488$), organisational stress (Hedge's $g = -.268$, 95% CI [−.688, .152], $p = .210$), perceived stress (Hedge's $g = .170$, 95% CI [−.448, −108], $p = .231$), and cortisol awakening response Hedge's $g = -.289$, 95% CI [−.584, .007], $p = .055$) were found, however significance was not reached.

The I^2 statistics indicated an absence of heterogeneity for cortisol awakening response ($I^2 = .000$, $p = .695$), operational stress ($I^2 = .000$, $p = .945$), and perceived stress ($I^2 = .000$, $p = .529$), and low but non-significant heterogeneity for organisational stress ($I^2 = 46.641$, $p = .171$). Meta-regression was therefore not performed. Publication bias was not detected, indicated by non-significance of Egger's regression test (intercept = −.266, $t = .205$, $df = 7$, $p = .843$). Inspection of the funnel plots, and Duval and Tweedie's trim-and-fill analysis revealed one missing study with the observed effect altered from Hedge's $g = -.198$, 95% CI [−.353, −.043] to Hedge's $g = -.217$, 95% CI [−.358, −.076], however the magnitude and directions of the effect remained unchanged. The funnel plot is presented in Figure S1 of the Supplementary Materials.

Between-group effects comparing MBI and control groups at follow-up

As displayed in Figure 3, the overall summary effect of MBIs on stress small (Hedge's $g = -.094$, 95% CI [−.282, .094], $p = .327$), but did not reach significance. The pooled effect sizes indicated small effects of MBIs on operational stress (Hedge's $g = -.033$, 95% CI [−.327, .261], $p = .825$), organisational stress (Hedge's $g = -.079$, 95% CI [−.373, .215], $p = .597$), and perceived stress (Hedge's $g = -.265$, 95% CI [−.706, .176], $p = .239$), however the effects were not significant in comparison to the control groups at follow-up.

An absence of heterogeneity was indicated by a zero I^2 statistic for both operational stress ($p = .930$), and organisational stress ($p = .722$), and low but non-significant heterogeneity was found for perceived stress ($I^2 = 42.060$, $p = .189$), therefore meta-regression was not performed. Egger's regression test did not detect publication bias (intercept = 1.288, $t = .622$, $df = 4$, $p = .568$). Duval and Tweedie's trim-and-fill analysis and inspection of the imputed funnel plot identified one missing study, which increased the effect from Hedge's $g = -.094$, 95% CI [−.282, .094] to Hedge's $g = -.148$, 95% CI [−.314, .018],

Table 1. Summary of the characteristics of included studies investigating mindfulness-based interventions among police officers.

Author	Country	Study Design	MBI Details	Participant Demographics	Measures
Christopher et al. (2018)	USA	RCT A1 = MBRT A2 = WL	MBRT 8 weeks 2 hr weekly sessions 6 hr retreat week 7 Home practice activities Face-to-face delivery	$N = 61$ (Intervention group: $n = 31$; control group: $n = 30$) Age: Intervention $M = 44.73$ ($SD = 6.63$); Control $M = 43.22$ ($SD = 5.43$) Sex: 7 female; 54 male Years in job: Intervention $M = 18.50$ ($SD = 6.98$); control $M = 17.97$ ($SD = 6.69$)	PROMIS-SD PROMIS-AU PROMIS-A PROMIS-D PSQ CAR
Christopher et al. (2016)	USA	Single Arm A1 = MBRT	MBRT 8 weeks 2 hr weekly sessions 6 hr retreat week 7 Home practice activities Face-to-face delivery	$N = 62$ Age: $M = 43.76$ ($SD = 7.22$) Sex: 22 female; 40 male Years in job: $M = 13.72$ ($SD = 5.96$)	PROMIS-SD PSS PSQ CAR
Christopher et al. (2024)	USA	RCT A1 = MBRT A2 = SME A3 = WL	MBRT/Modified MBRP 8 weeks 6 hr intensive week 1 1 hr weekly sessions 4 hr retreat week 7 Home practice activities Online delivery	$N = 73$ (Intervention group 1: $n = 33$; intervention group 2: $n = 24$; control group 2: $n = 16$) Age: Intervention 1: $M = 39.57$ ($SD = 10.28$); intervention 2: $M = 38.08$ ($SD = 6.80$); control $M = 37.06$ ($SD = 10.14$) Sex: 22 female; 51 male Years in job: Intervention 1: $M = 11.82$ ($SD = 9.51$); intervention 2: $M = 10.48$ ($SD = 5.62$); control $M = 9.03$ ($SD = 9.05$)	PROMIS-SD-SF PROMIS-AU-SF PROIMIS-D-SF PROMIS-A-SF PCL-5 PSS
Grupe, McGehee, et al. (2021)	USA	Single Arm A1 = MBI	Modified MBSR/MBRT 8 weeks 2 hr weekly sessions 4 hr retreat week 7 Home practice activities Face-to-face delivery	$N = 30$ Age: $M = 38.4$ ($SD = 7.70$) Sex: 16 female; 14 male Years in job: $M = 10.80$ ($SD = 7.50$)	PSQ PSQI PCL-C PROMIS-D PROMIS-A PROMIS-SD

(*Continued*)

Table 1. (Continued).

Author	Country	Study Design	MBI Details	Participant Demographics	Measures
Grupe, Stoller, et al. (2021)	USA	RCT A1 = MBI A2 = WL	Modified MBSR/MBRT 8 weeks 2 hr weekly sessions 4 hr retreat week 7 Home practice activities Face-to-face delivery	$N = 114$ (Intervention group: $n = 57$; control group: $n = 57$) Age: Intervention; $M = 40.20$ ($SD = 7.40$); control $M = 39.80$ ($SD = 9.30$) Sex: 47 female; 67 male Years in job: Intervention $M = 13.8$ ($SD = 7.90$); control $M = 14.30$ ($SD = 8.30$)	PSS PSS PTSD-Checklist PROMIS-A PROMIS-D PROMIS-SD PSQI AUDIT CAR HCC
Hoeve et al. (2021)	Netherlands	Single Arm A1 = MBI	MBI based on Williams & Cullen., 2013 6 weeks 2 hr weekly sessions No retreat Home practice activities Face-to-face delivery	$N = 82$ Age: $M = 49$ ($SD = 8.40$) Sex: 46 female; 36 male Years in job: Unreported	DASS-21 (stress subscale only) PSQ-Op SCL-90
Khatib et al. (2022)	USA	RCT A1 = MBSR A2 = MBRT A3 = mPEAK	MBSR 8 weeks 2.5 hr weekly sessions 7 hr retreat Home practice activities Online delivery MBRT 8 weeks 2.5 weekly sessions 7 hr retreat Home practice activities Online delivery mPEAK 8 weeks 2.5 hr weekly sessions 7 hr retreat Home practice activities Online delivery	$N = 50$ (Intervention group 1: $n = 14$; intervention group 2: $n = 17$; intervention 3: $n = 19$) Age: $M = 44$ (SD unreported) Sex: 16 female; 34 male Years in job: Unreported	PSS BDI-II SAI

(*Continued*)

Table 1. (Continued).

Author	Country	Study Design	MBI Details	Participant Demographics	Measures
Krick and Felfe (2020)	Germany	RCT A1 = MBI A2 = TAU	Modified MBSR 6 weeks 2 hr weekly sessions Retreat; not reported Home practice activities Face-to-face delivery	$N = 267$(Intervention group: $n = 126$; control group: $n = 141$) Age: $M = 25.96$ ($SD = 5.57$) Sex: 57 female; 210 male Years in job: Unreported	HR HRV
Márquez et al. (2021)	Spain	Single arm A1 = MBI	Modified MBSR 7 weeks 2 hr weekly sessions x 6 4 hr retreat Home practice activities Face-to-face delivery	$N = 20$ Age: $M = 45.63$ ($SD = 10.17$) Sex: 11 female; 9 male Years in job: Unreported	PSS
Navarrete et al. (2022)	Spain	NRCT A1 = MBI A2 = WL	MPPW 8 weeks 2 hr weekly sessions Retreat; not reported Home practice activities Face-to-face delivery	$N = 38$ (Intervention group: $n = 20$; control group: $n = 18$) Age: $M = 39.97$ ($SD = 6.41$) Sex: 15 female; 23 male Years in job: Unreported	DASS-21 PROMIS-SD
Trombka et al. (2021)	Brazil	RCT A1 = MBI A2 = WL	MBHP 8 weeks Session length; not reported Retreat; not reported Home practice activities Face-to-face delivery	$N = 170$ (Intervention group: $n = 88$; control group: $n = 82$) Age: $M = 42.26$ ($SD = 7.71$) Sex: 127 female; 43 male Years in job: Unreported	HADS

MBRT = Mindfulness-Based Resilience Training; PROMIS = Patient-Reported Outcomes Measurement Information System; PROMIS-SD = PROMIS Sleep Disturbance; PROMIS-AU = PROMIS Alcohol Use; PROMIS-A = PROMIS Anxiety; PROMIS-D = PROMIS Depression; PSQ = Police Stress Questionnaire; CAR = Cortisol Awakening Response; PSS = Perceived Stress Scale; SME = Stress Management Education; MBRP = Mindfulness-Based Relapse Prevention; SF = Short Form; PCL-5 = PTSD Checklist for DSM-5; MBSR = Mindfulness-Based Stress Reduction; PSQI = Pittsburgh Sleep Quality Index; PCL-C = PTSD Checklist-Civilian Version; AUDIT = Alcohol Use Disorder Identification Tool; HCC = Hair Cortisol Concentration; MBI = Mindfulness-based intervention; DASS-21 = Depression Anxiety Stress Scale; SCL-90 = Symptom Checklist-90; mPEAK = Mindful Performance Enhancement, Awareness, and Knowledge; BDI-II = Beck Depression Inventory-II; SAI = State Anxiety Inventory; HR = Heart rate; HRV = Heart rate variability; MBHP = Mindfulness-Based Health Promotion; HADS = Hospital Anxiety and Depression Scale.

[a]Six month follow-up.

[b]Six week follow-up.

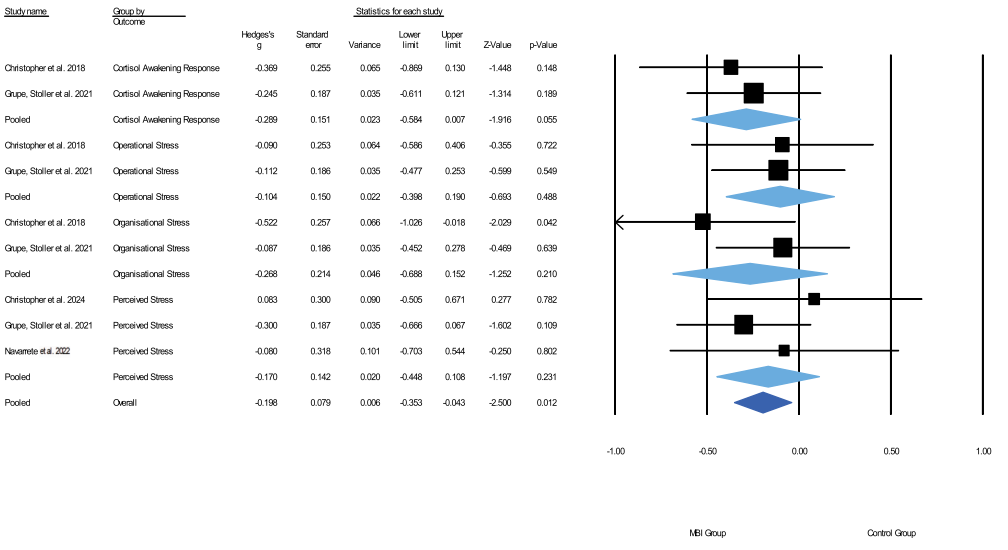


Figure 2. Forest plot of between-group analysis comparing MBI and Control groups at post-intervention on stress.

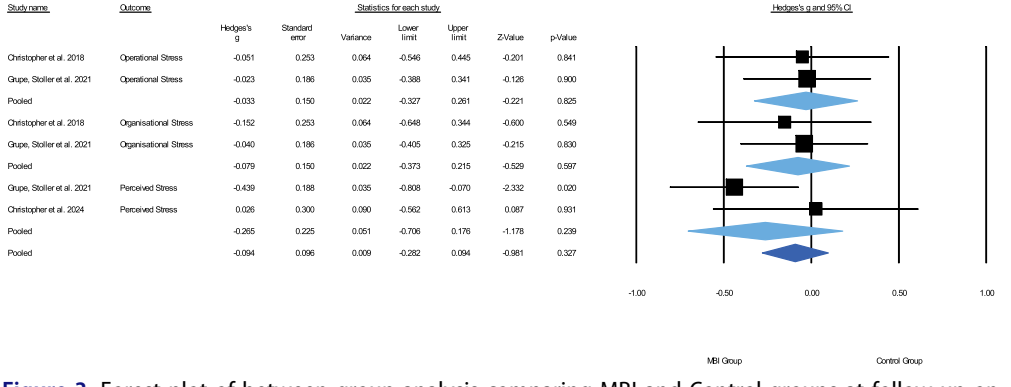
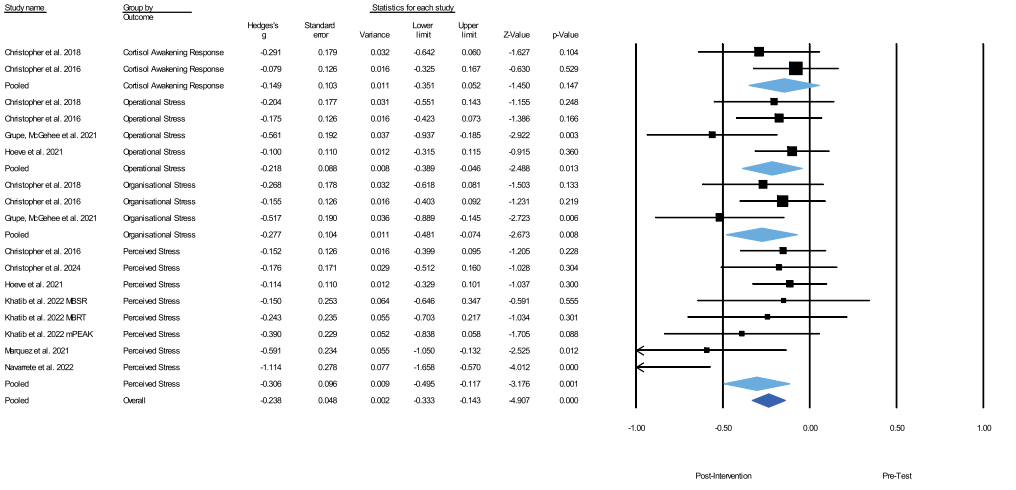


Figure 3. Forest plot of between-group analysis comparing MBI and Control groups at follow-up on stress.

however the direction and magnitude of the effect remained unchanged. Figure S2 of the Supplementary Materials displays the funnel plot.

Sensitivity analysis

To determine the degree of robustness of the findings, a sensitivity analysis was performed. Removing one study comprising the NRCT study design (Navarrete et al., 2022) did not change the direction or significance of the effect at post-intervention. The results of the sensitivity analyses are shown in Table S10 of the Supplementary Materials.



Study name	Group by Outcome	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Christopher et al. 2018	Cortisol Awakening Response	-0.291	0.179	0.032	-0.642	0.060	-1.627	0.104
Christopher et al. 2016	Cortisol Awakening Response	-0.079	0.126	0.016	-0.325	0.167	-0.630	0.529
Pooled	Cortisol Awakening Response	-0.149	0.103	0.011	-0.351	0.052	-1.450	0.147
Christopher et al. 2018	Operational Stress	-0.204	0.177	0.031	-0.551	0.143	-1.155	0.248
Christopher et al. 2016	Operational Stress	-0.175	0.126	0.016	-0.423	0.073	-1.386	0.166
Grupe, McGehee et al. 2021	Operational Stress	-0.561	0.192	0.037	-0.937	-0.185	-2.922	0.003
Hoeve et al. 2021	Operational Stress	-0.100	0.110	0.012	-0.315	0.115	-0.915	0.360
Pooled	Operational Stress	-0.218	0.088	0.008	-0.389	-0.046	-2.488	0.013
Christopher et al. 2018	Organisational Stress	-0.268	0.178	0.032	-0.618	0.081	-1.503	0.133
Christopher et al. 2016	Organisational Stress	-0.155	0.126	0.016	-0.403	0.092	-1.231	0.219
Grupe, McGehee et al. 2021	Organisational Stress	-0.517	0.190	0.036	-0.889	-0.145	-2.723	0.006
Pooled	Organisational Stress	-0.277	0.104	0.011	-0.481	-0.074	-2.673	0.008
Christopher et al. 2016	Perceived Stress	-0.152	0.126	0.016	-0.399	0.095	-1.205	0.228
Christopher et al. 2024	Perceived Stress	-0.176	0.171	0.029	-0.512	0.160	-1.028	0.304
Hoeve et al. 2021	Perceived Stress	-0.114	0.110	0.012	-0.329	0.101	-1.037	0.300
Khatib et al. 2022 MBSR	Perceived Stress	-0.150	0.253	0.064	-0.646	0.347	-0.591	0.555
Khatib et al. 2022 MBRT	Perceived Stress	-0.243	0.235	0.055	-0.703	0.217	-1.034	0.301
Khatib et al. 2022 mPEAK	Perceived Stress	-0.390	0.229	0.052	-0.838	0.058	-1.705	0.088
Marquez et al. 2021	Perceived Stress	-0.591	0.234	0.055	-1.050	-0.132	-2.525	0.012
Navarrete et al. 2022	Perceived Stress	-1.114	0.278	0.077	-1.658	-0.570	-4.012	0.000
Pooled	Perceived Stress	-0.306	0.096	0.009	-0.495	-0.117	-3.176	0.001
Pooled	Overall	-0.238	0.048	0.002	-0.333	-0.143	-4.907	0.000

Figure 4. Forest plot of within-group analysis at post-intervention on stress.

Within-group effects comparing post-intervention against pre-intervention

The overall summary effect at post-intervention on stress was small (Hedge's $g = -.238$, 95% CI [−.333, −.143], $p = .000$). The forest plot of the analysis showing the pooled effects for individual outcomes and studies is displayed in Figure 4.

As indicated by the I^2 statistics an absence of heterogeneity was found for CAR ($p = 0.332$), and low but non-significant heterogeneity for operational stress ($I^2 = 31.793$, $p = 0.222$), and organisational stress ($I^2 = 20.588$, $p = 0.284$). Moderate heterogeneity was evident for perceived stress ($I^2 = 52.240$, $p = .041$). The moderators of publication year ($Q = 2.92$, $df = 1$, $p = .087$), MBI protocol ($Q = 3.10$, $df = 3$, $p = .377$), and measure ($Q = 1.07$, $df = 3$, $p = .785$) were not responsible for the heterogeneity. The moderators of sample size ($Q = 20.91$, $df = 8$, p = .007), country ($Q = 12.93$, $df = 2$, $p = .002$), and research design ($Q = 10.90$, $df = 2$, $p = .004$) were accountable for the significant heterogeneity. The results of the meta-regression are displayed in Table S11 of the Supplementary Materials. Egger's regression test evidenced publication bias (intercept = −3.143, $t = 4.440$, $df = 15$, $p < .001$). Duval and Tweedie's trim-and-fill analysis and inspection of the adjusted funnel plot identified seven missing studies. Imputation of these studies reduced the observed effect from Hedge's $g = -.238$, 95% CI [−.333, −.143] to Hedge's $g = -.144$, 95% CI [−.253, −.035]. Inspection of the fail-safe *N* values (Rosenthal, 1979) indicated 177 additional studies with null results would be required to nullify the effect. The funnel plot is displayed in Figure S3 of the Supplementary Materials.

Within-group effects comparing follow-up against pre-intervention

The overall summary effect on stress at follow-up was moderate (Hedge's $g = -.611$, 95% CI [−.773, −.449], $p = .000$). Figure 5 shows the forest plot of the analysis.

The I^2 statistics for operational stress ($I^2 = 75.132$, $p = .007$), and organisational stress ($I^2 = 82.454$, $p = .003$) were high, and perceived stress ($I^2 = 50.778$, $p = .058$) was moderate. Meta-regression indicated that the moderators of sample size ($Q = 16.88$, $df = 8$, $p = .031$), and research design ($Q = 8.42$, $df = 2$, $p = .016$) were responsible for the

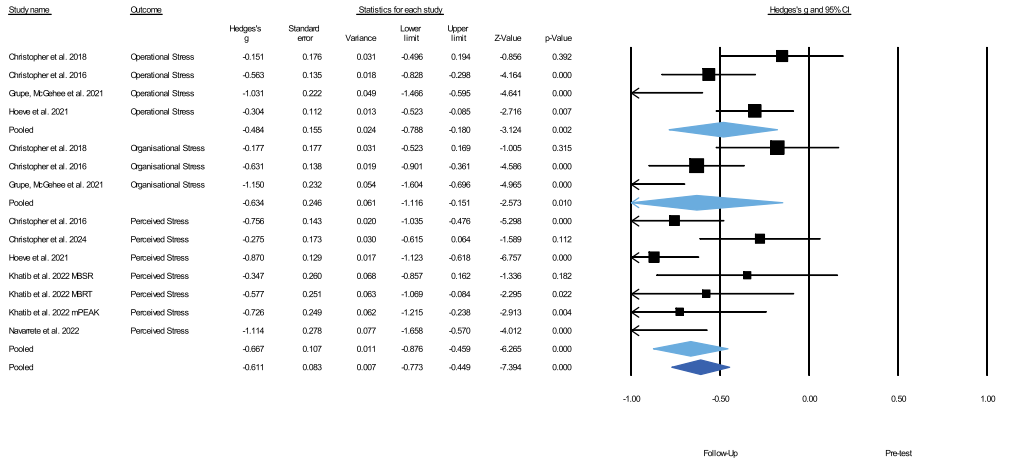


Figure 5. Forest plot of within-group analysis at follow-up on stress.

significant heterogeneity. The meta-regression results are displayed in Table S12 of the Supplementary Materials. Egger's regression test (intercept = −1.606, $t = .932$, $df = 12$, $p = .370$) indicated publication bias was not detected. Duval and Tweedie's trim-and-fill procedure and inspection of the adjusted funnel plot indicated two missing studies, which altered the effect from Hedge's $g = -.611$, 95% CI [−.773, −.449) to Hedge's $g = -.531$, 95% CI [−.701, −.361], however the direction and magnitude of the effect remained unchanged. Rosenthal's fail-safe N analysis (Rosenthal, 1979) determined that 565 additional studies with null results would be necessary to overturn the observed effect. The funnel plot is presented in Figure S4 of the Supplementary Materials.

Analysis of RQ2

RQ2: Are mindfulness-based interventions effective for reducing mental health outcomes in police officers?

Between-group effects comparing MBI and control groups at post-intervention

As presented in Figure 6, the overall summary effect of MBIs on mental health outcomes at post intervention yielded a small significant effect compared to controls (Hedge's $g = -.273$, 95% CI [−.427, −.119], $p = .001$). The pooled effect sizes of individual outcomes indicated MBIs had a small-moderate effect on anxiety (Hedge's $g = -.398$, 95% CI [−.725, −.070], $p = .017$) and a small effect on sleep disturbance (Hedge's $g = -.236$, 95% CI [−.458, −.014], $p = .037$) in comparison to control groups. While a small effect was indicated for PTSD (Hedge's $g = -.248$, 95% CI [−.770, .274], $p = .351$), depression (Hedge's $g = -.315$, 95% CI [−.753, .123], $p = .159$), and alcohol use (Hedge's $g = -.126$, 95% CI [−.422, .755], $p = .639$) at post-intervention, significance was not reached.

The I^2 value for and depression ($I^2 = 78.445$, $p = .001$) indicated substantial heterogeneity. Heterogeneity was also detected for PTSD ($I^2 = 57.241$, $p = .126$), anxiety ($I^2 = 57.152$, $p = .072$), sleep disturbance ($I^2 = 8.355$, $p = .351$), and alcohol use

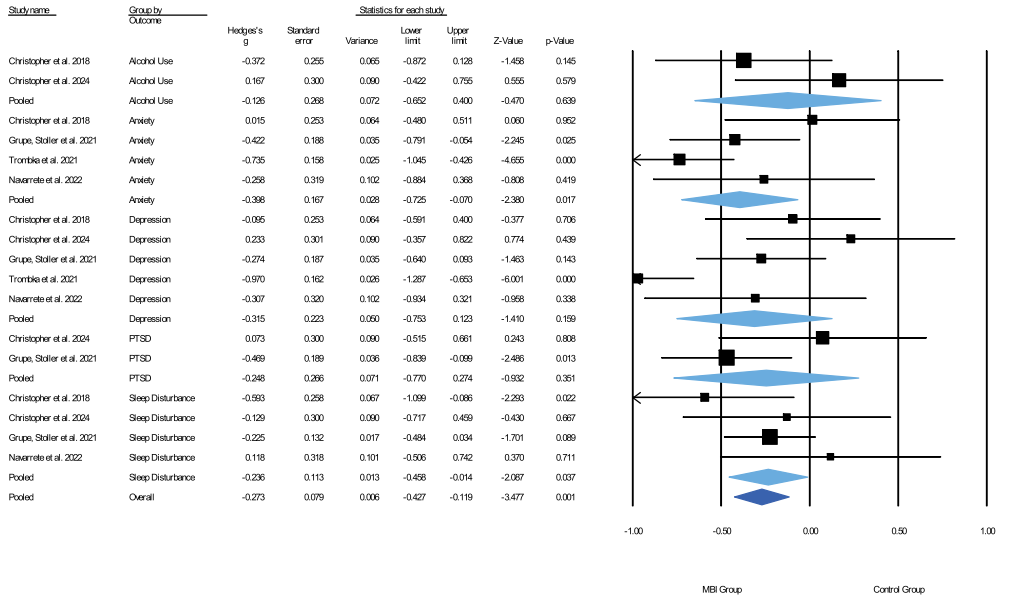


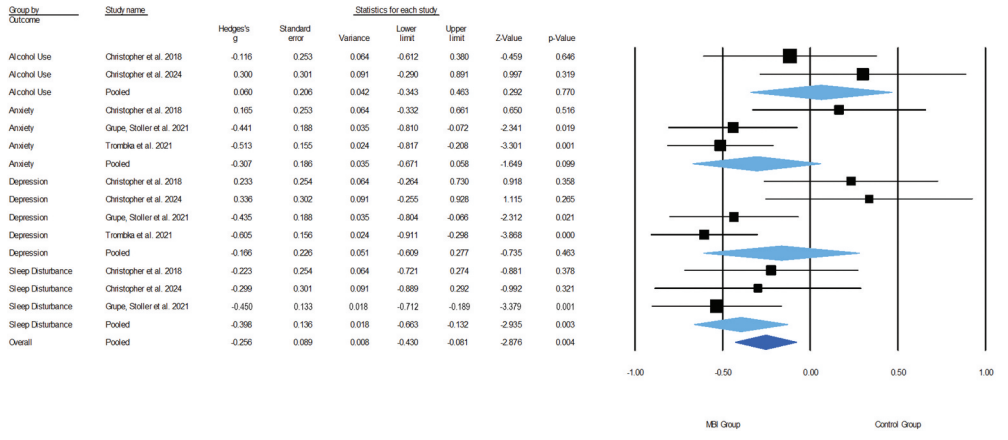
Figure 6. Forest plot of between-group analysis comparing MBI and Control groups at post-intervention on mental health outcomes.

(I^2 = 46.471, p = .172), but was not significant. Meta-regression indicated the moderators of publication year (Q = 10.04, df = 3, p = .018), country (Q = 24.12, df = 2, p =.000), sample size (Q = 29.79, df = 4, .000), and MBI protocol (Q = 26.76, df = 3, p = .000) accounted for the heterogeneity. The results of the meta-regression are presented in Table S13. Publication bias was detected by Egger's regression test (intercept = 2.861, t = 2.590, df = 15, p = .020). Duval and Tweedie's trim-and-fill procedure, along with an examination of the adjusted funnel plot, revealed six potentially missing studies. Inclusion of these studies increased the observed effect size from Hedge's g = −.273, 95% CI [−.427, −.119] to Hedge's g = −.457, 95% CI [−.624, −.202]. The funnel plot is presented in Figure S5 of the Supplementary Materials.

Between-group effects comparing MBI and control groups at follow-up

As shown in Figure 7, the overall summary effect on mental health outcomes at follow-up was small (Hedge's g = −.276, 95% CI [−.434, −.119], p = .001). The pooled effects show MBIs had a small effect on sleep disturbances (Hedge's g = −.388, 95% CI [−.603, .-172], p = .000) in comparison to control groups at follow-up. Small effects were evident for depression (Hedge's g = −.166, 95% CI [−.609, .277], p = .463), anxiety (Hedge's g = −.307, 95% CI [−.671, .058], p = .099), and alcohol use (Hedge's g = .060, 95% CI [−.343, .463], p = .770), however these effects were not significant.

The I^2 statistics for depression (I^2 = 77.216, p = .004) indicated a high degree of heterogeneity. Moderate and low, but not significant heterogeneity was detected for anxiety (I^2 = 63.219, p = .066), and alcohol use (I^2 = 10.809, p = .290), respectively. A zero I^2 statistic indicated an absence of heterogeneity for sleep disturbances. Meta-regression indicated the moderators of publishing year (Q = 18.94, df = 2, p < .001),



Group by Outcome	Study name	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Alcohol Use	Christopher et al. 2018	-0.116	0.253	0.064	-0.612	0.380	-0.459	0.646
Alcohol Use	Christopher et al. 2024	0.300	0.301	0.091	-0.290	0.891	0.997	0.319
Alcohol Use	Pooled	0.060	0.206	0.042	-0.343	0.463	0.292	0.770
Anxiety	Christopher et al. 2018	0.165	0.253	0.064	-0.332	0.661	0.650	0.516
Anxiety	Grupe, Stoller et al. 2021	-0.441	0.188	0.035	-0.810	-0.072	-2.341	0.019
Anxiety	Trombka et al. 2021	-0.513	0.155	0.024	-0.817	-0.208	-3.301	0.001
Anxiety	Pooled	-0.307	0.186	0.035	-0.671	0.058	-1.649	0.099
Depression	Christopher et al. 2018	0.233	0.254	0.064	-0.264	0.730	0.918	0.358
Depression	Christopher et al. 2024	0.336	0.302	0.091	-0.255	0.928	1.115	0.265
Depression	Grupe, Stoller et al. 2021	-0.435	0.188	0.035	-0.804	-0.066	-2.312	0.021
Depression	Trombka et al. 2021	-0.605	0.156	0.024	-0.911	-0.298	-3.868	0.000
Depression	Pooled	-0.166	0.226	0.051	-0.609	0.277	-0.735	0.463
Sleep Disturbance	Christopher et al. 2018	-0.223	0.254	0.064	-0.721	0.274	-0.881	0.378
Sleep Disturbance	Christopher et al. 2024	-0.299	0.301	0.091	-0.889	0.292	-0.992	0.321
Sleep Disturbance	Grupe, Stoller et al. 2021	-0.450	0.133	0.018	-0.712	-0.189	-3.379	0.001
Sleep Disturbance	Pooled	-0.398	0.136	0.018	-0.663	-0.132	-2.935	0.003
Overall	Pooled	-0.256	0.089	0.008	-0.430	-0.081	-2.876	0.004

Figure 7. Forest plot of between-group analysis comparing MBI and Control groups at follow-up on mental health outcomes.

sample size ($Q = 19.56$, $df = 3$, $p < .001$), and MBI protocol ($Q = 19.35$, $df = 3$, $p < .001$) were accountable for the significant heterogeneity. The meta-regression results are displayed in Table S14. Egger's regression test indicated publication bias was present (intercept = 4.305, $t = 4.780$, $df = 10$, $p < .001$). Duval and Tweedie's trim-and-fill analysis and inspection of the imputed funnel plot identified two missing studies, which altered the effect from Hedge's $g = -.276$, 95% CI [−.434, −.119] to Hedge's $g = -.309$, 95% CI [−.497, −.122]. The funnel plot is displayed in Figure S6 of the Supplementary Materials.

Sensitivity analysis

To determine the degree of robustness of the findings, seven sensitivity analyses were performed. Removing one study with a follow-up period of 6 months (Trombka et al., 2021), and one study which delivered MBI online (Christopher et al., 2024) and did not change the direction or significance of the effect at post-intervention or follow-up on overall mental health. Similarly, removing one study at post-intervention which comprised a NRCT (Navarrete et al., 2022) did not alter the direction or significance of the effect. After removing one study which employed a closely modified version of MBSR (Grupe, Stoller, et al., 2021), the effect of MBIs on overall mental health changed from significant to not significant at post-intervention ($p = .079$), and follow-up ($p = .360$). The results of the sensitivity analyses are shown in Tables S15 – S21.

Within group effects comparing post-intervention against pre-intervention

As shown in Figure 8, the effect of MBIs on mental health outcomes overall was small (Hedge's $g = -.361$, 95% CI [−.481, −.241], $p = .000$). The I^2 statistics for anxiety ($I^2 = 70.636$, $p = .004$), depression ($I^2 = 75.626$, $p = .000$), and sleep disturbance ($I^2 = 58.399$, $p = .047$) indicated heterogeneity was moderate. Heterogeneity was not significant for PTSD ($I^2 = 64.121$, $p = .095$, and alcohol use ($I^2 = 20.313$, $p = .263$). Meta-regression indicated the moderators of sample size ($Q = 27.35$, $df = 8$, $p < 0.001$), and study design ($Q = 4.03$, $df = 1$, $p = .046$) accounted for the heterogeneity. Publication bias

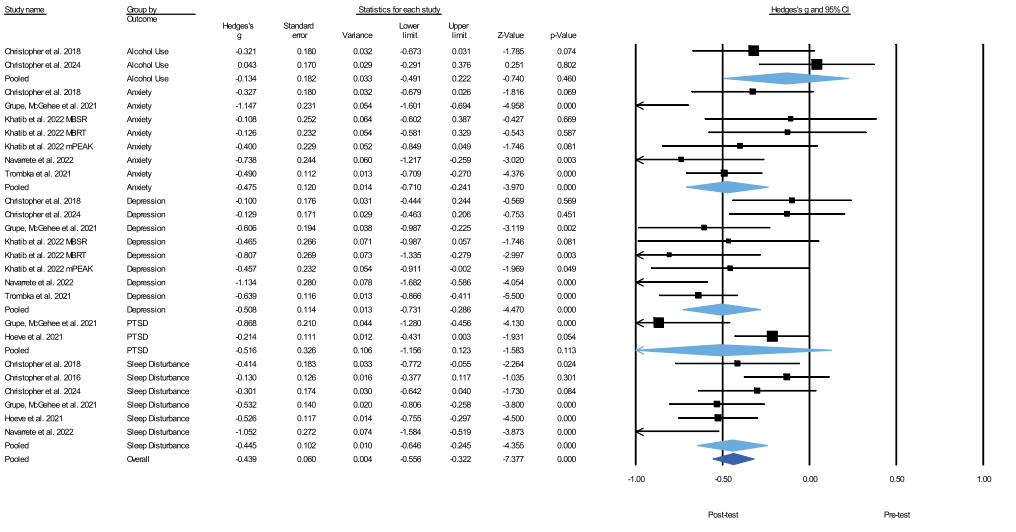


Figure 8. Forest plot of within-group analysis at post-intervention on mental health outcomes.

was not identified (intercept = −2.366, $t = 1.957$, $df = 20$, $p = .064$). The results of the meta-regression are presented in Table S22. Duval and Tweedie's trim-and-fill procedure, along with an examination of the adjusted funnel plot, revealed two potentially missing studies. Inclusion of these studies increased the effect size from Hedge's $g = -.361$, 95% CI [−.481, −.241] to an effect size of Hedge's $g = -.405$ (95% CI [−.527, −.284]. Figure S7 of the Supplementary Materials displays the funnel plot.

Within-group effects comparing follow-up against pre-intervention

As presented in Figure 9, the overall summary effect showed a small effect of MBI on mental health outcomes (Hedge's $g = -.361$, 95% CI [−.481, −.241], $p = .000$). The I^2 statistics for anxiety ($I^2 = 70.636$, $p = .004$), and depression ($I^2 = 75.626$, $p = .003$) suggested a high degree of heterogeneity, and a moderate degree was detected for sleep disturbances ($I^2 = 58.399$, $p = .047$). Moderate and low but not significant heterogeneity was detected for PTSD ($I^2 = 64.121$, $p = .095$), and alcohol use ($I^2 = 20.313$, $p = .263$), respectively. Meta-regression indicated the moderators of sample size ($Q = 27.35$, $df = 8$, $p < .001$), and research design ($Q = 4.03$, $df = 1$, $p = .045$) accounted for the significant heterogeneity. Table S23 presents the results of the meta-regression. As indicated by Egger's regression test (intercept = −2.366, $t = 1.957$, $df = 20$, $p = .064$), publication bias was not detected. Duval and Tweedie's trim-and-fill analysis and inspection of the funnel plot identified three missing studies, which altered the effect from Hedge's $g = -.361$, 95% CI [−.481, −.241] to Hedge's $g = -.335$, 95% CI [−.478, −.192], however the magnitude and direction of the effect did not change. The fail-safe N values indicated 653 additional studies would be required to nullify the effect. The funnel plot is presented in Figure S8 of the Supplementary Materials.

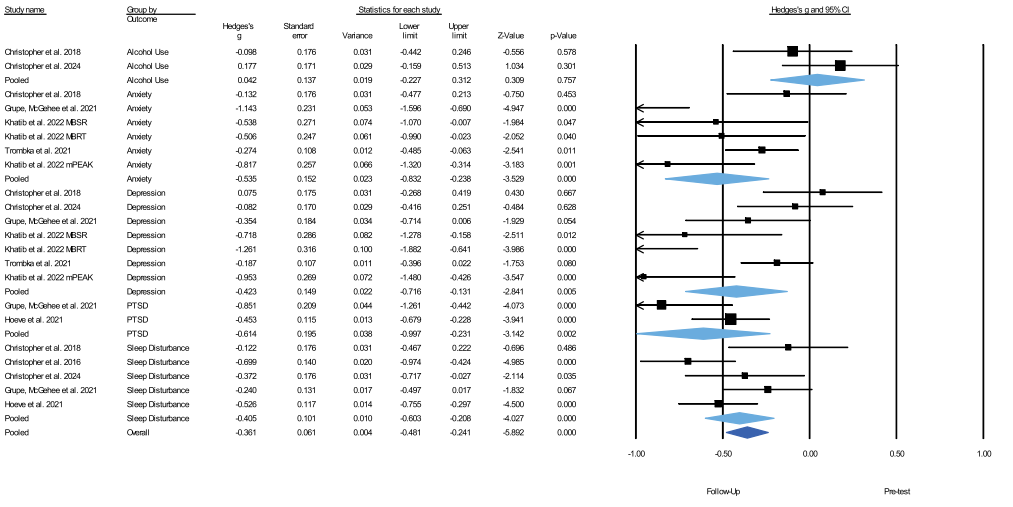


Figure 9. Forest plot of within-group analysis at follow-up on mental health outcomes.

Discussion

The aim of this systematic review and meta-analysis was to evaluate whether MBIs are effective for reducing stress and improving mental health outcomes in police officers. Eleven studies with 967 participants were included.

Results from the between- and within-group analyses provide evidence towards MBIs being effective for reducing stress and improving mental health in police officers. Between-group comparisons indicated a small effect of MBIs favouring the MBI group compared to controls on overall stress and mental health outcomes at post-intervention, however, only a significant effect on mental health remained at follow-up. The within-group comparisons show that MBIs demonstrated small to moderate effects for reducing overall stress and improving general mental health in police officers at post-intervention. These effects increased to moderate at follow-up. These findings are generally consistent with other meta-analyses which have found MBIs to be effective for reducing stress and improving mental health outcomes in other populations, however the effects of MBIs in other populations tend to be larger than the observed effects in this study (Li, Nannestad, et al., 2024; Ong et al., 2024; Qin et al., 2024; Xunlin et al., 2020).

Between-group comparisons detected small to moderate effects of MBIs on operational, organisational and perceived stress, and cortisol awakening response at post-intervention and follow-up, however the effects did not reach significance. The analysis showed an aggregated significant reduction in overall stress at post-intervention. This result underscores the enhanced statistical power afforded by the meta-analytic approach, which enables the detection of cumulative effects that might remain undetected in smaller-scale studies and individual outcomes (Borenstein et al., 2021). Two of the included studies (Christopher et al., 2024, 2018) were feasibility trials characterised by relatively small sample sizes. The authors of both studies suggested that the non-significant results at post-intervention might be attributed to the limited sample sizes, which in turn reduced statistical power. The sample included in our meta-analysis was also

small, therefore significance may not have been reached despite small to moderate effects being present. The absence of significant effects on individual stress outcomes could also be due to the persistent and chronic nature of stressors in police work. Other meta-analytic reviews evaluating MBIs in other comparable high-stress populations (Ong et al., 2024; Rogerson et al., 2024), have also found small and/or non-significant effects on stress. Addressing high-baseline stress levels among police, as well as the intensity and complexity of stressors, may require more time, and sustained daily mindfulness practice. Moreover, the interventions employed across the included RCTs were modified for use in police, with practices focusing on police work. These modifications may have restricted participant's practice of mindfulness to the policing environment, subsequently impeding the therapeutic benefit of the interventions. Regular and sustained daily mindfulness practice forms a core component of mindfulness training (Kabat-Zinn, 2013; Parsons et al., 2017), therefore the opportunity for participants to practice mindfulness consistently beyond the policing environment may have inhibited the effectiveness. Furthermore, qualitative data from Fitzhugh et al. (2024) study suggests that police officers may be hesitant to practice mindfulness in the workplace due to embarrassment and stigma, therefore teaching mindfulness practices which can be implemented and practiced beyond the policing environment, such as MBSR (Kabat-Zinn, 1982), may provide a more effective treatment for stress in police. Consistent with this, the lack of significant overall effect on stress observed at follow-up may be due to low rates of participant engagement in mindfulness practices beyond the intervention. The included studies reported low rates of engagement in mindfulness by participants during the follow-up period. As such the longer-term therapeutic value of the programs may have been impacted due to low ongoing practice rates. The extent of formal and informal mindfulness practice has been shown to be positively associated with intervention outcomes (Parsons et al., 2017), however other studies have found no association between engagement in daily practice and changes in stress (Grupe, Stoller, et al., 2021).

Our meta-analysis also evaluated the effect of MBIs on changes in biomarkers of stress in police, specifically changes in the cortisol awakening response (CAR). While only a small trend-level reduction in CAR was observed favouring the MBI treatment groups at post-intervention (Hedges $g = -.289$, $p = .055$), this may indicate normalisation of the stress-hormone, cortisol. The results are similar in magnitude to the findings of Rogerson et al. (2024) meta-analysis examining the effectiveness of stress management interventions on cortisol awakening response levels in other high-stress populations. Only one RCT (Grupe, Stoller, et al., 2021) provided follow-up data for CAR, therefore we were unable to perform a meta-analysis for changes in CAR beyond post-intervention for between-group comparisons. The results of Grupe, Stoller, et al. (2021) study however indicated participants in the MBI intervention group had significantly lower CAR at follow-up (3 months) relative to waitlist participants. These findings suggest the benefits of MBIs may emerge more slowly over time, and may buffer against the consequences of chronic stress. Other biological markers of stress have also been studied. One study examined the effect of MBIs on hair cortisol concentrations (HCC; Grupe, Stoller, et al., 2021), however no significant effect was observed at post-intervention or 3-month follow-up. This result may be attributed to divergence of cortisol levels across hair samples, where high variations in HCC exist dependent on cumulative traumatic load and stress, PTSD, comorbid mental health issues, and childhood adversity (Koumantarou Malisiova et al., 2021). One RCT (Krick & Felfe,

2020) assessed the effect of MBIs on heart rate variability (HRV) with results indicating a positive effect of MBIs on HRV at post-intervention. The combined findings may underscore the complex interactions between chronic stress psychopathology, as well as the potential of MBIs to alter biological markers of stress in police. Given the link between pathological functioning of biological stress systems and adverse psychological health outcomes (Creswell & Lindsay, 2014; Finlay et al., 2022; McEwen, 2017), further research assessing the effect of MBIs on biomarkers of stress among policing samples is needed to comprehensively evaluate the impact of MBIs on biological stress indicators. Furthermore, the effects of MBIs on biological stress markers may emerge over time (Grasmann et al., 2023), therefore, future studies involving police should incorporate medium and long-term follow-up measures of stress biomarkers to assess sustained or delayed MBI treatment impacts.

Relative to controls, MBI groups demonstrated small-moderate reductions in anxiety at post-intervention. A number of studies suggest that MBIs, particularly MBIs employing focused meditation practices, recruit multiple brain regions involved in attentional control (Ganesan et al., 2022; Tang et al., 2015) which are associated with decreases in anxiety, and threat responses (Creswell & Lindsay, 2014; Eysenck et al., 2007; Williams et al., 2024). Small reductions in sleep disturbances were also evident at post-intervention, with effects strengthening at follow-up. Despite the significant improvements in anxiety and sleep disturbances, our meta-analysis found no significant differences in depression between MBI treatment groups and controls at both post-intervention and follow-up, which contrasts with the moderate effects reported by Withrow et al. (2024). This discrepancy is likely attributable to Withrow et al. (2024) incorporating outcomes from Krick and Felfe's (2020) study, which did not specifically measure depression or anxiety. Instead, Krick and Felfe (2020) assessed negative affect using the Positive and Negative Affect Schedule-X (PANAS-X; Röcke & Grühn, 2003), and the Psychological Strain Scale (Irritation Scale; Mohr et al., 2005) which also include emotions such as fear, anxiety, and hostility, therefore the effects observed may be attributable to changes in related symptoms rather than depression and anxiety specifically.

The results of our study suggested a large effect of MBIs on PTSD symptoms at post-intervention, however the effect did not reach significance. Only one study reported data for this could indicate that MBIs may be effective for reducing emotional reactivity, and physiological arousal associated with PTSD in police. Moreover, mindfulness training may serve to reduce the full range of negative cognitions, moods, trauma-related reactivity, sleep disturbances and anxiety to support successful engagement in other PTSD-specific interventions (Nagy et al., 2020). Only one study provided data for PTSD at follow-up (Grupe, Stoller, et al., 2021), therefore a meta-analysis at follow-up could not be performed.

The cumulative findings of our meta-analysis suggest that while some stressors and emotional experiences may not change, the effects on behaviours, such as sleep disturbances, may shift. This shift in reaction to stress or emotions is aligned with mindfulness-based practices, and has been seen in other studies examining mindfulness and MBIs (Nagy et al., 2020). To this end, while stressors may remain, mindfulness may have increased, thereby moderating and mediating the impact of stress on the wellbeing of officers. Future studies should examine the mechanisms of mindfulness among officers, to provide a more comprehensive understanding the benefits of MBIs for police.

Limitations and future research

There are some limitations that exist in both the included studies and our meta-analysis. Firstly, only a small number of studies were eligible for inclusion for between-group analyses, therefore the ability to detect a significant effect may be reduced. Future RCTs should attempt to increase sample sizes to enable significant effects to be detected. Secondly, the inclusion of NRCTs in our between-group analyses may introduce potential biases or confounding factors that could not be fully controlled. However, the robustness of our findings, as demonstrated by the sensitivity analysis, supports the validity and reliability of our conclusions. Thirdly, limited studies incorporated biological measures of stress as outcome variables, and few studies provided follow-up data. Given the association between the persistent activation of the stress response and adverse psychological health outcomes (Finlay et al., 2022; McEwen, 2017), measurement of biological markers, particularly those implicated in chronic stress, is recommended. Moreover, other studies, including meta-analytic reviews in other populations (Grasmann et al., 2023; Rogerson et al., 2024), have found positive outcomes or greater effects of MBIs at longer-term follow-up, future studies should incorporate longer-term follow-up measures into the design to determine the long-term benefits of MBIs for police. Researchers implementing MBIs within policing environments should also consider including booster sessions to determine whether ongoing mindfulness training sessions improve medium- and long-term treatment effects on stress. Future studies assessing the effects of MBIs on stress and mental health outcomes, including sleep over extended time periods are therefore warranted. Fourth, the results of the meta-regression analyses demonstrated substantial levels of heterogeneity across some outcomes, implying that the effects of MBIs on stress and mental health outcomes are higher in some police populations and lower in others (Borenstein, 2019). Caution should be utilised when generalising the findings from this meta-analysis to all police populations. Fifth, some evidence of publication bias was observed for certain outcomes, which might influence the reliability of the results and should be considered when interpreting the findings. Sixth, most interventions employed within the primary studies were adapted to more closely align with policing culture, which may be counterintuitive. Results of the sensitivity analyses indicate that after removing the study which employed a closely modified MBSR protocol (Grupe, Stoller, et al., 2021), the significant effects on overall mental health disappeared at post-intervention and follow-up, suggesting interventions more closely aligned to MBSR or protocols which do not focus on the policing environment and stressors specifically, may be more effective for improving mental health in police officers. Future research should seek to evaluate the effectiveness of the original MBSR curriculum (Kabat-Zinn, 1982, 2015) on stress in police, which can be more broadly applied to daily life. Lastly, there is a significant lack of reporting on the adverse effects of MBSR in the individual studies, particularly concerning adverse psychological and social impacts resulting from the intervention. This absence of data makes it challenging to fully understand the potential risks associated with the intervention (Li, McIntyre, et al., 2024). Future research should prioritise systematic investigations of potential adverse effects and factors contributing to adverse impacts, including experiences of trauma in childhood, to offer a more thorough understanding of the

intervention's safety profile for use in police settings.

Recommendations for police agencies

Police agencies are encouraged to establish research partnerships with academic institutions, mental health professionals, and other organisations to deepen the understanding of MBIs within the unique context of policing. These collaborations should focus on leveraging academic expertise including the specialised knowledge and methodological skills of researchers to design and conduct high-quality studies, as well as securing funding through grant applications and sharing resources to support rigorous studies exploring the effectiveness of MBIs in enhancing officer wellbeing. Focus should also be given to assessing the safety profile of MBIs for use with police officers to ensure interventions are both effective and safe with police. Furthermore, collaborative efforts should aim to implement pilot programs to test the feasibility and effectiveness of MBIs across various countries, jurisdictions, and sub-populations of police (specialised units, recruits, high versus low stress and mental health symptomology) to understand the benefits of MBIs among policing populations, and established an understanding of who, under what conditions, are MBIs effective and safe. It is also recommended that police agencies evaluate existing mindfulness programs and initiatives which have been implemented by organisations through empirical and systematic assessment to support refinement, improvement of programs, and to establish the safety profile of existing initiatives and interventions. By fostering research collaborations, agencies can contribute to the broader evidence-base for the use of MBIs among police and ensure that resources are directed toward programs with proven efficacy and safety.

Conclusion

Our study offers important implications for future research, practice and policy. The results of the current review and meta-analysis show reductions in overall stress and improved overall mental health outcomes among police following MBI interventions. Findings from the study provide supportive evidence that MBIs may have a positive cumulative impact on officer wellbeing and can be utilised to support police officers manage stress and enhance their mental health while serving in the profession. Our meta-analysis provides preliminary support for police agencies to establish partnerships with research and academic institutions to rigorously examine the use of MBIs, both independently and alongside existing mental health support frameworks, and to guide leadership decision-making processes to enhance occupational health policy to improve officer wellbeing.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This research is supported by an Australian Government Research Training Program Scholarship.

Notes on contributors

Jennifer Gaskin is a PhD candidate within the College of Healthcare Sciences at James Cook University, Australia. Her research focuses on stress, mental health, mindfulness, and policing. She obtained a Bachelor of Criminology and Bachelor of Psychological Science at Deakin University, Australia, and Advanced Post-Graduate Diploma of Psychological Practice at Charles Sturt University, Australia. She has worked extensively across the Australian criminal justice system, including police, courts, and corrective services.

Wendy Li is an experienced researcher in the field of mental health and wellbeing employing mindfulness interventions and has published extensively in the areas of mental health, and mindfulness. She is a qualified Mindfulness-Based Stress Reduction (MBSR) teacher certified by Brown University, and founder and leader of the Mindfulness Lab at James Cook University. Wendy completed her PhD at the University of Waikato, New Zealand. She is currently an Associate Professor in the Department of Psychology at James Cook University, Australia.

Liza van Eijk's background is in neuropsychology and neuroimaging. Her research focuses on improving early detection, diagnosis as well as treatment outcomes for several conditions including stress and mental health disorders, by utilising early markers in prediction models. She obtained her PhD at the University of Queensland, Australia, and Research Master in Cognitive Neuropsychology at the VU University, The Netherlands, cum laude, which included a research internship at Cambridge University and a clinical neuropsychology internship. She is a Senior Lecturer in the Department of Psychology at James Cook University, Australia.

Zoltan Sarnyai is a medically trained PhD neuroscientist with internationally recognised expertise in stress and mental health research. He was trained at Harvard Medical School and Rockefeller University in the USA and was on the faculty of the University of Cambridge, UK. He is currently Professor within the College of Medicine and Dentistry at James Cook University, Australia.

ORCID

Jennifer Gaskin http://orcid.org/0009-0008-5985-527X
Wendy Wen Li http://orcid.org/0000-0002-0056-6130
Liza van Eijk http://orcid.org/0000-0001-8254-1019
Zoltan Sarnyai http://orcid.org/0000-0002-2380-7902

Authorship contribution statement

Jennifer Gaskin significantly contributed to the conceptualisation, formal analysis, investigation, methodology, project administration, visualization, writing – original draft, and writing (review and editing) of this paper. Wendy Li contributed to the conceptualisation, formal analysis, investigation, methodology, writing (review and editing) of this paper, and provided supervision to Ms Gaskin. Both Liza van Eijk and Zoltan Sarnyai contributed to the conceptualisation, methodology, writing (review and editing) of this paper, and provided supervision to Ms Gaskin.

Data availability statement

All data generated or analysed during this study are included in this published article and its supplementary material files.

References

American Psychological Association, APA Task Force on Psychological Assessment and Evaluation. (2020). *APA guidelines for psychological assessment and evaluation*. https://www.apa.org/about/policy/guidelines-psychological-assessment-evaluation.pdf

Astridge, B., Li, W. W., McDermott, B., & Longhitano, C. (2023). A systematic review and meta-analysis on adverse childhood experiences: Prevalence in youth offenders and their effects on youth recidivism. *Child Abuse and Neglect*, *140*, 106055. https://doi.org/10.1016/j.chiabu.2023.106055

Borenstein, M. (2019). Publication bias In. *common mistakes in meta-analysis and how to avoid them. Biostat Inc. USA*, 155–186. https://meta-analysis-books.com/pages/cmma/download/excerpt/Heterogeneity.pdf

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2019). *Comprehensive meta-analysis version 3.0*. https://www.meta-analysis.com/downloads/Meta-Analysis%20Manual%20V3.pdf

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2021). *Introduction to meta-analysis* (2nd ed.). Wiley. https://doi.org/10.1002/9781119558378

Carleton, R. N., Afifi, T. O., Taillieu, T., Turner, S., Mason, J. E., Ricciardelli, R., McCreary, D. R., Vaughan, A. D., Anderson, G. S., Krakauer, R. L., Donnelly, E. A., Camp, R. D., Groll, D., Cramm, H. A., MacPhee, R. S., & Griffiths, C. T. (2020). Assessing the relative impact of diverse stressors among public safety personnel. *International Journal of Environmental Research and Public Health*, *17*(4), 1234–1259. https://doi.org/10.3390/ijerph17041234

Chopko, B. A., Palmieri, P. A., & Adams, R. E. (2013). Associations between police stress and alcohol use: Implications for practice. *Journal of Loss & Trauma*, *18*(5), 482–497. https://doi.org/10.1080/15325024.2012.719340

Christopher, M., Bowen, S., Witkiewitz, K., Grupe, D., Goerling, R., Hunsinger, M., Oken, B., Korecki, T., & Rosenbaum, N. (2024). A multisite feasibility randomized clinical trial of mindfulness-based resilience training for aggression, stress, and health in law enforcement officers. *BMC Complementary Medicine and Therapies*, *24*(1), 142. https://doi.org/10.1186/s12906-024-04452-y

Christopher, M. S., Goerling, R. J., Rogers, B. S., Hunsinger, M., Baron, G., Bergman, A. L., & Zava, D. T. (2016). A pilot study evaluating the effectiveness of a mindfulness-based intervention on cortisol awakening response and health outcomes among law enforcement officers. *Journal of Police and Criminal Psychology*, *31*(1), 15–28. https://doi.org/10.1007/s11896-015-9161-x

Christopher, M. S., Hunsinger, M., Goerling, L. R. J., Bowen, S., Rogers, B. S., Gross, C. R., Dapolonia, E., & Pruessner, J. C. (2018). Mindfulness-based resilience training to reduce health risk, stress reactivity, and aggression among law enforcement officers: A feasibility and preliminary efficacy trial. *Psychiatry Research*, *264*, 104–115. https://doi.org/10.1016/j.psychres.2018.03.059

Cohen, J. (1968). Weighted kappa: Nominal scale agreement provision for scaled disagreement or partial credit. *Psychological Bulletin*, *70*(4), 213–220. https://doi.org/10.1037/h0026256

Cohen, J. (1977). *Statistical power analysis for the behavioral sciences*. Routledge.

Crane, R. S., Brewer, J., Feldman, C., Kabat-Zinn, J., Santorelli, S., Williams, J. M. G., & Kuyken, W. (2017). What defines mindfulness-based programs? The warp and the weft. *Psychological Medicine*, *47*(6), 1–10. https://doi.org/10.1017/S0033291716003317

Creswell, J. D., & Lindsay, E. K. (2014). How does mindfulness training affect health? A mindfulness stress buffering account. *Current Directions in Psychological Science: A Journal of the American Psychological Society*, *23*(6), 401–407. https://doi.org/10.1177/0963721414547415

Deeks, J. J., Higgins, J. P. T., Altman, D. G., McKenzie, J. E., & Veroniki, A. A. (2024). Chapter, 10: Analysing data and undertaking meta-analyses [Last updated November 2024]. In J. P. T. Higgins, J. Thomas, J. Chandler, M. Cumpston, T. Li, M. J. Page, & V. A. Welch (Eds.), *Cochrane handbook for systematic reviews of interventions (version 6.5)*. Cochrane. https://www.training.cochrane.org/handbook

Drew, J. M., & Martin, S. (2021). A national study of police mental health in the USA: Stigma, mental health and help-seeking behaviors. *Journal of Police and Criminal Psychology*, *36*(2), 295–306. https://doi.org/10.1007/s11896-020-09424-9

Drew, J. M., & Williamson, H. (2024). *Trauma, critical incidents, organizational and operational stressors: The relationship between harms and psychological outcomes for police*. Police Quarterly. https://doi.org/10.1177/10986111241275048

Duval, S., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, *56*(2), 455–463. https://doi.org/10.1111/j.0006-341X.2000.00455.x

Egger, M., Davey Smith, G., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ*, *315*(7109), 629–634. https://doi.org/10.1136/bmj.315.7109.629

Emary, P. C., Stuber, K. J., Mbuagbaw, L., Oremus, M., Nolet, P. S., Nash, J. V., Bauman, C. A., Ciraco, C., Couban, R. J., & Busse, J. W. (2022). Risk of bias in chiropractic mixed methods research: A secondary analysis of a meta-epidemiological review. *The Journal of the Canadian Chiropractic Association*, *66*(1), 7–20.

Evans, S. R. (2010). Clinical trial structures. *Journal of Experimental Stroke & Translational Medicine*, *3*(1), 8–18. https://doi.org/10.6030/1939-067X-3.1.8

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion*, *7*(2), 336–353. https://doi.org/10.1037/1528-3542.7.2.336

Fendel, J. C., Bürkle, J. J., & Göritz, A. S. (2021). Mindfulness-based interventions to reduce burnout and stress in physicians: A systematic review and meta-analysis. *Academic Medicine*, *96*(5), 751–764. https://doi.org/10.1097/ACM.0000000000003936

Finlay, S., Rudd, D., McDermott, B., & Sarnyai, Z. (2022). Allostatic load and systemic comorbidities in psychiatric disorders. *Psychoneuroendocrinology*, *140*, 105726. https://doi.org/10.1016/j.psyneuen.2022.105726

Fisher, V., Li, W. W., & Malabu, U. (2023). The effectiveness of mindfulness-based stress reduction (MBSR) on the mental health, HbA1C, and mindfulness of diabetes patients: A systematic review and meta-analysis of randomised controlled trials. *Applied Psychology: Health and Well-Being*, *15*(4), 1733–1749. https://doi.org/10.1111/aphw.12441

Fitzhugh, H., Michaelides, G., Daniels, K., Connolly, S., & Nasamu, E. (2024). Mindfulness for performance and wellbeing in the police: Linking individual and organizational outcomes. *Review of Public Personnel Administration*, *44*(3), 566–590. https://doi.org/10.1177/0734371X231155794

Freedman, B., Li, W. W., Liang, Z., Hartin, P., & Biedermann, N. (2024). The prevalence of incivility in hospitals and the effects of incivility on patient safety culture and outcomes: A systematic review and meta-analysis. *Journal of Advanced Nursing*. https://doi.org/10.1111/jan.16111

Gallistl, M. A. M., Roman Linz, L. P., & Engert, V. (2020). Exploring the association of trait mindfulness with HPA axis activation during acute psychosocial stress. *Psychoneuroendocrinology*, *119*, 104976. https://doi.org/10.1016/j.psyneuen.2020.104976

Gamaiunova, L., Kreibig, S. D., Dan-Glauser, E., Pellerin, N., Brandt, P.-Y., & Kliegel, M. (2022). Effects of two mindfulness based interventions on the distinct phases of the stress response across different physiological systems. *Biological Psychology*, *172*, 108384. https://doi.org/10.1016/j.biopsycho.2022.108384

Ganesan, S., Beyer, E., Moffat, B., Van Dam, N. T., Lorenzetti, V., & Zalesky, A. (2022). Focused attention meditation in healthy adults: A systematic review and meta-analysis of cross-sectional functional MRI studies. *Neuroscience & Biobehavioral Reviews*, *141*, 104846. https://doi.org/10.1016/j.neubiorev.2022.104846

Garbarino, S., Magnavita, N., & Marquez-Romero, J. M. (2019). Sleep problems are a strong predictor of stress-related metabolic changes in police officers. A prospective study. *PLoS One*, *14*(10), e0224259. https://doi.org/10.1371/journal.pone.0224259

Gaskin, J., Chao, M., & Li, W. (in press). Mindfulness-based stress reduction: Effectiveness and future directions. In W. Li, W. Griffith, S. Shapiro, & Z. Zhu (Eds.), *The Palgrave handbook of third-wave psychotherapies*. Palgrave Macmillan.

Gershon, R. R. M., Barocas, B., Canton, A. N., Li, X., & Vlahov, D. (2009). Mental, physical, and behavioral outcomes associated with perceived work stress in police officers. *Criminal Justice & Behavior*, *36*(3), 275–289. https://doi.org/10.1177/0093854808330015

Grasmann, J., Almenräder, F., Voracek, M., & Tran, U. S. (2023). Only small effects of mindfulness-based interventions on biomarker levels of inflammation and stress: A preregistered systematic review and two three-level meta-analyses. *International Journal of Molecular Sciences*, *24*(5), 4445. https://doi.org/10.3390/ijms24054445

Grupe, D. W., McGehee, C., Smith, C., Francis, A. D., Mumford, J. A., & Davidson, R. J. (2021). Mindfulness training reduces PTSD symptoms and improves stress-related health outcomes in police officers. *Journal of Police and Criminal Psychology*, *36*(1), 72–85. https://doi.org/10.1007/s11896-019-09351-4

Grupe, D. W., Smith, C., & McGehee, C. (2021). Introducing mindfulness training and research into policing: Strategies for successful implementation. In E. P. Arble & B. B. Arnetz (Eds.), *Interventions, training, and technologies for improved police well-being and performance* (pp. 125–149). Information Science Reference/IGI Global. https://doi.org/10.4018/978-1-7998-6820-0.ch007

Grupe, D. W., Stoller, J. L., Alonso, C., McGehee, C., Smith, C., Mumford, J. A., Rosenkranz, M. A., & Davidson, R. J. (2021). The impact of mindfulness training on police officer stress, mental health, and salivary cortisol levels. *Frontiers in Psychology*, *12*, 720753. https://doi.org/10.3389/fpsyg.2021.720753

Gullon-Scott, P., & Longstaff, L. (2024). The prevalence of depression, anxiety, stress, and their relationship to length of service in the UK police force. *Police Journal: Theory, Practice and Principles*, *97*(1), 131–149. https://doi.org/10.1177/0032258X221140813

Hedges, L. (2019). Stochastically dependent effect sizes. In H. Cooper, L. Hedges, & J. C. Valentine (Eds.), *The handbook of research synthesis and meta-analysis* (pp. 281–298). Russel Sage Foundation. https://doi.org/10.7758/9781610448864.16

Hendry, E., McCallister, B., Elman, D. J., Freeman, R., Borsook, D., & Elman, I. (2024). Validity of mental and physical stress models. *Neuroscience & Biobehavioral Reviews*, *158*, 105566. https://doi.org/10.1016/j.neubiorev.2024.105566

Higgins, J., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M., & Welch, V. (2022). *Cochrane handbook for systematic reviews of interventions*. Retrieved April 20, 2024, from www.training.cochrane.org/handbook

Hoeve, M., de Bruin, E. I., van Rooij, F., & Bögels, S. M. (2021). Effects of a mindfulness-based intervention for police officers. *Mindfulness*, *12*(7), 1672–1684. https://doi.org/10.1007/s12671-021-01631-7

Hölzel, B. K., Carmody, J., Vangel, M., Congleton, C., Yerramsetti, S. M., Gard, T., & Lazar, S. W. (2011). Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatry Research: Neuroimaging*, *191*(1), 36–43. https://doi.org/10.1016/j.pscychresns.2010.08.006

Hong, Q. N., Pluye, P., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M.-P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M.-C., & Vedel, I. (2018). Mixed methods appraisal tool (MMAT), version 2018. *Registration of Copyright*, *1148552*(1), 1–7.

Hong, Q. N., Pluye, P., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M.-P., Griffiths, F., Nicolau, B., O'Cathain, A., Rousseau, M.-C., & Vedel, I. (2019). Improving the content validity of the mixed methods appraisal tool: A modified e-Delphi study. *Journal of Clinical Epidemiology*, *111*, 49–59.e1. https://doi.org/10.1016/j.jclinepi.2019.03.008

Imhoff-Smith, T. P., & Grupe, D. W. (2023). The impact of mindfulness training on posttraumatic stress disorder symptoms, subjective sleep quality, and objective sleep outcomes in police officers. *Psychological Trauma*, *16*(Suppl 3), S590–S598. https://doi.org/10.1037/tra0001566

Kabat-Zinn, J. (1982). An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *General Hospital Psychiatry*, *4*(1), 33–47. https://doi.org/10.1016/0163-8343(82)90026-3

Kabat-Zinn, J. (2013). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. Bantam Books.
Kabat-Zinn, J. (2015). Mindfulness. *Mindfulness*, *6*(6), 1481–1483. https://doi.org/10.1007/s12671-015-0456-x
Kabat-Zinn, J. (2019). *Mindfulness for beginners: Reclaiming the present moment-and your life*. Hachette Books.
Kaplan, J., Bergman, A. L., Green, K., Dapolonia, E., & Christopher, M. (2020). Relative impact of mindfulness, self-compassion, and psychological flexibility on alcohol use and burnout among law enforcement officers. *Journal of Alternative and Complementary Medicine (New York, NY)*, *26*(12), 1190–1194. https://doi.org/10.1089/acm.2020.0178
Khatib, L., Glaser-Reich, J., Mosbey, D., Oliva, V., Riegner, G., Dean, J. G., Harth, N. M., & Zeidan, F. (2022). Mindfulness meditation training reduces aggression and improves well-being in highly stressed law enforcement officers. *Journal of Police and Criminal Psychology*, *37*(4), 972–983. https://doi.org/10.1007/s11896-022-09554-2
Koumantarou Malisiova, E., Mourikis, I., Darviri, C., Nicolaides, N. C., Zervas, I. M., Papageorgiou, C., & Chrousos, G. P. (2021). Hair cortisol concentrations in mental disorders: A systematic review. *Physiology & Behavior*, *229*, 113244. https://doi.org/10.1016/j.physbeh.2020.113244
Krick, A., & Felfe, J. (2020). Who benefits from mindfulness? The moderating role of personality and social norms for the effectiveness on psychological and physiological outcomes among police officers. *Journal of Occupational Health Psychology*, *25*(2), 99–112. https://doi.org/10.1037/ocp0000159
Kyron, M. J., Rikkers, W., Bartlett, J., Renehan, E., Hafekost, K., Baigent, M., Cunneen, R., & Lawrence, D. (2022). Mental health and wellbeing of Australian police and emergency services employees. *Archives of Environmental & Occupational Health*, *77*(4), 282–292. https://doi.org/10.1080/19338244.2021.1893631
Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *33*(1), 159–174. https://doi.org/10.2307/2529310
Leow, T., Li, W. W., Miller, D. J., & McDermott, B. (2024). Prevalence of university non-continuation and mental health conditions, and effect of mental health conditions on non-continuation: A systematic review and meta-analysis. *Journal of Mental Health (Abingdon*, *34*(2), 222–237. https://doi.org/10.1080/09638237.2024.2332812
Li, M., Gao, Q., & Yu, T. (2023). Kappa statistic considerations in evaluating inter-rater reliability between two raters: Which, when and context matters. *Bone Marrow Concentrate Cancer*, *23*(1), 1–799. https://doi.org/10.1186/s12885-023-11325-z
Li, W. W., McIntyre, R., Reid, C., & Chao, M. (2024). A systematic review on the state of the art of culturally adapted mindfulness-based interventions for first nations peoples: Cultural adaptation, effectiveness, and feasibility. *Mindfulness*, *15*(9), 2147–2172. https://doi.org/10.1007/s12671-024-02440-4
Li, W. W., Miller, D., Shapiro, S., & Narayanan, A. (2023). Editorial: Mindfulness and mental health in the time of the COVID-19 pandemic. *Frontiers in Psychology*, *14*, 1209911. https://doi.org/10.3389/fpsyg.2023.1209911
Li, W. W., Nannestad, J., Leow, T., & Heward, C. (2024). The effectiveness of mindfulness-based stress reduction (MBSR) on depression, PTSD, and mindfulness among military veterans: A systematic review and meta-analysis. *Health Psychology Open*, *11*. https://doi.org/10.1177/20551029241302969
Lu, S., Wei, F., & Li, G. (2021). The evolution of the concept of stress and the framework of the stress system. *Cell Stress*, *5*(6), 76–85. https://doi.org/10.15698/cst2021.06.250
Magnavita, N., Garbarino, S., & Garbarino, S. (2013). Is absence related to work stress? A repeated cross- S ectional study on a special police force. *American Journal of Industrial Medicine*, *56*(7), 765–775. https://doi.org/10.1002/ajim.22155
Márquez, M. A., Galiana, L., Oliver, A., & Sansó, N. (2021). The impact of a mindfulness-based intervention on the quality of life of Spanish national police officers. *Health & Social Care in the Community*, *29*(5), 1491–1501. https://doi.org/10.1111/hsc.13209

McEwen, B. S. (2017). Neurobiological and systemic effects of chronic stress. *Chronic Stress*, *1*. https://doi.org/10.1177/2470547017692328

McHugh, M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica*, *22*(3), 276–282. https://doi.org/10.11613/BM.2012.031

Mei, F., Yao, M., Wang, Y., Huan, J., Ma, Y., Li, G., Zou, K., Li, L., & Sun, X. (2024). Integration of non-randomized studies with randomized controlled trials in meta-analyses of clinical studies: A meta-epidemiological study on effect estimation of interventions. *BMC Medicine*, *22*(1), 1–17. https://doi.org/10.1186/s12916-024-03778-1

Melis, M., Schroyen, G., Pollefeyt, J., Raes, F., Smeets, A., Sunaert, S., Deprez, S., & Van der Gucht, K. (2022). The impact of mindfulness-based interventions on brain functional connectivity: A systematic review. *Mindfulness*, *13*(8), 1857–1875. https://doi.org/10.1007/s12671-022-01919-2

Ménard, K. S., & Arter, M. L. (2013). Police officer alcohol use and trauma symptoms: Associations with critical incidents, coping, and social stressors. *International Journal of Stress Management*, *20*(1), 37–56. https://doi.org/10.1037/a0031434

Mohr, G., Rigotti, T., & Müller, A. (2005). Irritation - ein instrument zur erfassung psychischer beanspruchung im arbeitskontext. Skalen- und itemparameter aus 15 studien [irritation scale. A tool to assess psycho logical strain in the work context. Scale and item parameters from 15 studies]. *Zeitschrift für Arbeits- und Organisationspsychologie A&O*, *49*, 44–48.

Moreno, A. F., Karanika-Murray, M., Batista, P., Hill, R., Vilalta, S. R., & Oliveira-Silva, P. (2024). Resilience training programs with police forces: A systematic review. *Journal of Police and Criminal Psychology*, *39*(1), 227–252. https://doi.org/10.1007/s11896-023-09633-y

Moyes, E., Nutman, G., & Mirman, J. H. (2022). The efficacy of targeted mindfulness-based interventions for improving mental health and cognition among youth and adults with ACE histories: A systematic mixed studies review. *Journal of Child & Adolescent Trauma*, *15*(4), 1165–1177. https://doi.org/10.1007/s40653-022-00454-5

Murad, M. H., Wang, Z., Chu, H., & Lin, L. (2019). When continuous outcomes are measured using different scales: Guide for meta-analysis and interpretation. *BMJ (Online)*, 364. https://doi.org/10.1136/bmj.k4817

Nagy, S., Pickett, S. M., Sosa, J., & Garcell, A. (2020). 0262 an exploratory examination of the relationship between negative affect, stress and emotional reactivity, mindfulness, and sleep incompatible behaviors. *Sleep (New York, NY)*, *43*(Supplement_1), A100. https://doi.org/10.1093/sleep/zsaa056.260

Navarrete, J., García-Salvador, M. Á., Cebolla, A., & Baños, R. (2022). Impact of mindfulness training on Spanish police officers' mental and emotional health: A non-randomized pilot study. *Mindfulness*, *13*(3), 695–711. https://doi.org/10.1007/s12671-022-01827-5

Ong, N. Y., Teo, F. J. J., Ee, J. Z. Y., Yau, C. E., Thumboo, J., Tan, H. K., & Ng, Q. X. (2024). Effectiveness of mindfulness-based interventions on the well-being of healthcare workers: A systematic review and meta-analysis. *General Psychiatry*, *37*(3), e101115. https://doi.org/10.1136/gpsych-2023-101115

Parsons, C. E., Crane, C., Parsons, L. J., Fjorback, L. O., & Kuyken, W. (2017). Home practice in mindfulness-based cognitive therapy and mindfulness-based stress reduction: A systematic review and meta-analysis of participants' mindfulness practice and its association with outcomes. *Behaviour Research and Therapy*, *95*, 29–41. https://doi.org/10.1016/j.brat.2017.05.004

Phythian, R., Birdsall, N., Kirby, S., Cooper, E., Posner, Z., & Boulton, L. (2023). Organisational and individual perspectives of police wellbeing in England and Wales. *The Police Journal*, *96*(1), 128–152. https://doi.org/10.1177/0032258x211052250

Purba, A., & Demou, E. (2019). The relationship between organisational stressors and mental wellbeing within police officers: A systematic review. *BMC Public*, *19*(1), 1286–21. https://doi.org/10.1186/s12889-019-7609-0

Qin, K., Yu, Y., Cai, H., Li, J., Zeng, J., & Liang, H. (2024). Effectiveness of mindfulness-based intervention in schizophrenia: A meta-analysis of randomized controlled trials. *Psychiatry Research*, *334*. https://doi.org/10.1016/j.psychres.2024.115808

Rehder, K., Eddy, A., Kaplan, J., Bergman, A., & Christopher, M. (2021). The relationships between reduced alcohol use and decreased burnout following mindfulness-based resilience training in

law enforcement officers. *The Journal of Alternative and Complementary Medicine*, *27*(11), 984–990. https://doi.org/10.1089/acm.2021.0052

Ribeiro, L., Colgan, D. D., Hoke, C. K., Hunsinger, M., Bowen, S., Oken, B. S., & Christopher, M. S. (2020). Differential impact of mindfulness practices on aggression among law enforcement officers. *Mindfulness*, *11*(3), 734–745. https://doi.org/10.1007/s12671-019-01289-2

Röcke, C., & Grühn, D. (2003). *German translation of the PANAS-X*. Unpublished manuscript, Free University.

Rogerson, O., Wilding, S., Prudenzi, A., & O'Connor, D. B. (2024). Effectiveness of stress management interventions to change cortisol levels: A systematic review and meta-analysis. *Psychoneuroendocrinology*, *159*, 106415–106415. https://doi.org/10.1016/j.psyneuen.2023.106415

Rosenthal, R. (1979). The file drawer problem and tolerance for null results. *Psychological Bulletin*, *86*(3), 638–641. https://doi.org/10.1037/0033-2909.86.3.638

Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse*. Guilford Press.

Shapiro, S., Siegel, R., & Neff, K. D. (2018). Paradoxes of mindfulness. *Mindfulness*, *9*(6), 1693–1701. https://doi.org/10.1007/s12671-018-0957-5

Sun, L.-N., Gu, J.-W., Huang, L.-J., Shang, Z.-L., Zhou, Y.-G., Wu, L.-L., Jia, Y.-P., Liu, N.-Q., & Liu, W.-Z. (2021). Military-related posttraumatic stress disorder and mindfulness meditation: A systematic review and meta-analysis. *Chinese Journal of Traumatology*, *24*(4), 221–230. https://doi.org/10.1016/j.cjtee.2021.05.003

Syed, S., Ashwick, R., Schlosser, M., Jones, R., Rowe, S., & Billings, J. (2020). Global prevalence and risk factors for mental health problems in police personnel: A systematic review and meta-analysis. *Occupational and Environmental Medicine (London, England)*, *77*(11), 737–747. https://doi.org/10.1136/oemed-2020-106498

Tang, Y.-Y., Hölzel, B. K., & Posner, M. I. (2015). The neuroscience of mindfulness meditation. *Nature Reviews Neuroscience*, *16*(4), 213–225. https://doi.org/10.1038/nrn3916

Trombka, M., Demarzo, M., Campos, D., Antonio, S. B., Cicuto, K., Walcher, A. L., García-Campayo, J., Schuman-Olivier, Z., & Rocha, N. S. (2021). Mindfulness training improves quality of life and reduces depression and anxiety symptoms among police officers: Results from the police study-a multicenter randomized controlled trial. *Frontiers in Psychiatry*, *12*. https://doi.org/10.3389/fpsyt.2021.624876

Vadvilavičius, T., Varnagirytė, E., Jarašiūnaitė-Fedosejeva, G., & Gustainienė, L. (2023). The effectiveness of mindfulness-based interventions for police officers' stress reduction: A systematic review. *Journal of Police and Criminal Psychology*, *38*(1), 223–239. https://doi.org/10.1007/s11896-022-09570-2

Violanti, J. M., Charles, L. E., McCanlies, E., Hartley, T. A., Baughman, P., Andrew, M. E., Fekedulegn, D., Ma, C. C., Mnatsakanova, A., & Burchfiel, C. M. (2017). Police stressors and health: A state-of-the-art review. *Policing (Bradford, England)*, *40*(4), 642–656. https://doi.org/10.1108/PIJPSM-06-2016-0097

Wampold, B. E., Mondin, G. W., Moody, M., Stich, F., Benson, K., & Ahn, H.-N. (1997). A meta-analysis of outcome studies comparing bona fide psychotherapies: Empirically, "all must have prizes". *Psychological Bulletin*, *122*(3), 203–215. https://doi.org/10.1037/0033-2909.122.3.203

White, C. A., Uttl, B., Holder, M. D., & Pietschnig, J. (2019). Meta-analyses of positive psychology interventions: The effects are much smaller than previously reported. *PLOS ONE*, *14*(5), e0216588. https://doi.org/10.1371/journal.pone.0216588

Wigg, L., Li, W. W., & Leow, T. (2024). A systematic review and meta-analysis on teaching by humiliation in medical training: Its frequency and impact on the mental health outcomes of medical trainees. *Medical Science Educator*, *35*(1), 569–585. https://doi.org/10.1007/s40670-024-02213-7

Williams, M., Honan, C., Skromanis, S., Sanderson, B., & Matthews, A. J. (2024). Psychological and attentional outcomes following acute mindfulness induction among high anxiety individuals: A systematic review and meta-analysis. *Journal of Psychiatric Research*, *170*, 361–374. https://doi.org/10.1016/j.jpsychires.2023.12.009

Withrow, A., Russell, K., & Gillani, B. (2024). Mindfulness training for law enforcement to reduce occupational impact: A systematic review and meta-analysis. *Police Journal (Chichester)*, *97*(2), 221–239. https://doi.org/10.1177/0032258X231156710

Wood, G., Taylor, E., Ng, V., Murrell, A., Patil, A., van der Touw, T., Wolden, M., Andronicos, N., & Smart, N. A. (2023). Estimating the effect of aerobic exercise training on novel lipid biomarkers: A systematic review and multivariate meta-analysis of randomized controlled trials. *Sports Medicine (Auckland)*, *53*(4), 871–886. https://doi.org/10.1007/s40279-023-01817-0

Xunlin, N., Lau, Y., & Klainin-Yobas, P. (2020). The effectiveness of mindfulness-based interventions among cancer patients and survivors: A systematic review and meta-analysis. *Supportive Care in Cancer*, *28*(4), 1563–1578. https://doi.org/10.1007/s00520-019-05219-9

Zuiden, M., Savas, M., Koch, S. B. J., Nawijn, L., Staufenbiel, S. M., Frijling, J. L., Veltman, D. J., Rossum, E. F. C., & Olff, M. (2019). Associations among hair cortisol concentrations, posttraumatic stress disorder status, and amygdala reactivity to negative affective stimuli in female police officers. *Journal of Traumatic Stress*, *32*(2), 238–248. https://doi.org/10.1002/jts.22395