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The Role of Mindfulness and Meditation in Reducing Stress and Anxiety among Medical Students: A Systematic Review

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ABSTRACT

The journey to becoming a healthcare professional is notoriously challenging, characterised by intense pressure and significant stress throughout the educational process. Medical students confront a demanding curriculum, complex clinical experiences and a constant need to achieve high academic standards. This rigorous environment contributes to substantial anxiety and stress, making students particularly vulnerable to declines in mental health, reduced academic performance and a diminished quality of life. Recently, attention has been directed towards the mental health challenges faced by medical students, given their potential impact on student well-being and patient care. This systematic review aimed to evaluate the effectiveness of mindfulness-based interventions (MBIs) and meditation techniques in alleviating stress and anxiety among medical students. It also sought to assess how these interventions could enhance the overall mental and emotional well-being of students, thereby improving their resilience, coping strategies and academic performance. The thematic analysis of the included studies revealed that mindfulness and meditation practices significantly reduced stress and anxiety levels among medical students. Furthermore, the interventions fostered improved mental clarity, emotional balance and empathy, ultimately enhancing both personal well-being and professional development. However, barriers such as time constraints, institutional pressures and personal scepticism emerged as challenges to the widespread adoption of these practices. This review suggests that incorporating MBIs and meditation into medical education curricula could create a more supportive learning environment, ultimately benefiting both students and patients.

Keywords: *Mindfulness, Meditation, Mental health, Medical students, Systematic review*

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INTRODUCTION

The medical educational experience is notoriously challenging, with students often working under intense pressure throughout their training. Historically, the path to becoming a doctor, dentist or other healthcare professional requires many hours of study, demanding clinical experiences, and the consistent achievement of high grades to succeed academically and prepare for a career in the healthcare sector. These demands create significant anxiety and stress for medical students, rendering them vulnerable to deteriorating mental health, declining academic performance and a compromised quality of life (1).

In recent years, the mental health challenges faced by medical students have gained increasing attention, particularly given the concerning outcomes for both medical trainees and healthcare systems worldwide. The spillover effect of heightened stress and anxiety adversely affects medical students' professional well-being and poses a risk to the health of both patients and physicians. Research has shown that medical students who experience chronic stress and anxiety are more likely to perform poorly academically, misuse substances or exit their medical training programme. Furthermore, studies suggest that medical students are more susceptible to developing mental health issues compared to their peers in other academic fields, as the rigour of medical training often attracts individuals who may already be psychologically vulnerable (2, 3).

Studies have indicated that medical students can significantly reduce stress and anxiety through mindfulness-based techniques and meditation programmes. Mindfulness-based interventions (MBIs), alongside meditation practices, are gaining attention in medical schools for their capacity to mitigate stress and anxiety among medical students. Introducing such interventions into the undergraduate medical curriculum has practical implications at the personal, institutional and professional levels (4). In addition to reducing stress and anxiety, these therapies contribute to enhancing psychological resilience, developing effective coping strategies, and promoting overall well-being (5, 6). Mindfulness and meditation are particularly valuable in high-stakes academic settings, where students face significant pressure and uncertainty about their futures. These techniques address various underlying stressors, including academic expectations, performance pressures and students' anxiety about their future careers, helping them cultivate a sense of calm, focus and balance (2, 4, 7).

Numerous studies have investigated the efficacy of MBIs in reducing stress and anxiety levels among medical students. For example, a study by Shapiro et al. (7) examined the impact of a mindfulness-based stress reduction (MBSR) programme on the psychological state of medical students. The results indicated that participants who completed the MBSR programme experienced a significant reduction in stress levels, anxiety and depressive symptoms compared to the control group. Currently, a qualitative study explored medical students' experiences with mindfulness during their training. The results suggested that participants viewed mindfulness as a tool for self-awareness, enabling students to manage stress and develop coping skills (8).

Rooted in Buddhist traditions, mindfulness has gained recognition for its effectiveness in reducing stress and regulating emotions (5, 6). This involves achieving a heightened awareness by focusing on the present moment, which fosters a mental state characterised by acceptance and presence. Techniques such as mindfulness meditation, body scanning and mindful breathing encourage individuals to observe their experiences with curiosity and openness, cultivating a sense of calm and equanimity (9). Mindfulness can be defined in several ways: as a technique for mental clarity, a form of meditation, an aptitude and a specific therapeutic approach (10, 11).

This systematic review aimed to evaluate the efficacy of MBIs and meditation techniques in reducing stress and anxiety, specifically focusing on medical students. The primary objective was to review existing research on mindfulness and meditation to promote mental and emotional well-being among medical students. Initially, the effectiveness of various MBIs and meditation methods in alleviating stress and anxiety was assessed. In addition, implementing these practices within medical schools was evaluated to determine their effectiveness. The results from the analysis also brought the potential impacts of mindfulness and meditation on medical education and student well-being, elucidating their beneficial effects in fostering a supportive learning environment and enhancing overall student welfare.

Only qualitative studies were included in this systematic review to gain a deeper understanding of the personal experiences and perceptions of medical students engaging with mindfulness and meditation. Qualitative research is particularly well-suited for exploring the subjective and nuanced aspects of these interventions, such as how students experience stress reduction, emotional resilience, and the integration of mindfulness into their academic and personal lives. By focusing on qualitative data, this systematic review aims to capture the richness and diversity of individual responses, which may not be fully reflected in quantitative measures.

METHODOLOGY

Research Design

The priori protocol for this study was developed and registered under the PROSPERO, with the ID CRD42024542358 in the International Prospective Register of Systematic Reviews. This review adhered to the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Eligibility Criteria

The eligibility criteria for this review included medical students aged 18 years and older, articles that had passed the peer review process in ISI journals, and research specifically addressing MBIs or meditation exercises among medical learners. Studies needed to focus on stress and anxiety as primary themes and be published in English as original articles within the past five years. Exclusion criteria included quantitative studies, systematic reviews, met a-analyses, or other non-qualitative research designs; articles that could not be evaluated due to unavailability in full-text format or written in a language other than English; and studies published outside the specified time frame (before 2019 or after 2023).

Search Strategy and Study Selection

From January 2019 to December 2023, a comprehensive search of peer-reviewed articles and conference proceedings was conducted across several electronic databases: PubMed, MEDLINE (Cochrane Library), EMBASE (Ovid interface), Google Scholar and Web of Science. The references and citations of the selected papers were reviewed to identify additional relevant studies. Furthermore, grey literature was examined using open grey literature databases, and additional databases were identified for further searches.

Only studies published in English were included in this review. The search strategy was developed using keywords, synonyms, abbreviations, and Medical Subject Headings (MeSH) terms, including "(Mindfulness) OR (Mindfulness-based) OR (Meditation) OR (Contemplative practices) OR (Mindfulness meditation)" AND "(Stress) OR (Psychological stress) OR (Emotional) OR (Emotion)" AND "(Anxiety) OR (Psychological anxiety) OR (Worry) OR (Anxious) OR (Nervous) OR (Nervousness)" AND "(Medical students) OR (Medical trainees) OR (Healthcare students)." Appropriate search filters, as endorsed by the Cochrane Collaboration and librarians, were employed to ensure the accurate identification of relevant studies.

During the pilot review stage, all retrieved papers were imported into Endnote Library 20.0 (Clarivate, Boston, USA), where an initial deduplication of studies was carried out. Full texts and supplementary files were then retrieved, and titles and abstracts were assessed for relevance by two independent authors (CZT and CZYL) using Rayyan Software (USA) (12). Corresponding authors were contacted via email for any missing data. Only studies with full-text availability were included in this review.

Outcome

The primary outcome measure for this review was to assess the effectiveness of MBIs and meditation techniques in reducing stress and anxiety levels among medical students. The secondary outcome was to evaluate the implementation and application of these practices within medical school environments. Data extracted for effectiveness outcomes included studies that directly measured changes in stress and anxiety levels before and after the intervention.

Data Extraction and Risk of Bias Assessment

Duplicates were eliminated from the retrieved articles by importing them into Endnote 20.0 (Clarivate, 2013, Boston, USA). Data were extracted, full texts reviewed, and titles and abstracts evaluated for relevance. The risk of bias was assessed using Cochrane's Risk of Bias 2 (RoB2) tool, with assessments categorised as "low risk", "some concerns", or "high risk". Key study details—including study identifier, publication date, recruitment period, study location, study design, and baseline participant characteristics (e.g., sample size, mean age, and sex distribution)—were extracted and evaluated by two authors (CZT and CZYL). The duration of mindfulness or meditation interventions, primary outcomes, intervention type and dosage, and other relevant study features were also considered.

The RoB2 tool was used to evaluate the risk of bias across several domains: (a) randomisation process, (b) deviations from intended interventions, (c) missing outcome data, (d) outcome measurement, (e) selection of the reported results, and (f) overall risk of bias. In cases of disagreement between the two reviewers, a third reviewer conducted independent data extraction and risk of bias assessment to resolve disputes.

RESULTS

Included Studies

This systematic search strategy yielded a comprehensive database of 707 articles. The selection process and outcomes are illustrated in Figure 1. A rigorous screening procedure was employed, resulting in the removal of 256 duplicates and 415 articles deemed irrelevant to this study. Consequently, 32 studies were excluded for failing to meet the predetermined inclusion criteria for this systematic review, leading to the inclusion of four eligible studies. Finally, we reviewed the four eligible studies based on the eligibility criteria.

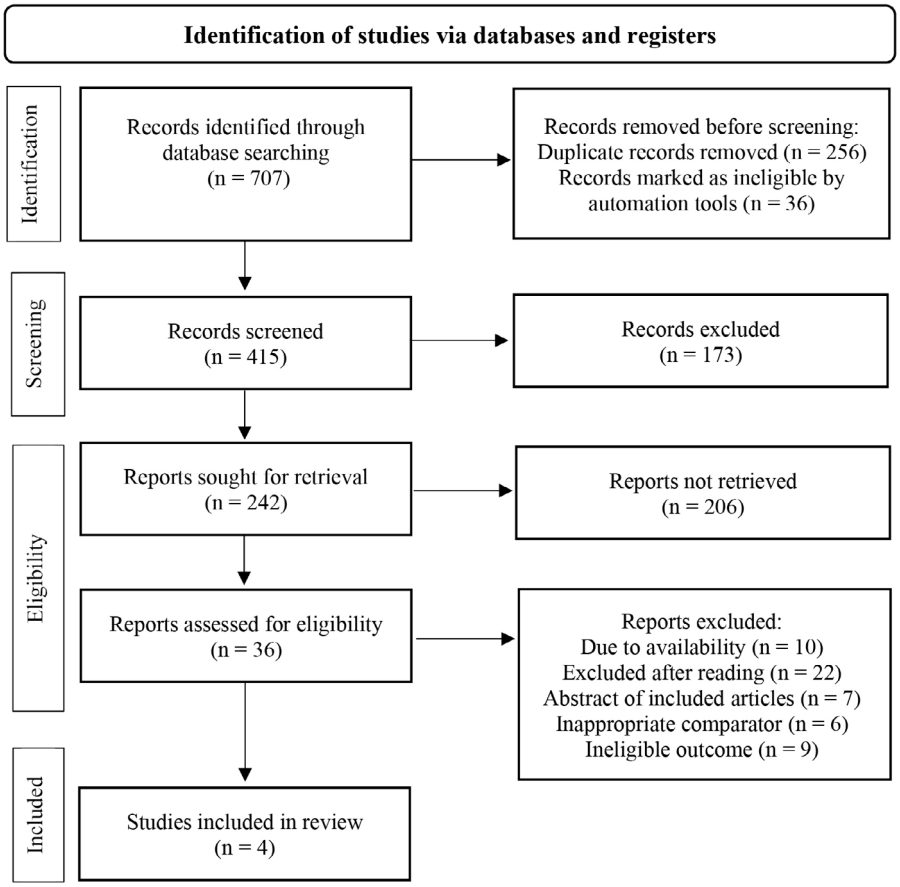

Figure 1: Summary of study search and selection process (PRISMA flow chart).

RESULTS

Study Characterisation

Table 1 summarises the key characteristics of the qualitative studies included in this review. The studies were conducted in the UK, Canada, and Australia, and involved varied participant sample sizes, ranging from 11 to 57 medical students. The primary focus of these studies was on the impact of MBIs and related practices on medical students' well-being

and educational experiences. These studies explored diverse aspects, including the effects of an 8-week mindfulness course, the role of social capital in clinical settings, students' perceptions of mandatory mindfulness interventions, and factors influencing responses to clinical uncertainty. The interventions assessed included structured mindfulness training, social capital enhancement, and mandatory curriculum components. The studies aimed to evaluate both the personal and institutional benefits of these interventions, as well as barriers to their effective implementation, with an emphasis on understanding how mindfulness and related practices affect stress management, professional development and coping strategies.

Quality Evaluation

All four studies included in this review were qualitative in design, with methodologies that varied in their approaches to data collection and analysis. Each study employed rigorous methods, including detailed interviews and focus groups, to ensure comprehensive data coverage. Although none of the studies utilised randomisation or blinding, they provided thorough descriptions of the participant recruitment and data collection processes. The risk of bias was evaluated using the Cochrane Risk of Bias 2 (RoB2) tool, with the majority of studies showing concerns due to potential biases in participant selection and data interpretation. Nonetheless, the studies were transparent regarding their methods and limitations, and no evidence of selective reporting was identified. Overall, the quality of the studies was considered acceptable for providing insights into the effects of MBIs on medical students, contributing to a reliable synthesis of their impact on well-being and educational outcomes.

Table 1: A synthesis of the key findings from the studies

Author, Year	Country	Sample size	Male: Female ratio	Purpose of the study	Duration	Intervention details	Outcome measures	Findings	Limitations
Malpass, Binnie & Robson (2)	UK	57 medical students who participated in an 8-week mindfulness training between Autumn 2011 and Spring 2015	15 males, 42 females	To qualitatively evaluate the impact of attending an 8-week mindfulness course on the emotional well-being and ability to manage workload and stressful situations.	8 weeks	8-week mindfulness training programme for medical students.	The effectiveness of the intervention was assessed based on its impact on students' emotional well-being, ability to manage workload and stress, resilience, self-awareness, and coping mechanisms.	Mindfulness training significantly improved students' ability to manage workload and stress, with reported benefits including enhanced focus, academic performance, resilience, empathy, and better clinical interactions. Challenges included difficulties with body awareness and self-critical thought patterns.	The study's small sample size may limit generalisability. The lack of a control group makes isolating the intervention's effects difficult. The short intervention duration may not capture long-term effects.
Nolan & Owen (13)	UK	20 medical students	9 males, 11 females	To understand learning and personal or professional skill development achieved through MSHCA roles and barriers preventing students from participating.	The study focused on understanding roles and barriers related to MSHCA without a specific intervention duration.	Not specified (emphasis was on understanding roles and barriers related to MSHCA roles rather than a specific intervention).	The study aimed to understand the development of personal and professional skills through MSHCA roles and the barriers preventing full engagement. It investigated the impact of increased social capital on learning and professional identity.	Increased social capital within clinical teams enhanced learning and participation. MSHCA roles were beneficial for professional identity and collaboration. Barriers included integration challenges and the impact of the COVID-19 pandemic.	The study did not specifically focus on mindfulness interventions, which limits relevance to mindfulness practice. The COVID-19 pandemic may have introduced variability in experiences. The focus on MSHCA roles may not fully address mindfulness effects.

(*Continued on next page*)

Table 1: (*Continued*)

Author, Year	Country	Sample size	Male: Female ratio	Purpose of the study	Duration	Intervention details	Outcome measures	Findings	Limitations
Sanchez-Campos et al. (4)	Canada	11 medical students	3 males, 8 females	To assess students' perceptions of a mandatory mindfulness intervention and to elicit recommendations for further curriculum development and implementation.	The study details a mandatory mindfulness intervention integrated into the curriculum, but the exact duration of the intervention or study period is not specified.	Mandatory mindfulness intervention integrated into the curriculum.	The effectiveness of the intervention was measured by assessing students' perceptions of its benefits, which included reduced time pressure, increased awareness of mindfulness, enhanced resilience, and improved balance in life. The study also identified personal barriers such as lack of time, forgetfulness, and scepticism, as well as institutional barriers like an overburdened curriculum. Recommendations for better integration of mindfulness practices into the curriculum were also provided.	The mandatory mindfulness intervention was perceived to offer personal benefits like stress reduction and improved resilience but faced barriers such as time constraints, scepticism, and curriculum overload. Institutional support was noted, but the curriculum's focus on biomedical education created challenges for integrating mindfulness practices effectively.	Personal barriers and institutional constraints might have affected engagement and effectiveness. Reliance on qualitative methods may not fully capture intervention effectiveness.
Stephens, Sarkar & Lazarus (14)	Australia	41 medical students were recruited (only 35 completed all 8 stages of the study)	28 males, 13 females	To explore the factors that medical students in their clinical years perceive as influencing their perceptions of and responses to uncertainty in clinical practice.	The study examined medical students during their clinical years, but specific duration details are not mentioned. The focus was on perceptions of uncertainty in clinical practice rather than a fixed intervention period.	Not specified (study focused on the perception of uncertainty rather than a specific mindfulness or meditation intervention).	The research examined how various factors influenced medical students' perceptions of and responses to uncertainty in clinical practice. The study identified major themes related to individual, sociocultural, and academic factors, as well as reflective learning, and how these factors impacted students' management of uncertainty.	Medical students encountered uncertainty in clinical practice related to educational ambiguity, professional identity, and complex patient conditions. Reflective learning was seen as a positive factor in managing uncertainty, while individual, sociocultural, and academic factors had mixed effects. The study emphasised the need for curriculum adjustments to better address these uncertainties.	Lack of focus on a specific mindfulness or meditation intervention limits applicability to mindfulness practices. The emphasis on uncertainty might not address all aspects of mindfulness or its direct effects on stress and anxiety. The thematic analysis may be subject to interpretative biases.

Note: MSHCA = Medical student healthcare assistant.

DISCUSSION

This review identified four qualitative studies that examined the impact of MBIs on medical students. Each study provided valuable insights into the different aspects of mindfulness practice and its effects on students' well-being and educational experiences. Malpass et al. (2) conducted a study in the UK involving 57 medical students participating in an 8-week mindfulness course. The study revealed that mindfulness training significantly improved students' workload management, focus, and academic performance. Enhanced resilience and empathy were noted, leading to better clinical interaction. However, some students faced challenges with body awareness and self-critical thoughts, indicating areas in which mindfulness practice could be further tailored to address these issues.

Nolan and Owen (13), also from the UK, involved 20 medical students and emphasised the importance of active participation and collaboration in clinical settings. This study proposed innovative roles, such as the medical student healthcare assistant (MSHCA), to improve

student engagement and professional identity. This highlighted the necessity for new models of clinical education to address the challenges exacerbated by the COVID-19 pandemic and to better integrate students into healthcare teams. This suggests a need for a re-evaluation of clinical training approaches to optimise educational benefits for students.

Sanchez-Campos et al. (4), from Canada, included 11 medical students and focused on their perceptions of a mandatory mindfulness intervention. The analysis identified four major themes: economic benefits, personal barriers, agency benefits and institutional barriers. Students recognised the benefits of mindfulness in reducing stress and developing resilience but faced obstacles such as lack of time, scepticism, and an overburdened curriculum. Recommendations include integrating mindfulness more effectively into the curriculum and addressing these barriers to enhance its adoption and effectiveness.

In Australia, Stephens, Sarkar, and Lazarus (14) studied 41 medical students and explored the factors influencing their responses to clinical uncertainty. This study identified three primary themes: educational ambiguity, professional uncertainty and clinical uncertainty. It highlights how uncertainty in clinical practice, including complex patient conditions and unclear role expectations, affects students' experiences. These findings suggest that educational curricula should include strategies for managing uncertainty to better prepare students for clinical practice, emphasising the need for further research on these dynamics.

Together, these studies underscore the multifaceted benefits of mindfulness and related interventions for improving medical students' well-being and academic performance. They also revealed significant barriers and challenges that need to be addressed to fully integrate mindfulness into medical education. These diverse findings suggest that while mindfulness can enhance resilience and clinical interactions, effective implementation requires overcoming institutional and personal obstacles to maximise its benefits.

To effectively reduce anxiety and stress among medical students, specific recommendations include implementing structured mindfulness programmes that combine mindfulness with cognitive-behavioural techniques, establishing peer support groups to foster community and emotional support, and conducting regular workshops focused on mindfulness techniques. Additionally, offering flexible scheduling to accommodate mindfulness practices and training faculty in mindfulness can create a supportive educational environment. Through these methods, institutions can facilitate the integration of mindfulness into medical education, thereby maximising its benefits for students.

CONCLUSION

In conclusion, this systematic review highlights the efficacy of MBIs and meditation techniques in enhancing medical students' well-being and academic performance. The reviewed studies have revealed significant improvements in resilience, stress management and clinical interactions. However, several limitations impact the findings of this review. Variability in the implementation and duration of mindfulness programmes, along with differences in student perceptions and institutional barriers, pose challenges in standardising interventions.

Additionally, reliance on qualitative studies limits the generalisability of the results. Future research should address these limitations by incorporating more rigorous study designs, standardising mindfulness practices, and evaluating long-term outcomes. By overcoming these challenges, mindfulness practices can be more effectively integrated into medical

education, ultimately fostering a supportive learning environment and improving students' welfare. The findings of this review support the incorporation of mindfulness practices into medical training, with an aim to foster a supportive educational environment and promote overall student welfare. Additionally, reliance on qualitative studies limits the generalisability of the results. Future research should address these limitations by incorporating more rigorous study designs, standardising mindfulness practices, and evaluating long-term outcomes. By overcoming these challenges, mindfulness practices can be more effectively integrated into medical education, ultimately fostering a supportive learning environment and improving students' welfare. The findings of this review support the incorporation of mindfulness practices into medical training, with an aim to foster a supportive educational environment and promote overall student welfare.

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