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Interventions for Medical Students' Psychological Wellbeing: A Scoping Review

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ABSTRACT

Amidst the acknowledged challenges to students' psychological wellbeing in medical education, this review aims to map and assess the wellbeing interventions employed in studies aimed to enhance medical students' quality of life and overall mental health and wellbeing. Despite the recognised need to address psychological wellbeing in medical education, ambiguity remains regarding the nature, range and effectiveness of the wellbeing interventions that have been made available to medical students for this purpose. Methods: Using the Arksey–O'Malley scoping review method, authors systematically searched Medline, PsycINFO, Embase, Cochrane, and Web of Science databases for publications from inception to December 2024. Two reviewers assessed study eligibility and extracted data on wellbeing interventions aimed at improving the psychological wellbeing of medical students. Results: Sixty papers met the criteria for inclusion as studies focusing on interventions targeting the psychological wellbeing of medical students. Our findings identified a diverse range of interventions, including mindfulness-based interventions, cognitive-behavioural therapy, mind-body medicine, pass/fail grading, curriculum changes, and wellness programs. These interventions demonstrated varying degrees of effectiveness in reducing poor psychological wellbeing and promoting positive outcomes. Specifically, mindfulness-based interventions showed positive impacts on anxiety reduction while cognitive-behavioural therapy interventions exhibited favourable effects on stress alleviation and psychological morbidity. Furthermore, students enrolled in pass/fail evaluation systems demonstrated substantial initial wellbeing improvement compared to other academic interventions. However, the effectiveness of mind-body medicine interventions, diverse curriculum changes, and wellness programs presented mixed results, stressing the need for tailored interventions. Despite the implementation of various interventions, uncertainty persists regarding their alignment with students' preferences, influenced by factors such as intervention format, time constraints, and academic pressures. Conclusions: The findings of this review offer insights into the nature, effectiveness and acceptability of psychological wellbeing interventions for medical students, underlining the need for interventions that align with students' preferences and choices. Continuous evaluations and adaptations of interventions are essential to meet evolving needs and to foster resilience among medical students.

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1. Introduction

The journey through medical school is both academically and emotionally demanding, a subject widely discussed in scholarly literature (Cuttilan et al., 2016; West & Coia, 2019). This challenging experience has been associated with poor psychological wellbeing in medical students, which has often been manifested as psychological distress, depression, anxiety, burnout, and increased substance use (Dyrbye et al., 2006; Esan et al., 2019; Fares et al., 2016). Studies worldwide have documented prevalence of psychological morbidity among medical students, estimating depression and anxiety rates at 28% and 33%, respectively, which is higher than that of their non-medical students (Dyrbye et al., 2006; Esan et al., 2019; Fares et al., 2016). Systematic reviews (Kötter et al., 2019; Rodrigues et al., 2018) and meta-analyses (Puthran et al., 2016; Rotenstein et al., 2016) have further corroborated these findings, underlining a persistent wellbeing issue in medical education. Importantly, the reported psychological strain on medical students extends beyond their training and persists post-graduation (Mineva, 2022; Shi et al., 2015), hindering a smooth transition into the professional stages and resulting in escalating rates of depression and anxiety in the healthcare workforce (Hill et al., 2018; Yusoff et al., 2011).

Medical students have been found to face numerous stressors, such as excessive workload, study-life balance conflicts, a competitive academic environment (Hill et al., 2018; Yusoff et al., 2011), limited leisure time (Butcher et al., 2021; Quince et al., 2012), and unique difficulties evolving with training years, including comprehending and managing complex medical knowledge, ethical conflicts, and exposure to death and illness (Teunissen & Westerman, 2011; Van Hell et al., 2008).

Furthermore, the consequences of poor mental health among medical students can extend beyond individual suffering and can have significant implications for the quality of healthcare provision. For instance, mental health challenges can impair cognitive function and decision-making abilities, potentially leading to medical errors and compromised patient care (Cohen et al., 2013; Tawfik et al., 2019). Moreover, untreated mental health issues among healthcare professionals can increase the risk of burnout and turnover, thereby undermining the effectiveness and stability of healthcare systems (Ishak et al., 2013; Luca et al., 2019). Additionally, mental health concerns may contribute to the alarming rates of suicide among medical students and physicians, highlighting the urgent need for comprehensive interventions to support their wellbeing and ensure a resilient and effective healthcare workforce (Dutheil et al., 2019).

Understanding the mental health challenges among medical students requires more in-depth consideration of the multi-faceted factors that serve as stressors in their lives, as well as an understanding of their coping mechanisms and idiosyncratic attitudes (e.g., personality) towards these stressors (Bergmann et al., 2019; Kötter et al., 2019). While studies on gender differences have yielded inconclusive results(Binswanger et al., 2010; Hill et al., 2018), the influence of diversity factors, such as racial and ethnic disparities, should be considered too, as suggested by a systematic review (Speller, 2010).

In light of the stressors and wellbeing challenges faced by medical students, recent endorsements by the General Medical Council(GMC, 2015) have highlighted an urgent need for the implementation of initiatives to safeguard the wellbeing of medical students as well as physicians. Furthermore, both the Accreditation Council for Graduate Medical Education (ACGME) and the National Academy of Medicine (NAM) have emphasised the importance of a systematic approach to addressing healthcare providers' wellbeing, introducing strategies aimed at enhancing their overall wellbeing (Sinskey et al., 2022). Several studies have explored strategies such as adjusting shift schedules, reducing workloads, and promoting healthy habits

to address work-life balance and reduce burnout among healthcare professionals; however, the effectiveness of these approaches requires further investigation (Krishnan et al., 2022; Raj et al., 2000; Thomas et al., 2017). Conversely, medical students have been found to be hesitant in seeking help from mental health professionals, highlighting the importance of establishing supportive and safe environments within medical schools (Butcher et al., 2021; Winter et al., 2017). Despite this recognition, existing systematic reviews of stress management interventions for medical students reveal limited available interventions, underscoring the need for more comprehensive efforts (Shapiro et al., 2000).

Although a lot of research has been conducted on the prevalence and characteristics of stress-related issues among medical students, little is known about the range, composition and effectiveness of wellbeing interventions that have been implemented to prevent psychological deterioration and foster overall mental health (Dyrbye et al., 2017). Hence, current reviews lack precision in delineating the desired outcomes and constituent elements of such interventions (Dyrbye et al., 2017; Thomas et al., 2017).

The present review, therefore, endeavours to scope the range and nature of the interventions that have been implemented for medical students, synthesising the existing research in order to provide a comprehensive overview of the approaches that have been applied to enhance the psychological wellbeing of medical students. This synthesis will specifically focus on wellbeing interventions studied for medical students that were designed to assess the impact of these interventions on the quality of life and other psychological wellbeing outcomes within this student population; and will embrace the Dual-Continua Model of Mental Health and Illness (Westerhof & Keyes, 2010) as a theoretical framework to contextualise the scope of this review. This model recognises not only the absence of mental illness but also the presence of positive mental health as crucial determinants of one's optimal mental health and wellbeing, in congruence with the need for improving levels of wellbeing in medical students whether in the absence or presence of mental health problems.

2. Methods

In this scoping review, we employed a systematic approach following the five-stage methodological framework developed by H. Arksey and L. O'Malley (Arksey & O'Malley, 2005) as outlined below:

2.1 Stage 1: Identifying the Research Question

This review aims to map the literature on psychological wellbeing interventions for medical students, evaluating their impact on quality of life and overall psychological wellbeing. The research questions that this scoping review aims to address are (1) What is the nature and range of the psychological wellbeing interventions that have been implemented to enhance the psychological wellbeing of medical students? (2) Can evidence be identified to support the effectiveness of these interventions in reducing poor psychological wellbeing and promoting positive outcomes?

2.2 Stage 2: Identifying Relevant Studies

We conducted a literature review using Medline, PsycINFO, Embase (Ovid platform), Cochrane, and Web of Science. Our search strategy included relevant headings, keywords, and terms related to psychological wellbeing. We also checked review databases and analysed reference lists for additional studies. The search spanned from the inception of the databases to December 2024. MeSH headings guided the search process, incorporating the following terms:

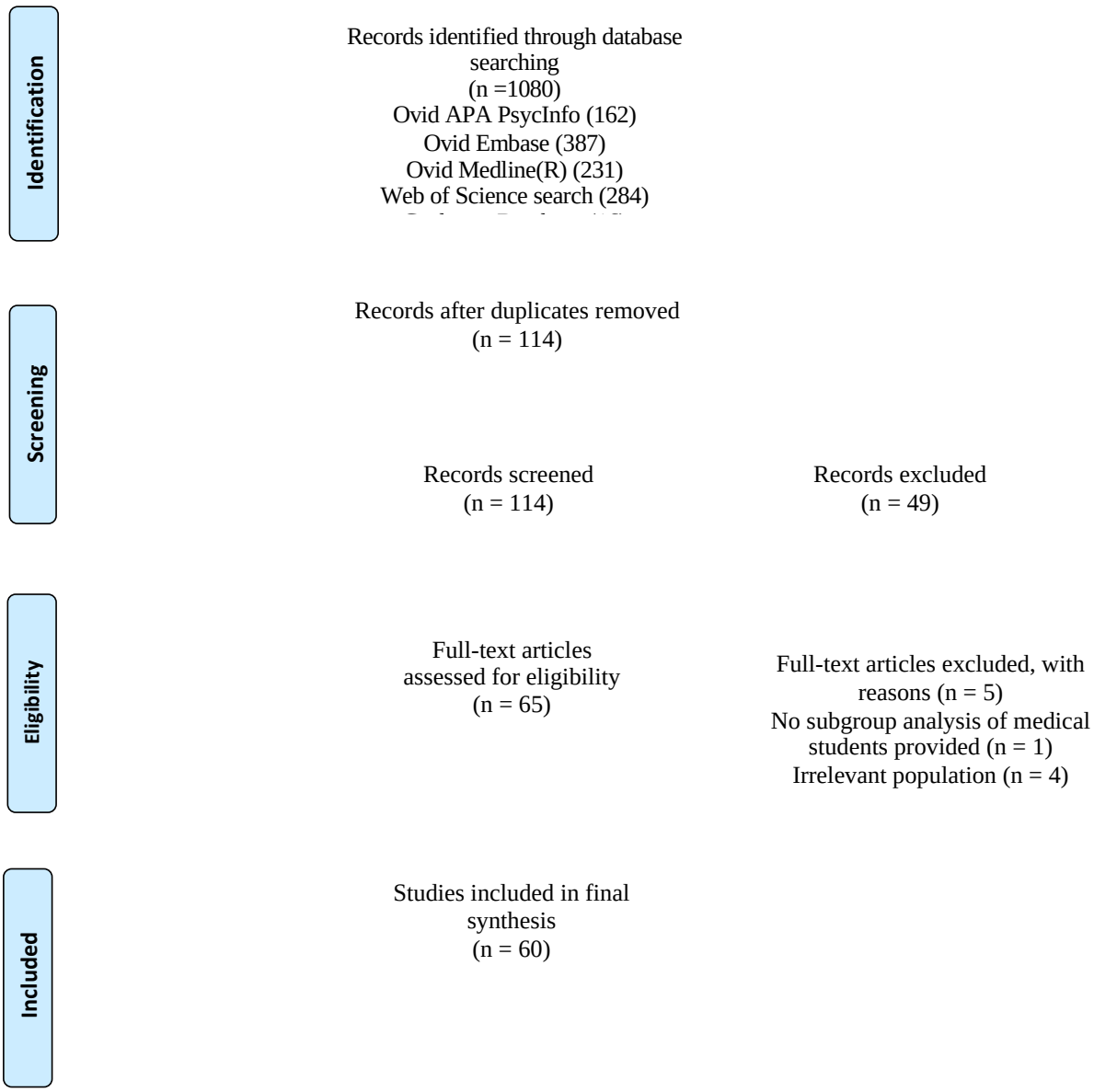
'Psychological Wellbeing Interventions' OR 'Wellbeing Interventions' OR 'Psychological Wellbeing Programs' OR 'emotions' OR 'mood' AND 'medical students' OR 'medical education' OR 'undergraduate medical students' OR 'student doctors.'

'mindfulness' OR 'mind-body medicine' OR 'cognitive behavioural therapy' OR 'MBIs' OR 'Counselling' OR 'Mindfulness-Based Cognitive Therapy' OR 'Mindfulness-Based Stress Reduction' OR 'ACT' OR 'Cognitive Behaviours Therapy' OR 'Computer-Based CBT' OR 'Digital/Face to Face Intervention' AND 'medical education' OR "medical students" OR "undergraduate medical students" OR student doctors"**. (See additional file for complete search strategies).**

2.3 Stage 3: Study Selection

Before initiating the scoping review searches, we conducted an initial search of selected databases to identify keywords relevant to the review's research questions. The process of selecting studies involved two stages: screening titles and abstracts, followed by an examination of the full text. Two reviewers (AH and AB) independently ran the search. Initially, our literature exploration yielded 1080 studies. After removing 966 duplicates, two reviewers (AH and AB) independently screened the titles and abstracts of the remaining 114 studies to assess their relevance for potential eligibility. Among these, 54 studies did not meet the inclusion criteria for review. Subsequently, we conducted a detailed screening of the full text of 65 papers against our inclusion criteria. Reference lists were then hand-searched for any additional relevant papers. Ultimately, after excluding five studies due to ineligibility, we finalised our review with a total of 60 studies; any discrepancies in the screening and selection process were resolved through discussion between the reviewers (AH) and (AB) or, if necessary, by involving a third reviewer (EN). We recorded and managed the results using reference management software, EndNote (version 20). A detailed overview of our study selection process is provided in Figure 1, depicted in the PRISMA Flowchart Diagram. Figure Legends.

Figure 1. PRISMA Flowchart



PRISMA Flow Diagram

The inclusion criteria for this scoping review encompassed investigations into psychological wellbeing interventions designed for medical students, focusing on stress management and overall wellbeing enhancement. Consideration was given to interventions delivered through individuals and groups, as well as face-to-face or remote formats. The review incorporated studies employing both quantitative and qualitative designs. English language interventional studies targeting medical students formed the inclusive scope, featuring clearly defined wellbeing-focused outcome measures. The inclusion criteria encompassed diverse study designs, including randomised, nonrandomised, and controlled and non-controlled investigations.

In terms of exclusion criteria studies that examined practitioners' perspectives on available interventions without actual hands-on experience in the intervention were excluded. Mixed population studies were considered only if specific results for medical students were identifiable. Excluded were studies without outcomes related to psychological wellbeing, suggestions for interventions, and those exploring medical students' perceptions or awareness.

2.4 Stage 4: Data Extraction

In this phase, we employed an Excel spreadsheet to systematically manage and extract relevant data from the 60 chosen studies. Each paper underwent independent review by two reviewers to ensure consistency and alignment with our research goals. We extracted pertinent information from each study, including intervention types, participant demographics, outcome measures, and key findings. Subsequently, we progressed to coding the data, a process which unfolded across three stages: open coding, where initial codes were assigned; category creation by grouping similar codes; and abstraction by identifying overarching themes from the categories (Elo & Kyngäs, 2008). Both reviewers contributed to each stage of coding to ensure a complete analysis of the data. Additionally, NVivo (version 14), a qualitative data analysis software, was employed during this phase for efficient coding and organisation. Discussions among the reviewers were held to refine and adjust the identified themes until a consensus was reached among all team members.

2.5 Stage 5: Collating, Summarizing and Reporting the Results

Upon identifying thematic groupings in the included studies, we considered our approach to data analysis and interpretation. By thematically organising interventions and other findings with similar characteristics, our aim was to address existing evidence and potential gaps in knowledge. This method allowed us to explore adherence patterns and emerging trends in an ultimate attempt to provide insights for educators and healthcare providers. Additionally, we provided recommendations for future research, concluding with a concise summary of key findings to advance knowledge of the nature and effectiveness of interventions to enhance medical student wellbeing.

3. Results

In the analysis of 1080 references, 109 eligible studies were identified after screening. Following full-text examination, 60 studies(Agarwal & Lake, 2016; Ali et al., 2015; Axisa et al., 2019; Barbosa et al., 2013; Bermudez et al., 2020; Bloodgood et al., 2009; Bond et al., 2013; Brennan et al., 2016; BScc & Dobkin, 2013; Bughi et al., 2006; Byrnes et al., 2020; Camp et al., 1994; Chakales et al., 2020; Chand et al., 2018; Chen et al., 2016; Danilewitz et al., 2016; Dare et al., 2009; de Vibe et al., 2013; Drolet & Rodgers, 2010; Dyrbye et al., 2017; Erogul et al., 2014; Finkelstein et al., 2007; Greeson et al., 2015; Guille et al., 2015; Habermann

et al., 2006; Hassed et al., 2009; Holtzworth-Munroe et al., 1985; Howell et al., 2019; Jain et al., 2007; Kabat-Zinn & Hanh, 2009; Kraemer et al., 2016; Kuhlmann et al., 2016; Lattie et al., 2017; Li et al., 2014; Malpass et al., 2019; Moir et al., 2016; Moore et al., 2020; Motz et al., 2012; Noble et al., 2019; Phang et al., 2016; Reed et al., 2011; Robins et al., 1995; Rosenzweig et al., 2003; Sahranavard et al., 2019; Saravanan & Kingston, 2014; Saunders et al., 2007; Scholz et al., 2016; Shapiro et al., 1998; Slavin et al., 2014; Strayhorn, 1989; Thompson et al., 2010; Tucker et al., 2015; van Vliet et al., 2017; Wald et al., 2016; Warnecke et al., 2011; Weingartner et al., 2019; White & Fantone, 2010; Michelle K. Williams et al., 2020; Y.-Y. Xu et al., 2019; Yang et al., 2018; Yusoff, 2011) met inclusion criteria, detailed in the PRISMA flowchart in Figure 1. Table 1 presents a summary of the included studies, illustrating their geographical distribution across a range of countries, including the United States, Australia, Brazil, the United Kingdom, Norway, Canada, Germany, the Netherlands, New Zealand, Pakistan, China, and Malaysia. The predominant study design identified in the scoping review was the pre/post design, which included studies with and without control groups. Other designs, including cohort, intervention, and qualitative studies, were also utilised in the remaining studies. See Table 1.

This review utilised thematic organisation to systematically categorise interventions and findings, providing clarity and aiding in the exploration of the research questions. Employing this method streamlined our data collection process, offering structure and facilitating the identification of two major themes and their respective sub-themes. Firstly, therapy-based interventions were standard psychological interventions, and their types were included as sub-themes, i.e., mindfulness, mind-body medicine, and cognitive-behavioural therapy. The second theme, academic-based interventions, referred to interventions developed to improve wellbeing based upon the initiatives of medical school organisations, and their types were encompassed as sub-themes, i.e., curriculum modifications, wellness programs, pass/fail grading system.

Table 1. Summary of studies included in the review

Study/ Year	Country	Sample size	Study design	Measures of psychological wellbeing	Duration	Intervention	Results
Therapy Based Interventions							
De Vibe et al., 2013(de Vibe et al., 2013)	Norway	288	RCT	(GHQ 12), (MBI), (PMSS), (SWB), Five Facet Mindfulness	Seven sessions per week, consisting of one 6-hour session and six 1.5-hr sessions.	MBSR program (144 participants) compared to control group (no intervention, 144 participants)	The intervention group experienced a notable stress reduction ($p = 0.019$, $d = 0.33$), but did not show a decrease in depression
Barbosa et al., 2013(Barbosa et al., 2013)	USA	28	Quasi experimental	(BAI), (JSPE) and (MBI)	2.5hr/week + 8 hr Silent retreat the 6th week:8 weeks	MBSR (n=13) versus control no intervention) (n=15)	The group receiving intervention exhibited a reduction in anxiety during the 8th ($p < 0.001$) and 11th ($p < 0.01$) weeks. Empathy increased significantly by week 8 ($p < 0.0096$), but by week 11, all participants experienced a non-significant decline in empathy. There was no significant decrease in burnout throughout the entire study period
Malpass et al., 2019(Malpass et al., 2019)	UK	57	Qualitative	N/a	8 weeks; 2 hrs each week	Mindfulness-Based Cognitive Therapy	Mindfulness training helps students develop a greater sense of control and resiliency, manage their workload better, and improve their empathy and communication skills
Chakales et al., 2020(Chakales et al., 2020)	USA	28	Single group pre-test–post-test	(BDI-II), (ESF), (PSS)	Seven sessions in two; for 3-4 hr	Mindfulness and Horsemanship (M&H) course	There was a significant improvement in perceived stress, depression, and stress factor severity. Mean scores of PSS and BDI pre- and post-assessment differed significantly, indicating reduced stress and depression levels. BDI scores showed fewer participants meeting the criteria for depression post-intervention, with most dropping below the clinical criteria
Danilewitz et al., 2016(Danilewitz et al., 2016)	Canada	30	Pilot study	(DASS-21), (FFMQ), (SCS)	1.5hr/week; 8 weeks	Peer-led group MBSR (group size =15) versus wait list control (group size =15)	The group that received intervention exhibited a significant decrease in stress levels and enhancements in self-compassion compared to their initial levels. Conversely, the control group displayed no significant change

Dyrbye et al.,2017(Dyrbye et al., 2017)	USA	44	Pre and post-intervention 2 groups	Happiness and Gratitude scale, (MBI), (PSS), CD-RISC	9 sessions/ 1 hr (embedded in course)	Longitudinal Stress Management and Resilience Training (SMART)	The mental quality of life (QOL) showed a significant decrease ($p < 0.001$) in both cohorts, accompanied by an increase in stress scores ($p < 0.0001$). While happiness and cognitive emotive empathy experienced a decline in cohort 2, the changes were not statistically significant. The prevalence of burnout increased, though insignificantly, and there was no observed alteration in resilience
Erogul et al., 2014(Erogul et al., 2014)	USA	58	RCT	(PSS), (RS), (SCS)	75 minutes per week, divided into 8 sessions, with an additional 20 minutes of daily meditation	MBSR intervention group (n = 28) compared to a control group with no intervention (n = 30)	The group receiving intervention showed a rise in self-compassion upon completion ($p = 0.002$), with a significant decrease in PSS scores at completion ($p = 0.03$), although not at the 6-month mark ($p = 0.08$). There was no statistically significant variance in resilience
Garneau et al., 2013(Zhang et al., 2021)	Canada	58	Single group pre-test – post-test	(MBI - HSS), (PSS-10), (SWB), (SCS), MAAS, (BDI– II)	2.5hr twice/week; 4weeks	MBMP (derived from MBSR) with home-based CD for practising	Depression exhibited a decrease ($p = 0.001$), accompanied by a significant reduction in stress ($p = 0.026$). The emotional exhaustion subscale of burnout also experienced a significant decrease ($p = 0.001$). Self-compassion exhibited a significant increase ($p = 0.001$) with a substantial effect size ($d = 0.38$-0.58)
Jain et al., 2007(Almaqbali, 2019)	USA	81	RCT	(BSI), (PSOM), (DER), INSPIRIT-R, M-C	1.5 hr./ week; 4 weeks	MBSR (27) vs. relaxation training (24) vs. wait-list control (30)	The MBSR group showed significant positive changes compared to the control. Cohen's effect sizes: MBSR RT - 0.91, MBSR - 1.36; control - 0.27
Moir et al., 2016(Moir et al., 2016)	New Zealand	232	RCT	(PHQ-9), (GAD-7), (QoL), Resilience (RS15)	3-hr intro sessions per week for 6 months	Peer support, mindfulness, and meditation (n=133) compared to standard care control (n=142)	There was no statistically significant difference observed in mental health outcomes between the intervention and control groups

Moore et al., 2020(Castaldelli-Maia et al., 2019)	Australia	47	Cohort Study - mixed methods	(PSS), (SCS), (CS)	8 weeks	Online Mindfulness Training	At 4 months, PSS scores decreased significantly from baseline. At 8 weeks and 4 months, SCS scores rose, while CS scores showed no change
Neto et al., 2020(Damião Neto et al., 2020)	Brazil	141	RCT	(WHOQOL - Brief) (DASS-21) (FFMQ)	2hr/week; 6 weeks + 10 min meditation daily	Mindfulness Protocol Teaching (n=70) versus Control (n=71) (organisational aspects of medical school)	The intervention and control groups did not show significant differences in outcome measures (Cohen's d = 0.01 to 0.14). Additionally, the pre-and post-measurements exhibited small alterations, with Cohen's d ranging from 0.02 to 0.18
Noble et al. 2019(Noble et al., 2019)	UK	10	Qualitative	BRS, MAAS, and Thematic Analysis were used	30 min training + 15 min practical; 6 weeks	Mindfulness training + workshop	Resilience scores showed improvement compared to baseline (p = 0.04). Thematic analysis revealed positive themes, indicating improvements in wellbeing, including enhanced coping, reduced stress, and diminished feelings of anger
Rosenzweig et al., 2009(Rosenzweig et al., 2003)	USA	302	Non – randomized cohort-controlled trial	(POMS)	Meditate for 90 minutes plus an additional 20 minutes per day, six days a week, for a total of 10 weeks	MBSR program (n = 140) versus control (n = 162)	The group that received intervention showed significantly reduced total mood disturbance scores. The depression (p=0.09, d = 0.07) and fatigue (p = 0.50, d = 0.49) subscales showed no significant changes. The intervention group started with higher scores in total mood disturbance

Shapiro et al., 1998(Shapiro et al., 1998)	USA	78	Pre-test/ Post-test	(ECRS), (SCL-90), State-Trait Anxiety Inventory, INSPIRIT	2.5h./week; 8 weeks	MBSR elective (n = 37) compare to wait list control (n = 41)	In comparison to the control group, the intervention group reported significantly lower levels of depression, state anxiety, and trait anxiety. Additionally, the intervention group exhibited a decrease in Global Severity Index (GSI) and an increase in empathy
Warnecke et al., 2011(Warnecke et al., 2011)	Australia	66	RCT	(PSS), (DASS-21)	30 min/day; 8 weeks	Compare a guided mindfulness audio CD (n=32) to usual care control (n=34) with Compassion Cultivation Training	Significant (PSS) scores were reported by the intervention group ($p = 0.05$), and this effect persisted at the 8-week follow-up. Additionally, there was a decrease in anxiety and the stress subscale of the (DASS). However, depression did not show significant reductions ($p > 0.05$)
Weingartner et al., 2019(Weingartner et al., 2019)	USA	45	Pre-test-post-test design conducted with a single group	Exploring stress and overall wellness through qualitative examination	Practice meditation at home for 15 to 30 minutes each day, dedicating 2 hours per week over the course of 8 weeks	Compare a guided mindfulness audio CD (n=32) to usual care control (n=34) with Compassion Cultivation Training	Themes identified in the studies include the decrease in stress related to studying and clinical encounters, the recognition of stress, and the positive influence on student compassion
Yang et al.,2018(Yang et al., 2018)	USA	88	RCT	(PSS), (FFMQ), (GWBS)	10-20 min daily meditation; 30 days	Comparison between a mindfulness mobile phone application and a wait-list control group	Intervention group exhibited reduced stress ($p < 0.05$) and sustained improved well-being at 30-day follow-up

Bond et al., 2013(Bond et al., 2013)	USA	27	Pre-test-post-test design conducted with a single group	Self-regulation questionnaire, Cohen's Perceived Stress scale, JSPES, SCS	1.5 hr./ week; 11 weeks	Mind Body Course	Empathy, self-regulation, and self-compassion showed significant increases, while the PSS experienced a slight decrease, albeit not significantly
Bughi et al., 2006(Bughi et al., 2006)	USA	104	Cross-sectional	(GWBS)	60 minutes	Brief Behavioural Intervention programme	The reduction in stress among students, as evidenced by a 46.7% decrease in pre and post-test scores, coincided with a decline in anxiety scores and a significant improvement in overall positive wellbeing.
Chen et al., 2016(Chen et al., 2016)	USA	20	Quasi experimental study	(JSPE-S), (PSS), (PHQ)	2 hr./ week; 11 weeks	Comparing Mind-Body Medicine (n = 13) to Control Group (n = 7)	Both groups saw increased PSS scores and reduced empathy. The control group also experienced a significant rise in depression ($p < 0.05$), unlike the intervention group
Brennan et al., 2016(Brennan et al., 2016)	USA	42	Pre-test-post-test design conducted with a single group	(BDI = II; (BAI), (SRRS-R); (CSE)	8 sessions	Stress Management /Relaxation – Mind Body	Significant enhancements were observed in anxiety and self-efficacy; however, there was no significant improvement in depression. Negative thoughts and problem-solving coping skills improved .
Greeson et al., 2015(Greeson et al., 2015)	USA	44	Single group pre-test/post-test	(CAMS-R), (PSS), Open-ended feedback	1.5 hr./week ; 4weeks	Mind Body Skills	Substantial reduction in PSS scores as compared to baselines
Finkelstein et al., 2007(Finkelstein et al., 2007)	USA	72	Non-randomized	(POMS), (PSMS), (STAI)	2 hr./ week; 10 weeks	Mind Body Medicine Elective (n = 26) versus control (n = 46)	A substantial reduction in anxiety and perceived stress was observed in the intervention group at both the completion and 3-month follow-up stages. The intervention group, consisting of 77% females with initially higher anxiety scores, demonstrated significant improvements

Kraemer et al., 2016(Kraemer et al., 2016)	USA	52	Non-randomized	(DTS), (CAMS-R), (PSS), PANAS	2hr./ week; 11 weeks	Control Group (n = 24) compared to Mind-Body Skills Development (n = 28)	Intervention groups saw significant moderate improvement in all distress tolerance subscales over time (p = 0.02), with qualitative reports indicating more consistent improvements in affective distress tolerance compared to control
Holtzworth-Munroe et al., 1985(Holtzworth-Munroe et al., 1985)	USA	40	RCT	(STAI)	1hr./week; 6weeks	Mind-body intervention group (n = 20) versus control group (n = 20)	The intervention group exhibited lower stress levels ($p < 0.04$) in comparison to the pre-test, while the control group demonstrated increased awareness of tension ($p < 0.001$)
Motz et al., 2012(Motz et al., 2012)	USA	72	In single group pre-test-post-test	(PSS), (FMI), (PANAS)	2 hr./week; 11 weeks	Mind Body Skills	Perceived stress decreased significantly ($p < 0.01$; $d = 0.73$
Saunders et al., 2009(Saunders et al., 2007)	USA	92	Non-randomized	Qualitative thematic analysis	2 hr /week; 11 weeks	Mind Body Skills	Improved student experiences; fostering a sense of "connection" and "stress relief"; overcoming feelings of isolation
Scholzet al., 2016(Scholz et al., 2016)	Germany	42	Pre-test – Post test	(BDI – II), (SOC-L9)	90 mins/ week; 13 weeks	Mind-Body Relaxation Techniques	Education resulted in a reduction of depressive symptoms; however, the changes were not statistically significant when compared to pre-assessment measures. There was an improvement in the sense of coherence, specifically in the aspect of self-management
VanVliet et al., 2017(van Vliet et al., 2017)	NLD	135	Non-randomized	(PSS-10), (IRI), (GRAS)	2 hr./week; 11 weeks	Mind-body medicine (n=74) compared to the control group (n=61) consisting of nutrition and palliative care elective	PSS had no significant effects. Empathy became significant at 12 months but not at 6 months. Lower personal distress levels persisted until the 12-month mark compared to the control group

Walad et al., 2016(Kulsoom & Afsar, 2015)	USA	16	pre- and post-assessment	(ProQO)L + Qualitative analysis	2 hours	Mind body Medicine And Interactive Reflective writing	Participants noted improved quality of life due to group support connections and gained emotion management skills, especially during clinical placements.
Williams et al., 2020(Michelle K Williams et al., 2020)	USA	24	Pre- and post-assessment	(FMI), (PSS-10)	2 hr./week; 11 weeks	Mind Body Elective	There was no change in perceived stress post-intervention. University-designed MCQs showed improved self-care and relationships. 66.7% felt attendance shouldn't be optional for focus, burnout, and time management. Emphasized support groups and skill enhancement
Bermudez et al., 2020 (Bermudez et al., 2020)	Brazil	62	In single group, pre- and post-assessment	Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q) and BDI-I	One session	CBT	Post-assessment revealed an improvement in depression levels and quality of life. Individuals meeting the criteria for panic disorder and social anxiety disorder demonstrated a significant reduction
Chand et al., 2018(Chand et al., 2018)	USA	4	In single group, pre- and post-assessment	Almost Perfect Scale, Dysfunctional Attitude Scale, Imposter Scale, CESD, and STAI	8 sessions	CBT	Depression decreased significantly at 3- and 6-month follow-ups, while anxiety remained stable. Participants also no longer exhibited maladaptive perfectionism.
Li et al., 2014(Li et al., 2014)	China	60	Pilot comparison study	Interpersonal Support Evaluation, Trait Coping Style Questionnaire, SDS, SAS	8 weeks	Williams Life Skills training (n= 30) versus control (n= 30)	The intervention group showed significant improvement in all outcomes through group time interaction, while the control group exhibited no significant change
Guille et al., 2015(Guille et al., 2015)	USA	199	RCT	(GAD-7)	4 weekly sessions, 30 mins	Web-based CBT (n = 100) versus attention	At follow-up, the intervention group showed reduced anxiety severity compared to the control group, with a minor treatment-time interaction effect

					each	control (n = 99)	
Howell et al., 2019(Howell et al., 2019)	USA	772	RCT	(GAD-7)	4 weekly sessions, 30 mins Each	CBT delivered via the web (n = 335) versus control (n = 417)	At follow-up, intervention group showed lower anxiety severity compared to control, with a minor interaction effect between assessment time and treatment
Kuhlmann et al., 2016(Kuhlmann et al., 2016)	Germany	183	Cross-sectional	(TICS), (BSI)	90min/week; 5 weeks	Medi Mind (n = 31) versus Autogenic Training (n = 32) versus control (n=17)	Psychological distress decreased in the intervention group while increasing in the control group. Post-hoc analyses for the BSI revealed a significant interaction effect, but no significance was found for GSI and TICS in terms of group-by-time interaction
Lattie et al., 2017(Lattie et al., 2017)	USA	14	pre- and post-assessment	(PSS), (MSWBI), (CB-RSS), semi structured interview,	14 sessions; 6 weeks	Internet based CBT	Perceived stress has decreased from baseline but remains within the high category; quality of life measures is stable, with fewer individuals reporting feelings of burnout compared to baseline
Phang et al., 2016(Phang et al., 2016)	Malaysia	135	RCT	(PSS), (GHQ), (MAAS)	2hr./week; 4 weeks	Control group (n = 38) compared to mindfulness-based CBT (n = 37)	Significant improvements in all outcomes were noted one week after the intervention, but only self-efficacy increased significantly in the intervention group after 6 months
Saravanan And Kingston, 2014(Saravanan & Kingston, 2014)	Malaysia	65	Randomized experimental study	Academic Motivation, Kessler PSS	5 sessions	Waitlist control (n = 33) compared to CBT-based intervention (n = 32).	Compared to their pre-test scores, the intervention group demonstrated decreased levels of motivation, anxiety, and psychological distress

Xu et al., 2019(Y. Y. Xu et al., 2019)	China	23	RCT	SED-D, Chinese college student adjustment scale, RPWB	2hr./week; 5 weeks	Placebo (n = 50) versus control (n = 50) versus Wellbeing therapy (n = 100)	Of the students surveyed, 65.2% reported scores above the accepted norms on the Perceived Stress Scale, with 34.8% reporting low stress levels, 55.9% moderate, and 9.3% reporting high-stress levels
Academic Based Strategies							
Ali et al., 2015(Ali et al., 2015)	Pakistan	387	2 groups pre-test – Post-test	Perceived Stress Scale, Westside Test Anxiety Scale	N/a	Tiered GPA System versus Pass/Fail	The Pass/Fail group exhibited reduced Perceived Stress Scale (PSS) scores and lower test anxiety in comparison to the GPA assessment group. Additionally, a greater number of individuals in the Pass/Fail group expressed overall contentment with their performance
Bloodgood et al., 2009 (Bloodgood et al., 2009)	USA	141	2 groups pre-test – Post-test	Dupuy General Wellbeing Schedule	N/a	5 interval grading system (n = 140) versus Pass/Fail (n = 141)	The intervention group found an improvement in wellbeing when compared to the graded cohort during the initial three semesters, along with higher satisfaction in both medical school and personal facets of life
Reed et al., 2011(Reed et al., 2011)	USA	1192	2 groups pre-test – Post-test	(PSS), (MBI) and Medical Outcomes Short Form	N/a	Pass/Fail (n = 701) versus 3 category grading scale (n = 491)	Compared to students under the grading system, those in the intervention group exhibited reduced levels of stress, depersonalization, and emotional exhaustion. They were also less likely to experience burnout or consider discontinuing medical school
Robins et al., 1995(Robins et al., 1995)	USA	195	2 groups pre-test – Post-test	Qualitative	N/a	4 system evaluation (n = 222) versus Pass/Fail (n	Students indicated that their anxiety was alleviated, and the decrease in competition fostered student collaboration, leading to enhanced wellbeing, improved social quality of life, and increased motivation

						=195)	
Habermann et al., 2006(Habermann et al., 2006)	USA	80	2 groups pre-test – Post-test	Profile of Mood States, Perceived Stress Scale, Perceived Cohesion Scale	N/a	Five-tier grading (n = 41) compared to pass/fail (n = 40)	The pass/Fail group had lower stress, better mood, and stronger group cohesion than the graded cohort. Test anxiety showed no significant difference. Effects persisted after Pass/Fail transitioned to grading, with no mood difference observed
White and Fantone, 2010(White & Fantone, 2010)	USA	340	Two-group Pre-test – Post-test	Qualitative	N/a	Pass/Fail	Students indicated they allocated additional time to engage with their families, enhance personal well-being, and participate in extracurricular activities. This resulted in a reduction of stress related to time constraints and a lack of leisure time
Camp et al., 1994(Camp et al., 1994)	USA	275	Two-group Pre-test – Post-test	Zung Self Rating Depression Scale	N/a	Lecture-Based Learning (n = 223) vs Problem-Based Learning (n = 52)	The group engaged in problem-based learning reported a lower likelihood of experiencing depression three months into medical school. However, once adjustments were made for self-actualization, this effect vanished
Agarwal and Lake, 2016(Agarwal & Lake, 2016)	USA	140	Two-group Pre-test – Post-test	Qualitative self-evaluation and questionnaire	N/a	Novel 4 - year curriculum	Most students conveyed experiencing enhanced self-awareness, smoother transitions, and diminished stress and isolation in their feedback.
Dare et al., 2009(Dare et al., 2009)	Australia	268	Two-group Pre-test – Post-test	(PSS)	N/a	42-week final year programme (n = 118) compared to a 47-week course (n = 116)	Reducing the curriculum had no significant impact on readiness, anxiety, or stress levels

Drolet and Rodgers, 2010(Drolet & Rodgers, 2010)	USA	143	pre- and post-assessment	Qualitative feedback and analysis	N/a	Wellness Curriculum Programme	Students indicated enhancements in their awareness of wellness and reported higher levels of life satisfaction in comparison to the period before the curricular modifications
Strayhorn, 1989(Strayhorn, 1989)	USA	478	Two-group Pre-test – Post-test	Rand Health Insurance Questionnaire, Social support Questionnaire, Environment Stresses, Learning Environment Questionnaire	N/a	Comparison school (n = 136) compared to full curriculum revision versus previous curriculum	In the updated curriculum, students experienced fewer stresses, decreased perceived stress, and improved mental well-being compared to the previous curriculum. Additionally, they reported better mental well-being and fewer environmental stresses compared to students from another school
Slavin et al., 2014(Slavin et al., 2014)	USA	178	Two-group Pre-test – Post-test	(CESD), (STAI), (PSS), (PCS)	N/a	Integrated curricular-change program	First-year students observed a decrease in symptoms associated with moderate to severe depression, anxiety, and stress. In contrast to prior class arrangements, there were noted improvements in community cohesion
Tucker et al., 2015(Tucker et al., 2015)	USA	305	Two-group Pre-test – Post-test	PSS, Perceived Cohesion Scale, QLSS, BDI, Curriculum Stress Questionnaire	N/a	Comparison between pre-clinical curricula (108 participants) and traditional curricula (207 participants)	The updated curriculum showed a reduction in subjective emotions, social connections, morale, recreational pursuits, and physical well-being. Students enrolled in the revised curriculum indicated a rise in depressive symptoms and life stress
Byrnes et al., 2020(Byrnes et al., 2020)	Australia	68	Open-ended questions	Qualitative	N/a	Wellbeing initiatives	Participants discussed enhancements in wellbeing, including improvements in work-life balance, self-care practices, the pursuit of psychological assistance, and the reliance on peer support

Axisa et al., 2019(Axisa et al., 2019)	Australia	70	RCT	(DASS-21), Alcohol use disorders identification test, Professional Quality of Life scale	4.5-hour Workshop	Wellness workshop (35 participants) compared to control group (25 participants)	Elevated levels of burnout, stress, depression, and anxiety were observed initially. After 6 months, the intervention group experienced a decrease in depression, burnout, and alcohol consumption compared to the control group, although the changes were not statistically significant
Hassed et al., 2009(Hassed et al., 2009)	Australia	148	pre- and post-assessment	Symptom Checklist-90-R, (WHOQOL)	8 lectures + 2hr Tutorials	Health Enhancement Programme + Lifestyle skills	Depression, hostility, and GSI decreased, while anxiety did not significantly change. The psychological domain of WHOQOL improved significantly, indicating enhanced student well-being across all measures
Thompson et al., 2010(Thompson et al., 2010)	USA	120	pre- and post-assessment	(CESD), (PHQ)	N/a	Mental Health Programme	Depressive symptoms and suicidal ideation decreased significantly ($p < 0.01$) compared to pre-intervention scores
Yusoff, 2011(Yusoff, 2011)	Malaysia	48	Non-randomized	(DASS-21)	3-4 hr. one-off session	Wellbeing workshop (n = 19) versus control (n = 29)	The intervention group experienced a decrease in depression, which persisted both during the exam stress period and at the 3-month follow-up. Although there was a reported decrease, it was not statistically significant in anxiety and stress

Abbreviations: General Health Questionnaire (GHQ 12); Maslach Burnout Inventory (MBI); Perceived Medical School Stress (PMSS); Subjective Wellbeing (SWB); Burns Anxiety Inventory (BAI); Jefferson Scale of Physician Empathy (JSPE); Beck Depression Inventory-II (BDI-II); Evaluation of Stress Factors (ESF); Depression, Anxiety and Stress Scale (DASS-21); Five Facet Mindfulness (FFMQ); Resilience Scale (RS); Self-Compassion Scale (SCS); Perceived Stress Scale (PSS-10); Brief Symptom Inventory (BSI); Positive States of Mind Scale (PSOM); Daily Emotion Report (DER); Primary Health Questionnaire (PHQ-9); Generalized Anxiety Disorder (GAD-7); Quality of Life (QoL); Compassion Scale (CS); Mindfulness Attention Awareness Scale (MAAS); Profile of Mood States (POMS); Empathy Construct Rating (ECRS); Hopkins Symptom Checklist (SCL-90); General Well-Being Scale (GWBS); Social Readjustment Rating Scale (SRRS-R); Coping Self-Efficacy Scale (CSE); Cognitive and Affective Mindfulness Scale (CAMS-R); Perceived Stress of Medical School (PSMS); State Trait Anxiety Inventory (STAI); Distress Tolerance Scale (DTS); Positive and Negative

Affect Schedule (PANAS); Freiberg Mindfulness Inventory (FMI); Interpersonal Reactivity Index (IRI); Self-Reflection (GRAS); Center for Epidemiological Studies Depression Scale (CESD); Self-Rating Anxiety Scale (SAS); Self-Rating Depression Scale (SDS); Trier Inventory for the Assessment of Chronic Stress (TICS); Well-Being Index (MSWBI); Cognitive and Behavioural Response to Stress Scale (CB-RSS); Ryff's scales of psychological wellbeing (RPWB); WHO Quality of Life (WHOQOL); Sense of Coherence Scale (SOC-L9)

3.1 Therapy-based Interventions

Therapy-based interventions, rooted in psychotherapeutic frameworks, aim to enhance participants' wellbeing through conventional modalities; examples include Behaviour Therapy, Psychoeducation, Mindfulness-Based interventions, and Cognitive-Behavioural Therapies (CBT). The 42 studies in this category embedded these approaches, often administered communally and innovatively through various channels. Some studies have delivered these therapies virtually while a direct face-to-face assessment of their efficacy remains unexplored. Notably, these interventions predominantly featured evidence-based practices and have been investigated for effectiveness through research studies.

3.1.1 Mindfulness-Based Interventions (MBI)

Various mindfulness-based interventions aimed at enhancing medical students' wellbeing have been employed, utilising a range of approaches with diverse outcomes. Among the 17 studies, a common goal emerged: the introduction of mindfulness practices and the promotion of self-directed learning beyond the traditional curriculum confines. While the majority pursued this goal, two studies diverged by mandating participation in mindfulness courses (de Vibe et al., 2013; Dyrbye et al., 2017). A majority (63%) adhered to the standard protocol for Mindfulness-Based Stress Reduction (MBSR) courses (Kabat-Zinn & Hanh, 2009), involving eight weekly sessions lasting 2.5 hours each, encompassing elements such as body scans, mindfulness meditation, yoga, and breathing exercises.

Additionally, variations were observed in the duration of sessions, ranging from 1-1.5-hour weekly sessions spanning four weeks (Jain et al., 2007; Rosenzweig et al., 2003). Furthermore, certain interventions were tailored to compress or extend the program duration based on specific research objectives and contextual considerations (Chakales et al., 2020; Malpass et al., 2019). These tailored approaches yielded positive outcomes on wellbeing in cohorts undergoing MBSR courses of different durations. Notably, the completion rate for the condensed 5-week course was 80% while the conventional 8-week course had a completion rate of 40% (Weingartner et al., 2019). Of the 17 MBI analysed, 40% were RCTs. Ethical and logistical challenges led to the prevalent use of inactive control interventions, with a 50% dropout rate in RCTs (BScc & Dobkin, 2013; Weingartner et al., 2019). Both RCTs(Damião Neto et al., 2020; Warnecke et al., 2011; Yang et al., 2018) and 2 quasi-experimental MBSR studies(Barbosa et al., 2013; Dyrbye et al., 2017) observed significant participant dropout in both control and intervention groups.

Challenges in adhering to the program were highlighted, particularly in fulfilling daily meditation assignments. Five studies(Noble et al., 2019; Rosenzweig et al., 2003; Shapiro et al., 1998; Weingartner et al., 2019; Yang et al., 2018) reported a 40% completion rate, and one study(Damião Neto et al., 2020) discontinued mindfulness diary monitoring due to a low 20% response rate.

Additionally, Table 1 illustrates that out of the 17 interventions assessed for overall effectiveness, 13 showed positive impacts on psychological wellbeing. Some studies reported a significant decrease in anxiety symptoms compared to controls and baseline (Barbosa et al., 2013; Damião Neto et al., 2020; Danilewitz et al., 2016; Moir et al., 2016; Shapiro et al., 1998; Warnecke et al., 2011), while others demonstrated a modest reduction at eight weeks post-intervention (Pereira & Barbosa, 2013). Changes in depressive symptoms were also observed, with significant reductions reported at post-intervention (Shapiro et al., 1998). Assessments across five programs yielded

mixed results, with two studies showing positive outcomes for anxiety and depression (Rosenzweig et al., 2003; Warnecke et al., 2011).

In examining stress outcomes among the eleven studies (BScc & Dobkin, 2013; Damião Neto et al., 2020; Danilewitz et al., 2016; de Vibe et al., 2013; Dyrbye et al., 2017; Erogul et al., 2014; Moir et al., 2016; Moore et al., 2020; Warnecke et al., 2011; Weingartner et al., 2019; Yang et al., 2018), eight studies (BScc & Dobkin, 2013; Danilewitz et al., 2016; de Vibe et al., 2013; Erogul et al., 2014; Moore et al., 2020; Warnecke et al., 2011; Weingartner et al., 2019; Yang et al., 2018) reported reduced perceived stress at post-intervention among medical students. A study by Erogul et al. (2014) showed immediate enhancement post-intervention, but its significance did not last at the 6-month follow-up. In contrast, Moore et al. (2020) observed improvement at the 4-month follow-up despite no immediate impact. A longitudinal RCT study(Dyrbye et al., 2017) found no marked differences in stress levels between MBSR and control groups whereas a quasi-experimental study reported a significant stress level increase compared to baseline (Barbosa et al., 2013).

3.1.2 Mind-Body Medicine (MBM)

Several of the included studies have employed Mind-Body Medicine interventions in addressing the wellbeing concerns of medical students; these studies have utilised diverse approaches and their respective outcomes. Fourteen studies (Bond et al., 2013; Brennan et al., 2016; Bughi et al., 2006; Chen et al., 2016; Finkelstein et al., 2007; Greeson et al., 2015; Holtzworth-Munroe et al., 1985; Kabat-Zinn & Hanh, 2009; Kraemer et al., 2016; Motz et al., 2012; Saunders et al., 2007; Scholz et al., 2016; van Vliet et al., 2017; Wald et al., 2016; Michelle K. Williams et al., 2020) investigated MBM approaches, with sessions typically lasting 8 to 12 weeks and incorporating biofeedback, journaling, guided imagery, and relaxation training alongside meditation, often based on Dr James Gordon's Mind-Body Skills Group (MBSG) model (Gordon, 2014).

Most interventions (55%) (Chen et al., 2016; Finkelstein et al., 2007; Kraemer et al., 2016; Saunders et al., 2007; Wald et al., 2016; Michelle K Williams et al., 2020) chose a 2-hour session over 11 weeks. Duration did not significantly impact effectiveness; no visible differences in wellbeing outcomes were noted between brief and standard-duration interventions.

Three Georgetown University studies (Chen et al., 2016; Motz et al., 2012; Saunders et al., 2007), the birthplace of MBSG research, showed varied outcomes. One reported reduced stress (Motz et al., 2012), another noted increased stress, depression, and decreased empathy (Chen et al., 2016); while qualitative research has highlighted positive effects on psychological wellbeing, particularly regarding stress outcomes (Moir et al., 2016). Differences in the curriculum structure each year were also reported, including changes in the MBSG course facilitator, suggesting that instructor influence may play a key role in wellbeing improvement (Chen et al., 2016; Motz et al., 2012; Saunders et al., 2007).

Training medical students for MBSG may hold advantages, with qualitative data showing that students experienced the greatest improvement in relationships with medical peers (Michelle K Williams et al., 2020). Another qualitative study revealed increased group cohesion, peer support, and reduced competition, in support of presumed potential benefits of implementing an adapted peer-led course (Moir et al., 2016).

Subsequent evaluations were conducted on three studies (Brennan et al., 2016; Bughi et al., 2006; Finkelstein et al., 2007) that assessed mind-body skills programmes to reduce anxiety. All three

studies reported significant reductions in anxiety levels compared to the initial test scores. Concerning stress levels, four studies(Bughi et al., 2006; Finkelstein et al., 2007; Greeson et al., 2015; Motz et al., 2012) reported a significant decrease while one study found no change (Michelle K Williams et al., 2020), and another observed an increase in perceived stress for both MBM and non-MBM groups (Chen et al., 2016).

3.1.3 Cognitive Behavioural Therapy (CBT)

The exploration of (CBT) interventions revealed a variety of approaches, including different modalities, durations, outcomes, and delivery methods across eleven studies (Bermudez et al., 2020; Chand et al., 2018; Guille et al., 2015; Howell et al., 2019; Kuhlmann et al., 2016; Lattie et al., 2017; Li et al., 2014; Phang et al., 2016; Sahranavard et al., 2019; Saravanan & Kingston, 2014; Michelle K. Williams et al., 2020; Y.-Y. Xu et al., 2019). These studies encompassed cognitive restructuring techniques, systematic desensitisation, dialectical behaviour therapy and change strategies —all conventionally employed within the framework of CBT. Nine studies(Bermudez et al., 2020; Howell et al., 2019; Kuhlmann et al., 2016; Lattie et al., 2017; Li et al., 2014; Phang et al., 2016; Sahranavard et al., 2019; Saravanan & Kingston, 2014; Y.-Y. Xu et al., 2019) directly addressed psychological health, anxiety, and depressive symptoms, while two studies (Chand et al., 2018; Guille et al., 2015) focused on associated factors.

Intervention durations ranged from 3 to 8 weeks, with varied session frequencies. Research methodologies included five RCTs (Guille et al., 2015; Howell et al., 2019; Kuhlmann et al., 2016; Phang et al., 2016; Y.-Y. Xu et al., 2019) and six experimental or pilot studies (Bermudez et al., 2020; Chen et al., 2016; Lattie et al., 2017; Sahranavard et al., 2019), with two incorporating a comparison group (Li et al., 2014; Saravanan & Kingston, 2014). Among the RCTs, three studies (Guille et al., 2015; Howell et al., 2019; Kuhlmann et al., 2016) featured control groups receiving attention control through mental health-related emails or links to counselling services, with only one study using a placebo control group (Y. Y. Xu et al., 2019).

Regarding CBT delivery, two studies (Guille et al., 2015; Howell et al., 2019) explored web-based CBT while others utilised in-person lectures. Despite indications suggesting similar effectiveness between online and face-to-face CBT courses, the limited number of studies on web-based CBT provided a definitive comparison.

The majority of studies reported similar baseline stress and psychological morbidity levels; one trial(Saravanan & Kingston, 2014) exclusively enrolled participants with mild to moderate anxiety. Another study (Kuhlmann et al., 2016) found higher distress in pre-clinical students compared to clinical students at baseline; perceived stress levels showed no significant difference. Other studies have noted an increased baseline perception of stress when compared to the general and age-matched population (Kuhlmann et al., 2016; Moir et al., 2016).

Overall, a synthesis of the study outcomes revealed diverse effects, with ten instances showing positive impact (Brennan et al., 2016; Chand et al., 2018; Finkelstein et al., 2007; Howell et al., 2019; Kuhlmann et al., 2016; Lattie et al., 2017; Li et al., 2014; Phang et al., 2016; Sahranavard et al., 2019; Y.-Y. Xu et al., 2019), and one result being inconclusive concerning stress components and psychological morbidity (Guille et al., 2015). One study found a substantial reduction in the severity of anxiety in the Web-CBT group compared to the control group after 3 months (Howell et al., 2019), while another observed a decrease in depression at the 3- and 6-month follow-ups, albeit with a small impact (Chand et al., 2018). Further support comes from one study showing a sustained reduction in psychological distress among participants within the Mindfulness-Based

Cognitive Therapy (MBCT) intervention as compared to those who received the conventional intervention and the control group, one year after the treatment (Kuhlmann et al., 2016).

3.2 Academic Based Strategies (ABS)

Within this category, interventions aimed to modify medical school policies, structure, curriculum, and practices to impact student wellbeing. This cluster of 18 studies covered pass/fail grading, wellbeing-related curriculum change, and wellness programs. Their goal was to reshape the learning environment, alleviating pressures like academic stress and fostering wellbeing prioritisation.

3.2.1 Pass/Fail Grading

The exploration of pass/fail grading systems in medical education encompassed their effects on medical student mental health, motivation, and satisfaction, alongside an examination of various pass/fail grading strategies and outcomes. Six papers (Ali et al., 2015; Bloodgood et al., 2009; Habermann et al., 2006; Reed et al., 2011; Robins et al., 1995; White & Fantone, 2010) focused on modified assessment strategies, particularly the implications of pass/fail grading. Several of those studies (Ali et al., 2015; Habermann et al., 2006; Robins et al., 1995; White & Fantone, 2010) conducted comparative analyses, contrasting pass/fail with traditional grading systems. Although most studies only looked at the effects of grading on their own campuses, one study (Kuhlmann et al., 2016; Reed et al., 2007), compared grading policies at twelve different medical schools with 1,192 students.

The six studies (Ali et al., 2015; Bloodgood et al., 2009; Habermann et al., 2006; Reed et al., 2011; Robins et al., 1995; White & Fantone, 2010) utilising a pass/fail grading system showed initial improvement in mental health at the beginning of the year but varied in the sustainability of these improvements. Habermann et al. (2006) found enduring benefits even when students reverted to a traditional grading system in the second year. Conversely, Bloodgood et al. (2009) noted no sustained improvements by the fourth semester, with potential stress increase related to supplementary grading practices reported in 70% of participants. Implementation of extra evaluation techniques also had a positive impact on students' satisfaction and mental health over the academic year (Robins et al., 1995).

Extrinsic motivation, influenced by external rewards like grades and competition, played a significant role in students' academic performance too (Habermann et al., 2006; Yang et al., 2018). Concerns about reduced self-directed learning motivation, especially among students with varying academic proficiencies, were noted under the binary grading system. Habermann et al. (2006) indicated adverse effects on students' competitiveness for residency positions and revealed decreased study time due to diminished motivation. Conversely, White and Fantone (2010) pointed out that while the binary grading system might affect extrinsic motivation, it actually benefited intrinsic motivation and self-directed learning.

Further, one study found no statistically significant differences in test anxiety during tests in both grading groups (Habermann et al., 2006), in contrast with a study conducted by Reed et al. (2011) which reported a decrease in test-related anxiety in the pass/fail cohort. Regarding student satisfaction, five studies (Ali et al., 2015; Bloodgood et al., 2009; Reed et al., 2007; Robins et al., 1995; White & Fantone, 2010) found increased contentment in personal and overall life following the shift in evaluation systems. Themes included reduced competition, leading to decreased exam-related stress; the restructuring also allowed more time for personal wellbeing and supplementary

activities (Ali et al., 2015; Habermann et al., 2006; Robins et al., 1995; White & Fantone, 2010). Moreover, adopting pass/fail evaluation correlated with a decreased likelihood of students contemplating dropping out, attributed to perceived academic pressure alleviation (Ali et al., 2015; Habermann et al., 2006; Reed et al., 2011; Robins et al., 1995; White & Fantone, 2010).

However, a constraint found in four studies (Bloodgood et al., 2009; Reed et al., 2007; Robins et al., 1995; White & Fantone, 2010) was the sole assessment of psychological wellbeing among first-and second-year students without baseline comparisons; the absence of baseline measures made it unclear whether the two cohorts entered medical school with similar or disparate psychological wellbeing levels (Bloodgood et al., 2009; Reed et al., 2007; Robins et al., 1995; White & Fantone, 2010). Furthermore, the evidence suggested that pre-existing stress and anxiety levels among first-year students were notably high, persisting even after the implementation of pass/fail grading, contrary to an observed reduction (Habermann et al., 2006).

3.2.2 Wellbeing Related Curriculum Changes

Wellbeing-related curriculum changes were explored in seven academic-based interventions (Agarwal & Lake, 2016; Camp et al., 1994; Dare et al., 2009; Drolet & Rodgers, 2010; Slavin et al., 2014; Strayhorn, 1989; Tucker et al., 2015) which primarily focused on preventive strategies to mitigate stressors associated with medical school. A couple of studies (Drolet & Rodgers, 2010; Slavin et al., 2014) implemented multifaceted changes, emphasising strengthening peer and faculty relationships and creating communities of shared interests within the medical school for emotional support. Despite differing strategies, both reported enhancements in student wellbeing, with third-year students being less responsive to the interventions.

Further, four studies (Agarwal & Lake, 2016; Camp et al., 1994; Strayhorn, 1989; Tucker et al., 2015) looked into the influence of instructional approaches on medical students' wellbeing compared to traditional lecture-based methods. Positive outcomes were reported by two studies (Agarwal & Lake, 2016; Strayhorn, 1989), citing stress reduction and enhanced wellbeing. However, both studies highlighted the absence of an effect of social support on stress and wellbeing. In one study, a new curriculum led to a decline in mental health and increased depressive symptoms compared to the traditional one (Tucker et al., 2015). However, a reduction in depressive symptoms was observed in the Problem-Based Learning (PBL) group, with a weak and non-significant association with curriculum variations (Camp et al., 1994).

In a separate study, reducing the final year's duration in medical school by 5 weeks did not yield statistically significant impacts on stress, pressure, or anxiety levels; factors external to the academic calendar, such as perceived competence, may have had a more substantial influence on stress and anxiety outcomes than the course's length (Dare et al., 2009).

3.2.3 Wellness Programs

The exploration of wellness programs by a few studies (Axisa et al., 2019; Byrnes et al., 2020; Hassed et al., 2009; Thompson et al., 2010; Yusoff, 2011) aimed at enhancing the wellbeing of medical students and their review encompassed the content, methodologies, reported outcomes, and participant responses. These interventions, ranging from brief workshops to multi-session programs, focused on stress management and psychological self-care.

In terms of methodology, included studies employed RCT designs (Axisa et al., 2019), and utilised pre- and post-assessment measures within a single-group format(Thompson et al., 2010) as well as with a non-randomised comparison group (Yusoff, 2011).

Within the reported outcomes, the sample size emerged as a common limitation across various studies. Despite common sample size limitations, three studies (Hassed et al., 2009; Thompson et al., 2010; Yusoff, 2011) reported positive outcomes, underlining a significant reduction in depression and improved student wellbeing. Reductions in depression, burnout, and alcohol use were reported in another study, although not statistically significant.

The impact on anxiety remained inconclusive, with some studies reporting null effects on the anxiety subscale (Byrnes et al., 2020). However, the RCTs provided suggestive albeit limited evidence of possible advantages from the intervention, as participants continued to utilise learned abilities even a year after training. In particular, the comprehensive program involving the entire student cohort in one study stood out as a unique approach (Hassed et al., 2009). In terms of participant response, studies consistently reported moderate participant rates. One study noted significant dropout from pre to post-assessment, with marginal response to inquiries about suicidal ideation (Thompson et al., 2010). This observation was reinforced by evidence of students expressing apprehension about disclosing poor mental health after participating in a wellbeing initiative (Byrnes et al., 2020). An important finding stressed the crucial role of tutor selection in delivering essential skills and facilitating group discussions within a limited timeframe, as evidenced by qualitative insights reflecting students' perception of the instructor's critical role (Byrnes et al., 2020). Establishing positive relationships between teaching staff and students has been recognised as vital for students' engagement and commitment in mental health programs. Please refer to Table 2 for a summary of the findings and gaps of each intervention type.

Table 2. Summary of the Findings and Gaps of Each Intervention Type

Intervention Type	**Findings**	**Gaps**	**Paper**
Mindfulness-Based Interventions	Most studies demonstrated favourable impacts on psychological wellbeing, with significant decreases in anxiety symptoms compared to controls and baseline. Reductions in depressive symptoms were observed in a few studies. Mixed results were found for stress outcomes, with some studies reporting reduced perceived stress among medical students while others found no significant differences.	Challenges in program adherence, including fulfilling daily meditation assignments. Lack of eligibility criteria and variations in program format. Ethical and logistical challenges, such as prevalent use of inactive control interventions. High dropout rates, especially in randomized controlled trials (RCTs), have raised concerns about participant engagement, warranting further exploration.	Barbosa et al., 2013(Barbosa et al., 2013); Chakales et al., 2020(Chakales et al., 2020); Danilewitz et al., 2016(Danilewitz et al., 2016); De Vibe et al., 2013(de Vibe et al., 2013); Dyrbye et al.,2017(Dyrbye et al., 2017); Erogul et al., 2014(Erogul et al., 2014); Jain et al., 2007(Almaqbali, 2019); Malpass et al., 2019(Malpass et al., 2019); Moir et al., 2016(Moir et al., 2016); Moore et al., 2020(Castaldelli-Maia et al., 2019); Noble et al. 2019(Noble et al., 2019); Rosenzweig et al., 2009(Rosenzweig et al., 2003) ; Warnecke et al., 2011(Warnecke et al., 2011); Weingartner et al., 2019(Weingartner et al., 2019); Yang et al.,2018(Yang et al., 2018); Neto et al., 2020(Damião Neto et al., 2020); Shapiro et al., 1998(Shapiro et al., 1998)
Mind-Body Medicine	Varied outcomes were reported, with some studies showing reduced stress and anxiety levels, while others reported mixed results, but mainly improved wellbeing outcomes. Facilitators, often specialists, played a key role, with some studies suggesting	Varied outcomes across studies, indicating the need for further research to understand the effectiveness of MBM	Bond et al., 2013(Bond et al., 2013); Brennan et al., 2016(Brennan et al., 2016) ; Bughi et al., 2006(Bughi et al., 2006); Chen et

Intervention Type	Findings	Gaps	Paper
	the potential benefits of training medical students as facilitators due to their enhanced relationship with medical peers.	interventions. Differences in curriculum structure and facilitators' influence, suggest the importance of standardisation and training.	al., 2016(Chen et al., 2016); Finkelstein et al., 2007(Finkelstein et al., 2007); Greeson et al., 2015(Greeson et al., 2015); Holtzworth-Munroe et al., 1985(Holtzworth-Munroe et al., 1985); Kraemer et al., 2016(Kraemer et al., 2016); Motz et al., 2012(Motz et al., 2012); Saunders et al., 2009(Saunders et al., 2007); Scholzet al., 2016(Scholz et al., 2016); VanVliet et al., 2017(van Vliet et al., 2017); Walad et al., 2016(Kulsoom & Afsar, 2015); Williams et al., 2020(Michelle K Williams et al., 2020)
Cognitive Behavioural Therapy	Baseline stress and psychological morbidity levels varied across studies. Positive impacts on anxiety, depression, and psychological distress were observed in most instances, with sustained reductions noted in some studies at follow-up assessments. However, one study reported inconclusive results concerning stress components and psychological morbidity.	Limited number of studies on web-based CBT hinder comparisons with face-to-face CBT. Varied baseline stress levels and methodologies across studies present challenges in synthesising findings. Some studies lacked long-term follow-up assessments,	Bermudez et al., 2020 (Bermudez et al., 2020); Chand et al., 2018(Chand et al., 2018); Guille et al., 2015(Guille et al., 2015); Howell et al., 2019(Howell et al., 2019); Kuhlmann et al., 2016(Kuhlmann et al., 2016); Lattie et al., 2017(Lattie et al., 2017); Li et

Intervention Type	Findings	Gaps	Paper
		limiting understanding of sustained effects.	al., 2014(Li et al., 2014); Phang et al., 2016(Phang et al., 2016);Saravanan And Kingston, 2014(Saravanan & Kingston, 2014); Xu et al., 2019(Y. Y. Xu et al., 2019); Garneau et al., 2013(Zhang et al., 2021)
Pass/Fail Grading	Pass/fail grading systems demonstrated initial improvements in mental health among medical students. Varied outcomes were reported concerning the sustainability of mental health improvements over time. Pass/fail grading correlated with increased student satisfaction, reduced competition-related stress, and improved overall life satisfaction.	Limited longitudinal studies examining the sustainability of mental health improvements under pass/fail grading systems. Inconsistent findings regarding the impact of pass/fail grading on extrinsic motivation and test anxiety. Lack of baseline measures in some studies hinders the comparison of psychological wellbeing levels before and after the implementation of pass/fail grading.	Ali et al., 2015(Ali et al., 2015); Bloodgood et al., 2009 (Bloodgood et al., 2009); Habermann et al., 2006(Habermann et al., 2006); Reed et al., 2011(Reed et al., 2011); Robins et al., 1995(Robins et al., 1995); White and Fantone, 2010(White & Fantone, 2010)
Wellbeing Related Curriculum Changes	Interventions focused on preventive strategies to mitigate stressors associated with medical school. Multifaceted changes, including strengthening peer and faculty relationships and creating communities of shared interests, were implemented. Positive outcomes in life satisfaction were reported, although third-year students were less responsive to interventions. Positive outcomes in stress reduction and enhanced wellbeing were reported for instructional approaches compared to traditional lecture-based methods. Absence of an effect of social	Limited studies focusing on the effectiveness of specific curriculum changes on medical students' wellbeing. Variation in student responsiveness to interventions across different academic years warrants further investigation. The absence of an effect of social support on stress and wellbeing in the	Agarwal and Lake, 2016(Agarwal & Lake, 2016); Camp et al., 1994(Camp et al., 1994); Dare et al., 2009(Dare et al., 2009); Drolet and Rodgers, 2010(Drolet & Rodgers, 2010); Slavin et al., 2014(Slavin et al., 2014)Strayhorn,

Intervention Type	**Findings**	**Gaps**	**Paper**
	support on stress and wellbeing was highlighted. - One study reported a decline in mental health and increased depressive symptoms with the new curriculum compared to the traditional one. - Altering the final year's duration in medical school by reducing it by 5 weeks showed no statistically significant impact on stress, pressure, or anxiety levels External factors, such as perceived competence, may substantially influence stress and anxiety outcomes more than the course's length.	included studies warrants further investigation into the specific influence of social support within medical school curriculum changes on students' wellbeing. Lack of longitudinal studies examining the long-term effects of curriculum changes on medical students' wellbeing.	1989(Strayhorn, 1989); Tucker et al., 2015(Tucker et al., 2015)
Wellness Programmes	The program content canter on stress management techniques and general strategies for maintaining psychological wellbeing, equipping students with tools to navigate the demands of medical school. Initial findings from the studies revealed notable improvements, including significant reductions in depression and overall enhancement of student wellbeing. While decreases in depression, burnout, and alcohol use were reported, they did not reach statistical significance. The impact on anxiety remained uncertain. However, there was suggestive evidence indicating potential long-term benefits, with participants continuing to apply learned skills even a year after completing the interventions. Notably, comprehensive programs involving the entire student body were recognised as a distinctive approach. The selection of tutors emerged as a crucial factor, with qualitative insights underscoring the pivotal role of instructors in fostering meaningful discussions and imparting essential coping skills. Furthermore, fostering positive relationships between teaching staff and students emerged as a key element for promoting engagement and comprehension within mental health programs.	Limited number of studies focusing on wellness workshops in medical education. Variation in research methodologies and outcome measures across studies makes comparisons challenging. Small sample sizes limit the generalisability of findings. Inconclusive evidence regarding the impact on anxiety highlights the need for further research. Dropout rates and participant response rates raise concerns about the effectiveness and acceptability of wellness initiatives.	Axisa et al., 2019(Axisa et al., 2019); Byrnes et al., 2020(Byrnes et al., 2020); Hassed et al., 2009(Hassed et al., 2009); Thompson et al., 2010(Thompson et al., 2010); Yusoff, 2011(Yusoff, 2011)

4. Discussion

In this scoping review, the examination of psychological wellbeing interventions for medical students involved an assessment of 60 studies. In addressing the aims of this review which were mainly to map the nature and range of wellbeing interventions as well as their impact on the quality of life and overall psychological wellbeing of students, the findings portrayed a diverse range of approaches that have been implemented for improving the wellbeing of medical students.

The exploration of therapeutic modalities across 42 studies underlined the significance of self-reflection and revealed a varied landscape of structured interventions, encompassing MBI, MBM and CBT. Additionally, evidence from 18 studies examining academic-based strategies demonstrated a number of positive outcomes.

Examining prevalence, therapy-based interventions (69%) predominated over academic-based interventions (31%), aligning with trends in other health-related faculties (Klein & McCarthy, 2022). While 25% of studies investigated the integration of MBI into university curricula, the dropout rates raised concerns about participant engagement. Challenges in adherence were evident, potentially linked to performance bias favouring one group with more attention and support. Participants in wait-list control groups might have experienced demoralisation, leading to increased attrition and potential elevation in self-reported stress and anxiety levels (Furukawa et al., 2014). Additionally, time constraints were evident (Dyrbye et al., 2017; Erogul et al., 2014; Moore et al., 2020; Warnecke et al., 2011) with students finding it difficult to adhere to daily meditation homework, resulting in limited program completion. This pattern of findings aligns with a wider literature review, examining 20 mindfulness-based intervention RCTs(Nam & Toneatto, 2016), which found an average attrition rate of 29%. These findings underscored the necessity for further exploration of strategies aimed at enhancing participant engagement and retention in mindfulness interventions, which may involve tailored support mechanisms and addressing participant concerns.

With regard to outcomes, several studies (Barbosa et al., 2013; BScc & Dobkin, 2013; Chakales et al., 2020; Danilewitz et al., 2016; de Vibe et al., 2013; Erogul et al., 2014; Malpass et al., 2019; Noble et al., 2019; Rosenzweig et al., 2003; Shapiro et al., 2000; Warnecke et al., 2011; Weingartner et al., 2019; Yang et al., 2018) demonstrated positive impacts, particularly in relation to anxiety reduction; while the impacts on depression outcomes yielded mixed results, indicating the multifaceted nature of mindfulness interventions in addressing distinct dimensions of mental health.

While initial signs pointed to comparable effectiveness between online and face-to-face courses, the limited number of studies prevented a precise comparison between them (Andersson & Cuijpers, 2009; Christensen & Farrer, 2009). However, the use of electronically delivered courses aimed to cater for medical students' needs in facing time constraints and academic pressures (Chand et al., 2018; Guille et al., 2015). Howell et al. (2019) observed that Web-CBT had a minor impact size (d = 0.2–0.3) compared to in-person treatment, consistent with previous wider literature findings. This pattern of findings indicated that stand-alone internet-based CBT typically has had two logins on average whereas guided sessions have had nine logins (Andersson & Cuijpers, 2009; Christensen & Farrer, 2009). These results implicate the role of therapist support, either in addition to the intervention itself or through a combination of online and in-person instruction.

On the other hand, as previously mentioned, while fewer interventions targeted the learning environment in medical education, implementing a pass/fail grading system emerged as a

promising strategy for enhancing student wellbeing. However, subtle variations in outcomes across various studies (Habermann et al., 2006) suggested that while pass/fail grading might show promise in mitigating certain stressors in medical education, its long-term impact may require careful consideration and may be influenced by contextual factors and concurrent interventions.

Similarly, several studies examining curriculum changes demonstrated the contributing role of creating communities of shared interests and strengthening peer and faculty relationships. This focus on social support is in line with existing medical student literature (Dyrbye et al., 2010; Jenkins et al., 2018), which points out the positive impact of social support on the psychological wellbeing of medical students. The rationale behind incorporating a peer support component lies in addressing the competitive nature of medical school, which has been identified as a significant stressor in multiple studies (Dyrbye et al., 2010; Jenkins et al., 2018; MacArthur & Sikorski, 2020; Slavin, 2016; Thompson et al., 2016). The favourable outcomes of these studies underlined the importance of tailoring curriculum changes to the specific context of medical school, recognising the diverse needs and preferences of the student body (Slavin et al., 2014; Tucker et al., 2015).

While limited in number, studies exploring wellness programs implemented with medical students revealed positive outcomes, including significant reductions in depression and improvements in overall wellbeing (Axisa et al., 2019; Byrnes et al., 2020; Hassed et al., 2009; Thompson et al., 2010; Yusoff, 2011), in line with other literature involving medical students (Waechter et al., 2021). These findings pointed out the potential effectiveness of brief interventions in providing medical students with essential skills for psychological self-management.

Examining the geographic distribution of the 60 studies included in the review, 62% were conducted in the US, while the rest took place across Australia (Moore et al., 2020; Warnecke et al., 2011), Asia (Bermudez et al., 2020; Damião Neto et al., 2020; Li et al., 2014), and Europe (Kuhlmann et al., 2016; van Vliet et al., 2017) including the UK (Malpass et al., 2019; Noble et al., 2019). The concentration of research in Western settings raises concerns about the underrepresentation of regions with distinct stress and anxiety prevalence. Notably, anxiety rates in Asian and Middle Eastern medical schools surpass those in North American countries (Tian-Ci Quek et al., 2019), signalling a demand for psychological wellbeing interventions in these regions. However, limited implementation may be attributed to cultural differences and stigmatisation. This geographical context adds complexity to the interpretation of outcomes and emphasises the need for a more globally representative study pool to inform comprehensive intervention strategies.

A recurrent theme across interventions has been the efficacy of group settings (Drolet & Rodgers, 2010; Slavin et al., 2014), observed in both therapy and academic-based approaches, indicating the benefits of peer support and collaborative dynamics for enhancing psychological health among medical students. However, the current synthesis also highlights methodological considerations, underlining the scarcity of high-quality randomised controlled trials RCTs(Damião Neto et al., 2020; de Vibe et al., 2013; Erogul et al., 2014; Jain et al., 2007; Moir et al., 2016; Warnecke et al., 2011; Yang et al., 2018) and the imperative for rigorous experimental designs to authenticate intervention effectiveness.

It is worth noting that, despite the availability of these interventions, it remains uncertain whether they align with students' preferences and choices. The reviewed literature suggested that various factors, including the format of the intervention, time constraints, and competing academic pressures, might influence student engagement and adherence to these interventions. For example, studies examining mindfulness interventions reported challenges with participant

dropout rates, often citing time and scheduling constraints as primary reasons (Dyrbye et al., 2017; Erogul et al., 2014; Moore et al., 2020; Warnecke et al., 2011). This gap between existing interventions and students' preferences emphasises the need for future research to investigate the factors influencing student engagement with these interventions and to enable the design of more effective and relevant support systems.

5. Strengths and Limitations

This scoping review used a widely accepted approach for identifying multiple articles to synthesise available data on interventions for medical students' psychological wellbeing. The review provided a broad overview of 60 studies implementing diverse therapeutic modalities and academic-based strategies as wellbeing interventions in medical education. By involving multiple reviewers, we tried to ensure systematic data retrieval and minimised biases or errors. Moreover, the review highlighted emerging trends and gaps in the literature, offering valuable insights for guiding future research directions and informing evidence-based educational practice and policy decisions.

On the other hand, certain limitations should be acknowledged. Scope constraints in limiting inclusion to English-published studies may have introduced a potential language bias. Additionally, reliance on published studies may have overlooked insights from grey literature, conferences, or ongoing projects. Exploring diverse sources could enhance the review's comprehensiveness, recognising potential limitations in the chosen methodology as well as scope.

6. Future Directions

Future research needs to prioritise developing and evaluating tailored interventions/programs that are acceptable by medical students. Such adapted interventions need to also take into account racial and cultural diversity, particularly in regions with under-represented prevalence in the current literature. Adopting longitudinal designs can also address problems pertinent to short observation periods and sustainability concerns. Comparing individual and group-based interventions and exploring group dynamics' impact on psychological health could provide valuable insights too. There is a clear imperative for future studies to gain in-depth qualitative insights from medical students on their needs, preferences and potential barriers to their uptake of wellbeing interventions which can help further inform tailored and more comprehensive approaches to enhancing medical students' psychological wellbeing.

7. Conclusions

This scoping review offered an overview of psychological wellbeing interventions for medical students, providing insights for current practices and guiding future research. While diverse strategies have been implemented, including therapy-based and academic-based interventions, and positive wellbeing outcomes have been observed, it remains uncertain if these interventions align with students' preferences. Continuous evaluations and adaptations of interventions are essential to meet evolving medical student needs. The current findings bear important implications for educational as well as healthcare policies.

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