The effect of emotional management interventions on medical students: a scoping review

Efecto de las intervenciones en gestión emocional en estudiantes de medicina: una revisión de alcance

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Summary:

Introduction : Medical students face high levels of stress and burnout during their training, which affects their psychological well-being and academic performance. Emotional management interventions have been proposed as strategies to mitigate these adverse effects. **Methods:** A systematic review of the literature was conducted according to PRISMA guidelines. Studies published between 2019 and 2024 that evaluated interventions aimed at improving emotional management or regulation and resilience in medical students were included. Data on participants, type of intervention and outcomes (stress, burnout, well-being) were extracted, and given the methodological heterogeneity, a narrative synthesis of the findings was carried out. **Results** : Twenty-four studies were included that implemented diverse interventions, such as mindfulness/meditation programs, resilience and positive psychology training, mentoring and peer support groups, artistic-reflective activities and self-care modules integrated into the curriculum. Approximately 70% of the studies reported significant reductions in perceived stress and ~50% improvements in resilience or emotional well-being. Nearly 40% showed a decrease in burnout. Some interventions also increased empathy and self-efficacy in participants, although one study found no significant effect. The heterogeneity of designs limited comparability, and few studies evaluated long-term effects. **Conclusions** : Emotional management interventions have proven effective in reducing stress and improving the well-being of medical students in the short term. It is recommended that these strategies be systematically integrated into curricula, adapting them to the local context. Furthermore, multicenter studies with randomized assignment and long-term follow-up are needed to confirm sustained benefits and optimize their implementation.

Keywords: Medical Students; Burnout; Psychological Stress; Psychological Resilience; Mental Health.

Resumen:

Introducción: Los estudiantes de medicina enfrentan altos niveles de estrés y burnout durante su formación, lo cual afecta su bienestar psicológico y desempeño académico. Las intervenciones en gestión emocional han sido propuestas como estrategias para mitigar estos efectos adversos. **Métodos:** Se realizó una revisión sistemática de la literatura conforme a lineamientos PRISMA. Se incluyeron estudios publicados entre 2019 y 2024 que evaluaron intervenciones dirigidas a mejorar la gestión o regulación emocional y la resiliencia en estudiantes de medicina. Se extrajeron datos de participantes, tipo de intervención y resultados (estrés, burnout, bienestar), y dada la heterogeneidad metodológica se efectuó una síntesis narrativa de los hallazgos. **Resultados**: Se incluyeron 24 estudios que implementaron intervenciones diversas, tales como programas de mindfulness/meditación, entrenamiento en resiliencia y psicología positiva, mentoría y grupos de apoyo entre pares,

actividades artístico-reflexivas y módulos de autocuidado integrados al currículo. Aproximadamente 70% de los estudios reportó reducciones significativas del estrés percibido y ~50% mejoras en resiliencia o bienestar emocional. Cerca del 40% evidenció disminución del burnout. Algunas intervenciones también aumentaron la empatía y la autoeficacia en los participantes, aunque un estudio no halló efecto significativo. La heterogeneidad de diseños limitó la comparabilidad y pocos trabajos evaluaron efectos a largo plazo. **Conclusiones**: Las intervenciones de manejo emocional demostraron ser efectivas para disminuir el estrés y mejorar el bienestar de los estudiantes de medicina a corto plazo. Se recomienda integrar sistemáticamente estas estrategias en los planes de estudio, adaptándolas al contexto local. Además, se requieren estudios multicéntricos con asignación aleatorizada y seguimiento prolongado para confirmar beneficios sostenidos y optimizar su implementación.

Palabras clave: Estudiantes de Medicina; Agotamiento Profesional; Estrés Psicológico; Resiliencia Psicológica; Salud Mental.

1. Introduction

Medical students face high levels of stress and burnout throughout their training, resulting from academic demands, clinical practice, early exposure to human suffering, and a highly competitive environment (1). The prevalence of mental disorders such as anxiety, depression, and emotional exhaustion is significantly higher in this population than in the general population (2), affecting their academic performance and long-term well-being. A global systematic review estimated that the prevalence of anxiety in medical students reaches 33.8%, well above the university average (2-3). These figures are even more worrying in post-pandemic contexts, where alterations in the quality of training, an increase in academic stress, and the weakening of support networks have been documented in multiple countries (2-3). In regions such as Latin America, structural sociocultural factors—such as institutional instability, an overloaded healthcare system, and low investment in student mental health—further aggravate this situation (3).

Given this situation, various protective factors such as emotional intelligence, self-care, and social support have been proposed to mitigate these adverse effects (1-2). In response, multiple interventions focused on emotional management have been designed to address these problems. Among them, mindfulness-based programs have demonstrated effectiveness in reducing stress and improving mindfulness (4). Likewise, strategies aimed at developing emotional intelligence have strengthened skills such as critical thinking and resilience in health science students (5). In addition, interventions that promote peer mentoring and strengthen a sense of community have contributed to greater cohesion and effective stress management (6).

Despite these advances, the literature lacks a structured synthesis that integrates the results of these interventions from a systematic and practice-oriented perspective. Consolidating this evidence is essential to identify the most effective strategies, evaluate their applicability according to the context, and guide their implementation in medical education.

Therefore, the objective of this systematic review was to evaluate the available evidence on emotional management interventions implemented with medical students, in order to identify their characteristics, their effects on mental health indicators—such as stress, burnout, and psychological well-being—and to provide a critical synthesis to guide future educational strategies in the medical field.

2. Methods

A systematic review of the literature was conducted according to PRISMA. Studies were included that addressed populations of medical students or interns, that implemented interventions aimed at emotional management or regulation, resilience development, or related skills, and that reported outcomes associated with indicators such as stress, burnout, and psychological well-being. Clinical trial, quasi-experimental, and observational designs were considered. Only articles published between 2019 and 2024, in English or Spanish, were included to cover recent interventions relevant to the contemporary training context, especially in the period following the COVID-19

pandemic. Studies whose primary focus was on structural variables not directly linked to emotional management (such as socioeconomic factors), research focused exclusively on the impact of the pandemic, and systematic reviews were excluded, given that the purpose was to analyze primary studies with empirical data.

Search strategy

The literature search was conducted in the Web of Science (WOS) and Scopus databases. Combinations of terms related to the target population, interventions, and outcomes of interest were used, employing the following strategy: ALL = (("medical students" OR "medical interns") AND ("emotional management" OR "emotional regulation" OR "resilience") AND ("training" OR "courses" OR "programs") AND ("stress" OR "burnout" OR "mental health") NOT ("factors" OR "COVID-19")). After removing duplicates, 131 potentially eligible articles were identified.

Selection of studies

The selection process was carried out using the Rayyan platform (7). Two independent reviewers blindly evaluated the titles and abstracts. Discrepancies were resolved by consensus. Subsequently, 24 studies that met the defined criteria were selected. The process was reviewed by a medical education expert.

Data extraction

Data extraction was conducted by four reviewers in September 2024. Information was collected on participant characteristics (number, age, gender), intervention descriptions (type, duration, frequency), variables assessed (stress, burnout, psychological well-being), and the tools used to measure them. Figure 1 shows an outline of the process.
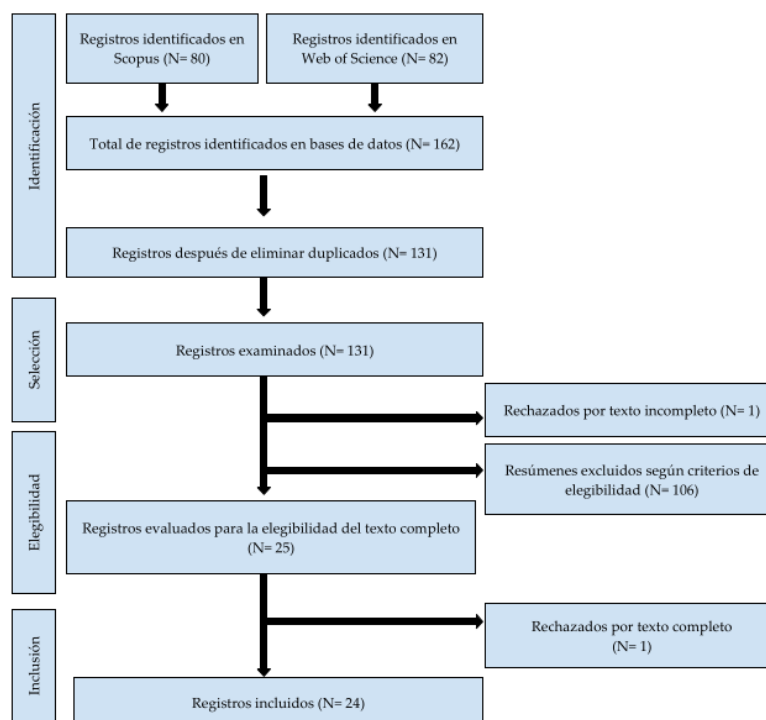

Figure 1. Protocol for searching and selecting evidence.

Assessment of risk of bias and methodological quality

Methodological quality was assessed using specific tools according to the design type. For randomized clinical trials, the Cochrane RoB 2 tool (8) was used, which analyzes domains such as random sequence generation, allocation concealment, intervention bias, missing data, outcome measurement, and selective reporting. For quasi-experimental studies without formal randomization, the ROBINS-I tool (9,10) was used, which allows the identification of confounding bias, participant selection, intervention bias, incomplete data, outcome measurement, and selective reporting. Observational studies were assessed using the Newcastle-Ottawa Scale (NOS), widely used to measure quality in non-randomized studies (11,12). This tool examines three domains: participant selection, comparability (when applicable), and outcome assessment, and has been adapted for cross-sectional studies.

Data organization

The extracted data were systematized into an analysis matrix. Given the methodological heterogeneity and exploratory approach of the review, a narrative synthesis of the findings was chosen. To facilitate analysis, the studies were grouped into six categories according to the type of intervention: mindfulness and meditation; positive psychology and resilience; peer support and mentoring; arts and philosophy; and proactivity in mental health.

Ethical considerations

This study is a systematic review based exclusively on secondary sources. No primary data were collected, nor were any interventions performed with human participants; therefore, informed consent or ethics committee approval were not required. All included studies reported institutional ethics approval in accordance with the Declaration of Helsinki. The authors also declare the use of the artificial intelligence tool ChatGPT (OpenAI, version GPT-4) to support manuscript structuring and editorial adaptation. Its use was exclusively for clinical purposes, without interfering with methodological, analytical, or conceptual decisions, which were the sole responsibility of the authors.

3. Results

Twenty-four studies evaluating emotional management interventions in medical students were included. Table 1 summarizes their main characteristics: country, methodological design, population, intervention applied, main results, and limitations.

Overall, most studies reported benefits in student mental health indicators. Approximately 70% found significant reductions in perceived stress, nearly 50% showed improvements in resilience or emotional well-being, and approximately 40% documented decreases in burnout, particularly its emotional component. Some studies reported additional effects such as increased empathy, self-efficacy, and social connectedness, especially in interventions based on mentoring and emotional reflection (Table 1).

Despite these encouraging results, methodological heterogeneity limited direct comparability and the possibility of performing meta-analyses. The tools used to measure the outcomes included the Perceived Stress Scale (PSS) (34), the Maslach Burnout Inventory (MBI) (35), and various scales of resilience, empathy, and well-being. A consistent trend toward post-intervention improvement was observed, with varying magnitudes depending on the type of intervention and program duration. Due to the diversity of designs and the exploratory nature of the review, tools to assess publication bias such as funnel plots or Egger tests, which require a minimum number of homogeneous studies, were not applied. However, a rigorous assessment of risk of bias (Table 2) was used using the methodological tools relevant to each design: RoB 2 for randomized trials, ROBINS-I for non-randomized intervention studies, and the Newcastle-Ottawa Scale (NOS) for observational designs (8, 12).

The studies were grouped into five thematic clusters according to the intervention approach: When interventions were grouped by approach, as illustrated in Table 3, distinct patterns were identified: Mindfulness/Meditation programs (8 studies) – including meditation, yoga, and mind-body therapy – consistently showed reduced stress and rumination, along with improvements in

students' mindfulness, emotional regulation, and quality of life. Positive Psychology and Resilience-based interventions (7 studies), such as resilience workshops, coaching, and gratitude exercises, tended to strengthen resilience and positive coping strategies; several studies reported reductions in anxiety and depression symptoms associated with wellness training. However, this cluster also included the only study without a favorable effect (the LAVENDER program), which showed no improvement in well-being or stress reduction, highlighting the importance of intervention design and content.

Peer support and mentoring initiatives were notable for improving perceived social support and integration into the educational community. For example, a peer-to-peer reflection group (PEERS) program was able to reduce feelings of isolation and increase students' emotional well-being, while mentoring schemes (both student-to-student and professional mentoring) were associated with lower academic stress, improved empathy, and greater self-efficacy in both mentored and mentored students. These findings suggest that creating support networks and safe spaces for conversation among colleagues can mitigate the stress inherent in medical training.

In the Arts and Philosophy cluster, interventions (narrative workshops, curriculum with artistic activities, and philosophical discussion) demonstrated positive impacts on the humanistic dimensions of training. A decrease in burnout and an increase in empathy and career satisfaction were reported (Table 3), suggesting that the incorporation of medical humanities (narrative, art, ethics) can contribute to students' emotional well-being and professional identity development. Finally, Proactive Mental Health strategies—such as curriculum-integrated resilience modules and self-care training—showed significant reductions in anxiety and depression symptoms when students were trained to actively manage their mental health. Furthermore, they showed high adherence: for example, ~85% retention of self-care skills learned after a brief workshop, indicating that students enthusiastically adopt practical tools for their well-being.

Overall, the findings suggest that emotional management interventions implemented in medical training can have a positive impact on key indicators of student mental health. The most consistent evidence was found in structured mindfulness and resilience programs, although effectiveness also depends on the methodological design, duration, and degree of curricular integration of each intervention.

4. Discussion

The results of this review support the usefulness of emotional management interventions as strategies for improving the mental health of medical students. The different approaches—from mindfulness to mentoring and resilience programs—addressed complementary dimensions of well-being, concurring in reducing stress and burnout and strengthening emotional coping (36-37).

These interventions not only mitigated the negative effects of the academic environment but also promoted emotional competencies relevant to medical practice. The implementation of mindfulness, for example, showed consistent benefits in emotional regulation, mindfulness, and reduced rumination (39). Mentoring and peer support programs, meanwhile, strengthened student cohesion and a sense of belonging, countering the isolation common during the training process (38).

However, methodological challenges persist. Most of the included studies were descriptive or quasi-experimental, without randomization or comparator groups, which limits the generalizability of their findings. High heterogeneity was also observed in the types of interventions, duration, intensity, and assessment methods, making standardization and comparative analysis difficult (40). Furthermore, few studies conducted long-term follow-up, making it impossible to determine whether the observed effects are sustained over time.

Despite these limitations, the convergence of positive results indicates that these strategies are viable and beneficial. Their curricular integration is suggested, beginning in the early years of education, with mandatory modules on emotional regulation, resilience, and self-care. It is also recommended that teachers be trained in emotional mentoring and that an institutional culture that normalizes psychoemotional care be fostered.

In short, promoting emotional management during medical training is not only feasible, but urgent. These findings can guide medical schools in adopting more structured, sustainable, and culturally relevant programs. Future research should focus on larger, controlled designs with objective assessments and longitudinal follow-up to consolidate the evidence of their effectiveness.

Based on the findings systematized in this review, it is possible to propose a series of practical recommendations to guide institutions in implementing effective strategies. These are summarized below in Table 4, which summarizes specific suggestions regarding curriculum, teaching, digital resources, and student support structures, based on the most effective approaches identified.

5. Conclusions

- Incorporating evidence-based emotional management interventions into medical programs represents a promising strategy for promoting student well-being. Despite the methodological limitations of some studies, the findings suggest positive effects on stress, burnout, resilience, and emotional health.
- Medical schools should integrate these approaches across their curricula, training faculty, creating peer support networks, and leveraging accessible digital tools. These measures will contribute to developing emotionally prepared physicians capable of practicing their profession in an empathetic and sustainable manner.
- Finally, it is proposed to move toward the institutionalization of mental health in medical education, recognizing emotional management as an essential professional competency. This will allow for the development of more humane and resilient training environments, with a positive impact on both future physicians and the quality of care provided to patients.

Declaration of conflict of interest : The authors declare that they have no conflict of interest.

Authors' contributions : Authorship: AD, CC, DK, and AH participated in the conceptualization of the study and the formulation of the review objective. AD, CC, and DK carried out the literature search, article selection, and data extraction. AD performed the thematic cluster classification and the analysis and synthesis of the findings. AD, CC, and DK wrote preliminary drafts of the manuscript, while AD was responsible for writing the results and discussion. AD, CC, and DK prepared tables, figures, and appendices. AD and AH assessed methodological quality and risk of bias. All authors (AD, CC, DK, and AH) participated in the critical review and final approval of the manuscript, and AH provided overall supervision of the work process.

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Table 1. Summary of Studies: Methodology, Interventions and Main Results.

Reduced Appointment	Country	Methodological Design	Population	Intervention	Main Results	Limitations
Ekbäck et al. (4)	Sweden	Single-group mixed pilot study (feasibility)	23 medical students (first semesters)	TARA Program (12 weeks, emotional regulation techniques, synchronized movement, breathing and self-awareness)	There was a trend toward improvement in stress, attention, and well-being across all measures (although not statistically significant given the small sample size); participants reported positive experiences and increased emotional awareness.	Very small sample size; no control group; the study suggests feasibility but requires broader evaluations to confirm efficacy.
Feingold et al. (6)	USA	Descriptive study	319 medical students (first to fourth year)	PEERS Program (10 sessions with mindfulness, reflective writing, positive appreciation, and open peer discussion)	Significant increase in perceived social support among peers and improved emotional well-being. Less sense of isolation and greater community at school.	Possible selection bias (high participation of already wellness-motivated students, especially first-year students); lack of a concurrent comparison group; results based on subjective surveys.
Patel et al. (13)	USA	Descriptive study	394 medical and physician assistant students	Emerging resilience curriculum based on arts and narrative integrated into training	Reduction in emotional exhaustion and increased empathy and satisfaction with the medical experience after implementation.	No control group; lack of rigorous quantitative measurements (mainly subjective assessment).
Versel et al. (5)	USA	Pre-post study without control group. l	70 medical students (second year)	6-session "EI-Resilience PROGRAM" elective curriculum focused on developing emotional intelligence and resilience as professional skills	Significant increase in emotional intelligence (p < 0.01) and reported resilience, along with better management of academic stress.	No control group; small sample size limits statistical power.
Lavadera et al.	USA	Randomized	61 medical students	Meditation and aerobic	Significant reduction in rumination	High dropout rate; no long-

(14)		controlled trial	(years 1 and 2)	exercise (2 times a week for 8 weeks)	and perceived stress, with improvement in quality of life	term follow-up after the intervention.
Priyadharshini et al. (15)	India	Non-randomized controlled trial	526 medical students (first to fourth year, 272 intervention vs 254 control).	Stress management program (yoga, breathing, and daily coping exercises) (duration ~7 weeks)	Significant reduction in stress in the intervention group	Lack of randomization; high dropout rate during follow-up.
Gunsilius et al. (16)	USA	Descriptive study	67 medical students (first year)	Short mindfulness course "MBAT-Rx" (4 weeks, weekly sessions of 2 hours + daily practice 10–15 minutes) focused on mindfulness and academic performance	Improved attention and concentration, better stress management, and greater psychological well-being	No control group or longitudinal follow-up to confirm maintenance of effects.
Malpass et al. (17)	United Kingdom	Qualitative study	57 medical students (years 1 to 5)	Mindfulness-Based Cognitive Therapy (MBCT), with group meditation sessions (approx. 8 weeks)	Greater ability to manage stress, better "coping reserves," and more conscious professional development.	Small sample; lack of objective quantitative measures of impact (emphasizes subjective perceptions).
Jeyasingam(18)	Australia	Descriptive study	140 medical students (first clinical year).	Tutorials on applied philosophy of resilience and medical ethics.	Well-received course, but without quantitative measures of resilience.	No changes were assessed using scales; exploratory nature.
Bhat et al. (19)	India	Quasi-experimental study	102 medical students (first year)	Emotional well-being and stress management workshop	Significant reduction in depression, anxiety and stress, with improvement in coping strategies (significant pre/post differences)	No control group; evaluation confined to a single institution (limiting generalizability).
Kulman-Lipsey et al. (20)	Canada	Descriptive study (program implementation without control	518 medical students (years 1 and 2)	A four-year longitudinal resilience curriculum integrated into the program	Promoting well-being and normalizing dialogue about mental health	No objective reductions in stress or burnout were measured; assessment was based on perceptions and

		group; satisfaction surveys + focus groups).		(regular workshops, online modules, and adversity counseling).		participation (evidence of impact on clinical indicators is lacking).
Forbes et al. (21)	Australia	Cohort study	24 medical interns (intervention) and 29 interns (control)	Pilot "Resilience on the Run" wellness program during the internship (brief workshops on mindfulness, work-life balance, and peer support).	There was a trend toward lower burnout and improved well-being in the intervention group, supported by positive qualitative evaluations from participants. However, the quantitative differences did not reach statistical significance given the low participation.	Insufficient participation to obtain robust statistical power; preliminary results are inconclusive but promising.
Brown et al. (22)	United Kingdom	Mixed study	24 medical students (third year)	Stoic philosophy training in virtual format (SeRenE, with daily online exercises focused on emotional resilience)	Significant increase in resilience and empathy after Stoic training	Small pilot sample; no control group; difficulty distinguishing specific effects given the lack of long-term follow-up.
Wadi et al. (23)	United Arab Emirates	Quasi-experimental essay	78 medical students (fourth year)	Systematic Resilience Assessment Framework (SAR).	Improved resilience and reduced academic stress, anxiety, and depression	Single-center study with no control group; the effect of potential external academic stressors (e.g., variable course load) was not isolated.
Machado et al. (24)	Brazil	Randomized controlled trial	69 medical students (sixth and seventh semester)	Emotional training based on positive psychology.	Increase in subjective well-being and reduction of symptoms of common mental disorders (anxiety, depression) in the intervention group.	Groups were not equivalent at baseline (baseline differences); randomization was lacking, which introduced selection bias.
Scullion et al. (25)	Germany	Uncontrolled mixed study	112 undergraduate medical students	Mind-Body Medicine (MBM) course focused on self-preservation	Reduction in perceived stress levels and increased self-efficacy in self-care habits. Improved coping with daily	No control group; exploratory study with possible volunteer bias

				(self-care strategies, stress management, and group mindfulness).	academic challenges.	(those who opt for the course already motivated by well-being).
Cheung et al. (26)	USA	Single-arm pilot study (pre/post without control)	157 medical students (third year)	Positive psychology program (LAVENDER) (8 weeks, single arm) to promote well-being through gratitude, mindfulness and optimism.	No significant improvement in well-being or mental health was observed after the program; paradoxically, perceived stress increased slightly post-intervention.	No control group; short duration and no follow-up, making it difficult to assess true effectiveness; this illustrates the need for adjustments to the content or timing of the intervention.
Johnson et al. (27)	United Kingdom	Mixed study (pre/post evaluation without control group; quantitative and qualitative methods)	115 medical students (clinical years)	Professional coaching and mentoring program "Reboot" (combining group coaching workshops + personalized mentoring with stress clinical case analysis) delivered in a hybrid in-person/virtual format.	Significant reduction in burnout and depression symptoms, along with increased resilience and confidence. Students positively valued the personalized support for managing clinical stress.	No control group; possible regression to the mean effect (measurement compared to own baseline); concurrent external factors that could influence the study (e.g., different clinical rotations) were not controlled for.
Alobaid et al. (28)	Saudi Arabia	Descriptive study	297 medical students (first year)	Peer Mentoring Program ('Big Sibling')	Less academic stress and improvements in emotional skills during the transition to university life. Emotional connection and a sense of belonging were strengthened in the mentored cohort.	Subjective assessment at a single institution; no comparative control; difficult to isolate the effect of mentoring versus natural adaptation over the year.
Abrams et al. (29)	USA	Quasi-experimental study	38 medical students (second to fourth year)	Peer support program where student volunteers received	Participating as a mentor was associated with significant improvements in self-efficacy and	Self-selected participants (potential volunteer bias); no comparison group of

				basic training and provided support to peers experiencing stress, seeking to reduce the stigma surrounding mental health.	empathy among student mentors (p < 0.01). No significant changes were observed in attitudes toward mental health stigma.	non-mentored students; mentor-centered intervention, no impact on supported students measured.
Rhines et al. (30)	USA	Randomized controlled trial	80 medical students (third year)	Integration of training sessions on emotional intelligence and stress management within the surgical internship (brief seminars during the rotation, with an emphasis on peer support and emotional recognition).	Students receiving the intervention scored significantly higher on resilience and emotional intelligence at the end of the rotation, compared to their control peers (p < 0.05 on EI scales).	Differences in post-rotation survey participation between groups (slight imbalance); single-center study; follow-up beyond the rotation was lacking to determine the persistence of benefits.
Flickinger et al. (31)	USA	Randomized controlled study	27 clinical internship students	Monthly workshops (12 sessions) with mindfulness, reflective writing and medical narrative	Significant improvement in stress management and emotional management	Small sample size; some participant dropouts during the program.
Kaligis et al. (32)	Indonesia	Randomized controlled trial	105 medical students (first year)	Online mental health strengthening module (included in the curriculum, focusing on resilience and proactive stress management) with self-directed methodology and periodic feedback.	Significant increase in resilience and a marked reduction in anxiety and depression among the treated students (pre/post vs. control differences, p < 0.001). Decreased perceived academic stress.	Although randomized, variability in exposure to academic stressors among students was not controlled; whether these positive effects are sustained over the long term is needed to assess this.

| Mugford et al. (33) | USA | Descriptive study | 35 medical students (first and second year) | Active Resilience Training ("ART") program through short, practical workshops to develop self-care and active coping skills. | High retention rate ($\approx 85\%$) of self-care skills learned within a few weeks. Training was perceived as highly effective, with participants reporting frequent application of the techniques in their academic lives. | No control group; small sample; very short-term evaluation (it is unknown whether the practices are maintained over time). |

Table 2. Evaluation of publication bias and methodological quality of the included studies according to their design.

Study (Reference)	Assessment of publication bias	Methodological quality assessment	Justification of the choice
Ekbäck et al. (4)	Not applicable (single study, no meta-analysis)	ROBINS-I (Risk of Bias In Non-randomized Studies of Interventions)	Non-randomized intervention study (single-group pre-post design); ROBINS-I is the recommended tool for assessing bias in non-randomized intervention studies.
Feingold et al. (6)	Not applicable (not a meta-analysis)	Newcastle-Ottawa Scale (NOS) (adapted to cross-sectional study)	Descriptive observational study (PEERS program implemented as part of the curriculum, no control group); the NOS scale is widely used to assess the quality of observational studies.
Patel et al. (13)	Not applicable	Newcastle-Ottawa Scale (NOS) (observational)	Descriptive study without a formal comparator group; NOS is used to assess the quality of non-randomized observational studies.
Versel et al. (5)	Not applicable	ROBINS-I (non-randomized intervention)	An educational intervention evaluated with before-and-after measurements without randomization; ROBINS-I allows for the assessment of bias in this type of quasi-experimental studies.
Lavadera et al. (14)	Funnel plot and Egger test (not applicable for n<10)	RoB 2 (Risk of Bias 2, Cochrane)	Randomized controlled trial; RoB 2 is the recommended tool for assessing risk of bias in RCTs. *Note:* Funnel plot/Egger would have been used to assess publication bias in meta-

			analyses of ≥ 10 RCTs, but not in this individual study.
Priyadharshini et al. (15)	Not applicable (individual study)	ROBINS-I (non-randomized intervention)	Intervention trial with a control group but without random assignment; ROBINS-I is designed to assess bias in non-randomized intervention studies.
Gunsilius et al. (16)	Not applicable	Newcastle-Ottawa Scale (NOS) (observational)	Evaluation of a mindfulness course without a control group (post-intervention survey data); NOS adapted to a cross-sectional study is applied to assess its methodological quality.
Malpass et al. (17)	Not applicable (no combinable quantitative data)	*N/A* (qualitative assessment, e.g. COREQ)	Qualitative study (mindfulness interviews); no quantitative risk of bias tool was used. *Note:* For qualitative studies, a checklist such as the COREQ could be used, although it was not required in this review.
Jeyasingam (18)	Not applicable	*N/A* (not applicable due to lack of quantitative data)	Exploratory curricular intervention without formal quantitative assessment; it cannot be assessed with standard biasing tools. (Outcomes were not measured with objective scales.)
Bhat et al. (19)	Not applicable	ROBINS-I (non-randomized intervention)	"Being Well" intervention applied to a single group with pre- and post-measurement; ROBINS-I should be used to assess potential bias in the absence of randomization.
Kulman-Lipsey et al. (20)	Not applicable	Newcastle-Ottawa Scale (NOS) (observational)	Resilience curriculum implemented without a control group and evaluated with satisfaction surveys; NOS (adapted) is used as this is a descriptive observational study.
Forbes et al. (21)	Not applicable	ROBINS-I (non-randomized intervention)	Resilience on the Run program with a non-randomized concurrent control group (comparison between hospitals); ROBINS-I allows for assessment of selection bias and confounding in this design.

Brown et al. (22)	Not applicable	ROBINS-I (non-randomized intervention)	Stoic philosophy training was assessed with pre/post (uncontrolled) measures and interviews; ROBINS-I was used for the quantitative pre/post component (a pilot study without randomization).
Wadi et al. (23)	Not applicable	ROBINS-I (non-randomized intervention)	Implementation of the SAR framework with a single-group pre- and post-treatment measurement; as a non-randomized intervention, the risk of bias is assessed using ROBINS-I.
Machado et al. (24)	Not applicable	ROBINS-I (non-randomized intervention)	Positive psychology training with a non-randomized control group; ROBINS-I is used to examine comparative biases and confounders.
Scullion et al. (25)	Not applicable	ROBINS-I (non-randomized intervention)	A 10-week mind-body elective, assessed with pre/post surveys (uncontrolled) and interviews; ROBINS-I is used for the quantitative pre/post component, as there was no control group.
Cheung et al. (26)	Not applicable	ROBINS-I (non-randomized intervention)	"LAVENDER" positive psychology pilot program without a control group (one-arm pre/post design); ROBINS-I should be used to assess bias given the lack of randomization and comparator.
Johnson et al. (27)	Not applicable	ROBINS-I (non-randomized intervention)	The "Reboot" coaching program was evaluated before and after without a control group (qualitative methods were included); ROBINS-I was used for the quantitative pre-post evaluation of the intervention's effect.
Alobaid et al. (28)	Not applicable	Newcastle-Ottawa Scale (NOS) (observational)	Cross-sectional survey of perceptions of the mentoring program; quality was examined using NOS criteria for observational studies (adapting items to a cross-sectional study).
Abrams et al.	Not applicable	ROBINS-I (non-randomized	Peer mentoring program evaluated among mentors with

(29)		intervention)	pre/post measurement without parallel control; as a non-randomized intervention study, ROBINS-I was applied to identify potential biases (e.g., self-selection of volunteers).
Rhines et al. (30)	Funnel plot/Egger (not applicable, <10 studies)	RoB 2 (Cochrane Risk of Bias 2)	Randomized trial in clinical rotation; assessed using the RoB 2 tool for risk of bias in RCTs. *Note:* Publication bias at the individual study level was not assessed; funnel plot/Egger would be recommended for meta-analyses if there were ≥ 10 trials.
Flickinger et al. (31)	Funnel plot/Egger (not applicable, scope review)	RoB 2 (Cochrane RoB 2)	The "Flourish" curricular intervention was evaluated as an RCT; RoB 2 is the standard for assessing risk of bias in randomized trials. (Publication bias analysis was not performed as there was no meta-analysis of multiple RCTs.)
Kaligis et al. (32)	Funnel plot/Egger (not applicable, limited)	RoB 2 (Cochrane RoB 2)	Online module evaluated using a pragmatic RCT; analyzed using RoB 2 as this is a randomized study. (Publication bias tools are not applicable due to an insufficient number of studies for formal testing.)
Mugford et al. (33)	Not applicable	Newcastle-Ottawa Scale (NOS) (observational)	Resilience training (ART) was assessed with a post-course survey (skill perception and retention, without a comparator); NOS was considered to assess the quality of the descriptive observational study.

Table 3. Summary of characteristics and effects of the interventions by thematic cluster (grouping of the 24 studies). Each cluster brings together similar interventions aimed at improving emotional management in medical students, highlighting their main approaches, typical outcomes, and common limitations .

Thematic cluster	Number of studies	Typical interventions (examples)	Observed results (summary)	Common limitations
Mindfulness and	8	Mindfulness training	↓ Perceived stress and	Many uncontrolled studies; small

Meditation	(14, 15, 16, 17, 18, 19)	(meditation), yoga, 4–12 week mind-body therapies (e.g. MBCT, exercise programs)	rumination (better coping with stress) ; ↑ Mindfulness , quality of life , and interpersonal relationships	sample sizes; short-term evaluations (immediate benefits, uncertain sustainability).
Positive Psychology and Resilience	7 (5, 20, 21, 22, 23, 24, 25, 26)	Curricula/workshops focused on resilience, gratitude, optimism, emotional intelligence (e.g. coaching, positive modules)	↑ Resilience, emotional self-efficacy, and positive affect in students; ↓ symptoms of anxiety, depression , and burnout in several studies.	High heterogeneity in interventions and methods; several studies lacked randomization or follow-up; some non-significant results from pilot samples.
Peer Support and Mentoring	4 (27, 28, 29, 30)	Student mentoring programs, peer-led support groups, academic coaching (e.g., "Big Sibling," PEERS sessions)	↑ Perceived social support, sense of community, and emotional well-being; ↓ academic stress and isolation. Improved empathy and self-efficacy in peer mentors; ↓ burnout with professional mentoring .	Uncontrolled descriptive/pre-post studies predominate; potential volunteer bias; lack of objective impact measurement (e.g., academic performance) and long-term effects.
Arts and Philosophy	2 (13, 31)	Artistic activities, reflective narrative, humanistic philosophy (e.g., writing workshops, art curriculum)	↓ Burnout; ↑ empathy and satisfaction with training . Creativity and personal reflection improve emotional well-being .	Small samples; mostly qualitative assessments (self-reports); lack of control groups.
Proactivity in Mental Health	3 (4, 32, 33)	Proactive strategies integrated into the curriculum (e.g., online resilience modules, self-care workshops)	↓ Anxiety and depression in students after interventions (significant effect); high adoption of self-care skills (≈85 % use them); improved coping with stress	Very few studies (initial evidence); contextual interventions at each institution; long-term impact on student life and performance remains to be assessed.