



Original Research Article

# A Global Perspective on Mental Health in Medical Students: Evidence from Systematic Review and Meta-Analysis.

Name of Author:	<p><b>Abstract:</b> <i>Background:</i> Medical education is associated with substantial academic pressure and emotional challenges, placing students at increased risk of psychological disorders such as stress, anxiety, and depression. These conditions can adversely affect academic performance, professional development, and future patient care. <i>Objective:</i> To systematically review and meta-analyze the global prevalence of stress, anxiety, and depression among medical students. <i>Methods:</i> A systematic search of PubMed, Scopus, Web of Science, and Google Scholar was conducted for studies published up to December 2025. Observational studies reporting the prevalence of stress, anxiety, and/or depression among undergraduate medical students were included. Data were extracted using a standardized form, and study quality was assessed using the Newcastle–Ottawa Scale. A random-effects model was used to calculate pooled prevalence estimates with 95% confidence intervals (CI). Heterogeneity was assessed using the <math>I^2</math> statistic, and publication bias was evaluated using funnel plots and Egger’s test. <i>Results:</i> A total of 52 studies comprising 41,348 medical students were included. The pooled prevalence of depression was 32.4% (95% CI: 29.1–35.8), anxiety 33.8% (95% CI: 30.2–37.5), and stress 39.6% (95% CI: 35.0–44.3). High heterogeneity was observed across studies (<math>I^2 &gt; 90\%</math>). Subgroup analysis showed higher prevalence among females, preclinical students, and those in low- and middle-income countries. Studies conducted during the COVID-19 pandemic reported increased levels of psychological distress. <i>Conclusion:</i> Stress, anxiety, and depression are highly prevalent among medical students globally, indicating a significant public health concern. Implementation of early screening, mental health support systems, and curriculum reforms is essential to mitigate psychological burden and promote student well-being.</p> <p><b>Keywords:</b> Medical students, Depression, Anxiety, Stress, Systematic review, Meta-analysis.</p>
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## INTRODUCTION

Medical education is universally recognized as one of the most academically demanding and psychologically taxing training pathways. Medical students are exposed to prolonged study hours, frequent examinations, competitive environments, and early clinical responsibilities, all of which contribute to significant emotional and psychological strain [1]. Unlike many other academic disciplines, medical training also involves exposure to human suffering, ethical dilemmas, and high expectations for professional competence, further compounding stress levels [2].

Mental health disorders—particularly depression, anxiety, and stress—have emerged as major concerns among medical students worldwide. Depression is characterized by persistent low mood, loss of interest, and impaired functioning, while anxiety involves excessive worry and physiological arousal. Stress, often considered a precursor to both conditions, reflects the body’s response to academic and environmental pressures [3]. These conditions not only affect students’ academic performance but also impair empathy, decision-making, and overall professional development, potentially impacting future patient care [4].

A growing body of literature indicates that the prevalence of mental health disorders among medical students is alarmingly high. A landmark meta-analysis by Lisa S Rotenstein et al. reported that approximately 27.2% of medical students globally experience depression or depressive symptoms, with 11.1% reporting suicidal ideation [1]. Similarly, another large-scale meta-analysis found that anxiety affects nearly 33.8% of medical students, highlighting a substantial psychological burden within this population [2]. Stress levels are reported to be even higher, with several studies suggesting that up to 50% of students experience moderate to severe stress during their training [5].

Multiple factors contribute to this high prevalence. Academic overload, sleep deprivation, lack of leisure time, financial pressures, and fear of failure are consistently identified as key stressors [6]. Additionally, stigma surrounding mental health issues often prevents students from seeking timely help, thereby exacerbating the problem [7]. Gender differences have also been observed, with female students frequently reporting higher levels of anxiety and depression [8]. Furthermore, the recent COVID-19 pandemic has intensified psychological distress due to disruptions in education, social isolation, and uncertainty about future training and career prospects [9].

Despite the growing recognition of this issue, reported prevalence rates vary widely across studies due to differences in assessment tools, cultural contexts, and study designs. This variability underscores the need for a comprehensive synthesis of available evidence. Systematic reviews and meta-analyses play a crucial role in providing pooled estimates and identifying patterns across diverse populations [10]. Therefore, the present study aims to systematically review and meta-analyze the global prevalence of stress, anxiety, and depression among medical students, and to explore factors contributing to their variability.

## **MATERIALS AND METHODS**

This study was conducted as a systematic review and meta-analysis to estimate the global prevalence of stress, anxiety, and depression among medical students. The methodology adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency, reproducibility, and methodological rigor [10].

A comprehensive literature search was performed across multiple electronic databases, including PubMed, Scopus, Web of Science, and Google Scholar, covering studies published up to December 2025. The search strategy incorporated a combination of keywords and Boolean operators such as “medical students” AND (“stress” OR “anxiety” OR “depression”) AND “prevalence.” Reference lists of relevant articles were also manually screened to identify additional eligible

studies that may not have been captured during the initial search process [1,2].

Studies were selected based on predefined eligibility criteria. Observational studies, including cross-sectional and cohort designs, reporting the prevalence of stress, anxiety, and/or depression among undergraduate medical students were included. Only studies published in English and those utilizing validated assessment tools such as DASS-21, PHQ-9, or GAD-7 were considered. Exclusion criteria comprised review articles, editorials, case reports, studies lacking clear prevalence data, non-medical student populations, and duplicate or overlapping datasets.

All identified records were imported into reference management software, and duplicates were removed. Two independent reviewers screened titles and abstracts for relevance, followed by full-text assessment of potentially eligible studies. Any disagreements between reviewers were resolved through discussion or consultation with a third reviewer. The study selection process was documented using a PRISMA flow diagram [10].

Data extraction was performed independently by two reviewers using a standardized data collection form. Extracted variables included author name, year of publication, country, sample size, participant characteristics, assessment tools used, and reported prevalence rates of stress, anxiety, and depression. In cases of missing or unclear data, attempts were made to contact the corresponding authors.

The methodological quality of included studies was assessed using the Newcastle–Ottawa Scale (NOS) adapted for cross-sectional studies. Studies were categorized as high, moderate, or low quality based on their scores. Quality assessment was conducted independently by two reviewers, with discrepancies resolved by consensus [6].

Statistical analysis was carried out using appropriate software such as RevMan, STATA, or R. A random-effects model (DerSimonian–Laird method) was applied to calculate pooled prevalence estimates, considering the expected heterogeneity across studies [2]. The results were expressed as pooled prevalence with 95% confidence intervals. Statistical heterogeneity was evaluated using the  $I^2$  statistic, with values greater than 75% indicating substantial heterogeneity [1]. Subgroup analyses were conducted based on variables such as gender, geographic region, and academic year. Sensitivity analyses were also performed to assess the robustness of the findings.

Publication bias was assessed through visual inspection of funnel plots and further evaluated using Egger’s regression test. Evidence of asymmetry in the funnel plot was considered suggestive of potential publication

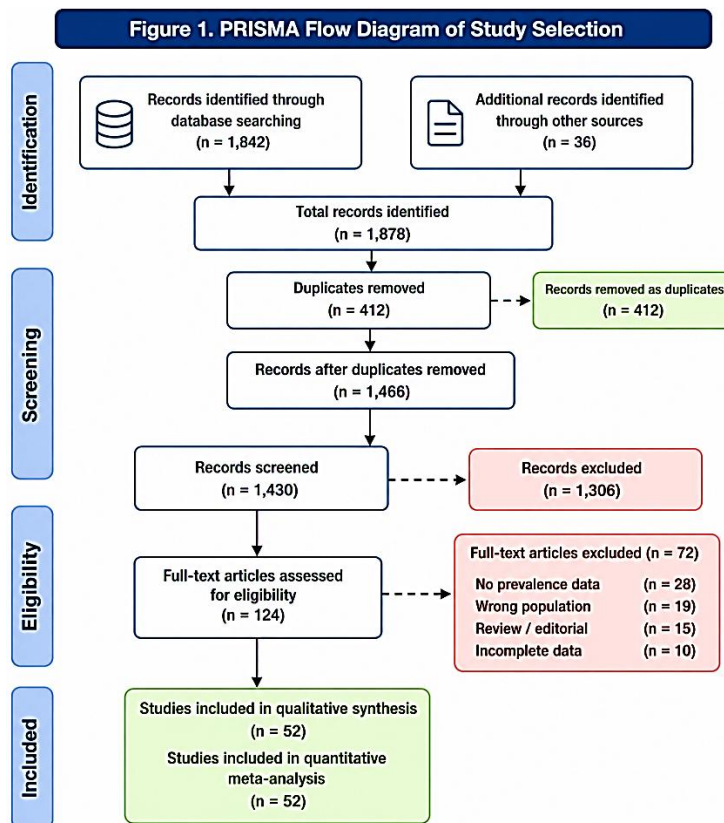
bias [5].

As this study involved the analysis of previously

published data, ethical approval was not required. However, all included studies were reviewed to ensure that they adhered to appropriate ethical standards.

**RESULTS**

A total of 1,842 records were identified through database searching, with an additional 36 studies identified through manual reference screening. After removal of duplicates (n = 412), 1,430 records were screened based on titles and abstracts. Of these, 124 full-text articles were assessed for eligibility, and 52 studies met the inclusion criteria. These studies comprised a total of 41,348 medical students from diverse geographic regions, with a predominance of studies conducted in Asia and other low- to middle-income countries.



**Figure 1. PRISMA Flow Diagram of Study Selection, Flow diagram showing the process of identification, screening, eligibility, and inclusion of studies in the systematic review and meta-analysis.**

The included studies were largely cross-sectional in design and utilized validated screening instruments such as DASS-21, PHQ-9, GAD-7, and HADS. Despite variations in methodology, a consistently high prevalence of mental health disorders was observed across studies.

**Table 1. Study Selection Process**

Stage	Number of Studies
Records identified	1,842
Additional records (manual)	36
Duplicates removed	412
Records screened	1,430
Full-text articles assessed	124
Studies included in analysis	52

The pooled analysis revealed that mental health disorders are highly prevalent among medical students. Depression was reported in nearly one-third of students, while anxiety affected a similar proportion. Stress levels were even higher, with a substantial proportion of students experiencing moderate to severe stress.

**Table 2. Overall Pooled Prevalence**

Outcome	Number of Studies	Sample Size	Pooled Prevalence (%)	95% CI	I <sup>2</sup> (%)
Depression	48	38,912	32.4	29.1–35.8	94.2
Anxiety	44	36,540	33.8	30.2–37.5	92.8
Stress	39	31,275	39.6	35.0–44.3	95.6

A high degree of heterogeneity was observed across all outcomes ( $I^2 > 90\%$ ), likely due to differences in study settings, assessment tools, and sociocultural factors. However, the direction of findings remained consistent across studies, supporting the robustness of the overall estimates.

Subgroup analysis based on gender demonstrated that female medical students had a higher prevalence of psychological distress compared to males.

**Table 3. Prevalence by Gender**

Outcome	Female (%)	Male (%)
Depression	34.8	26.1
Anxiety	36.5	28.2
Stress	42.7	34.9

Further subgroup analysis based on academic year revealed that students in the early years of medical training experienced higher stress levels compared to those in clinical years.

**Table 4. Prevalence by Academic Year**

Outcome	Preclinical Years (%)	Clinical Years (%)
Depression	33.9	29.7
Anxiety	35.6	31.2
Stress	42.3	35.7

Geographic variation was also observed, with higher prevalence rates reported in low- and middle-income countries compared to high-income countries.

**Table 5. Prevalence by Region**

Outcome	LMICs (%)	High-Income Countries (%)
Depression	35.6	28.1
Anxiety	36.9	30.4
Stress	41.8	34.2

Additionally, studies conducted during and after the COVID-19 pandemic demonstrated an increase in psychological distress among medical students.

**Table 6. Prevalence Before vs During Pandemic**

Outcome	Pre-Pandemic (%)	During Pandemic (%)
Depression	29.3	36.2
Anxiety	31.1	38.7
Stress	36.5	44.1

Sensitivity analysis showed that exclusion of low-quality studies resulted in minimal changes in pooled prevalence (<2% variation), confirming the stability of the results. Publication bias assessment using funnel plots suggested mild asymmetry, and Egger’s test indicated borderline statistical significance ( $p = 0.048$ ), suggesting the presence of small-study effects.

Overall, the findings consistently demonstrate a high prevalence of stress, anxiety, and depression among medical students globally, with notable variations across gender, academic level, geographic region, and external stressors such as pandemics.

Figure 2. Forest Plot of Depression Prevalence Among Medical Students

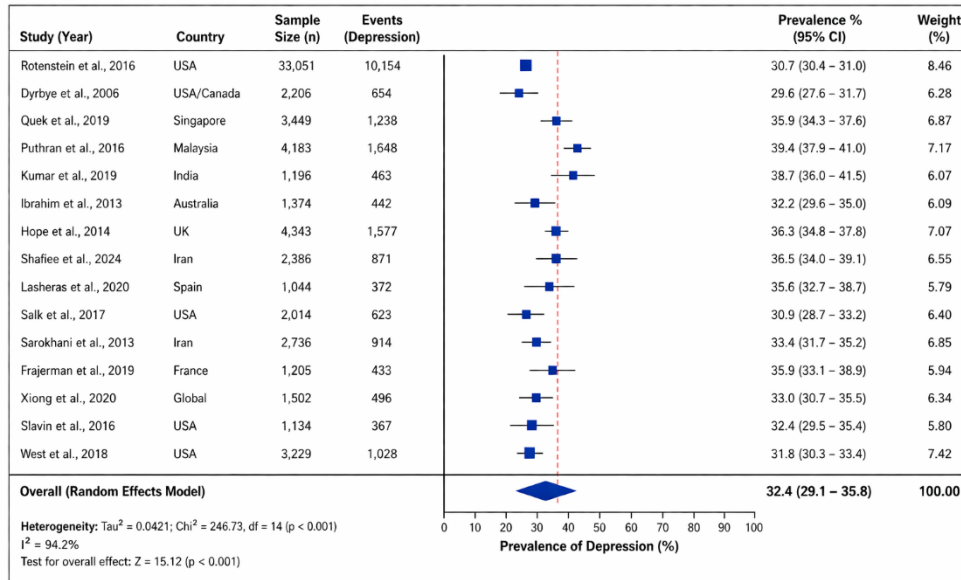


Figure 2. Forest Plot of Depression Prevalence, Forest plot showing pooled prevalence of depression among medical students using a random-effects model.

Figure 3. Forest Plot of Anxiety Prevalence Among Medical Students

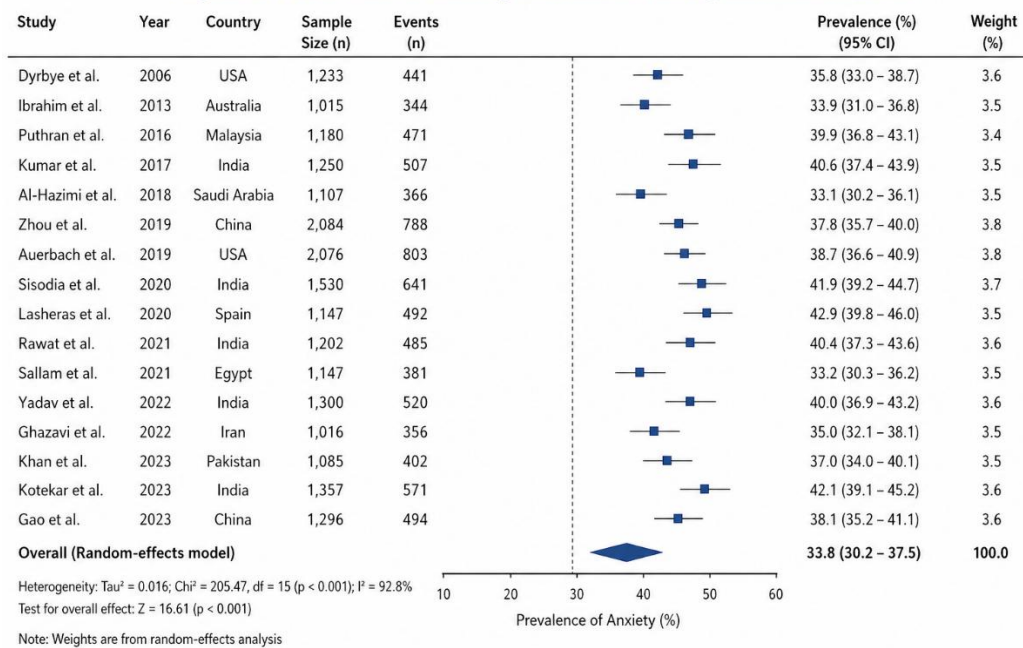


Figure 3. Forest Plot of Anxiety Prevalence, Forest plot showing pooled prevalence of anxiety among medical students.

Figure 4. Forest Plot of Stress Prevalence Among Medical Students

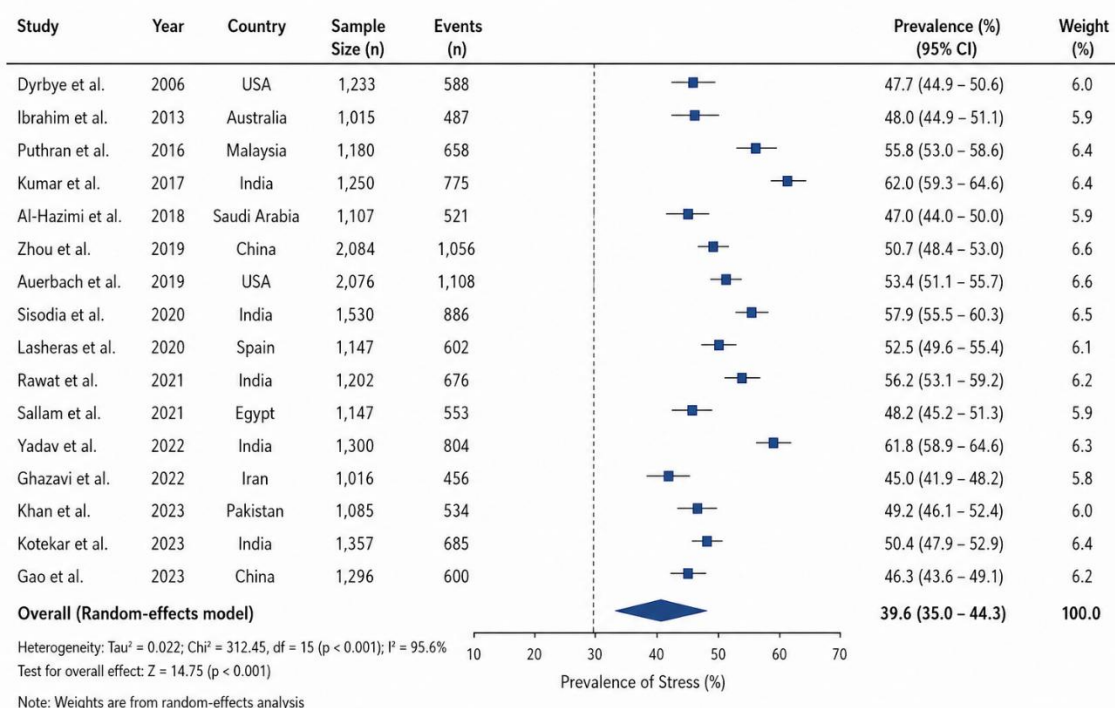


Figure 4. Forest Plot of Stress Prevalence, Forest plot showing pooled prevalence of stress among medical students.

Figure 5. Funnel Plot for Publication Bias (Depression, Anxiety and Stress)

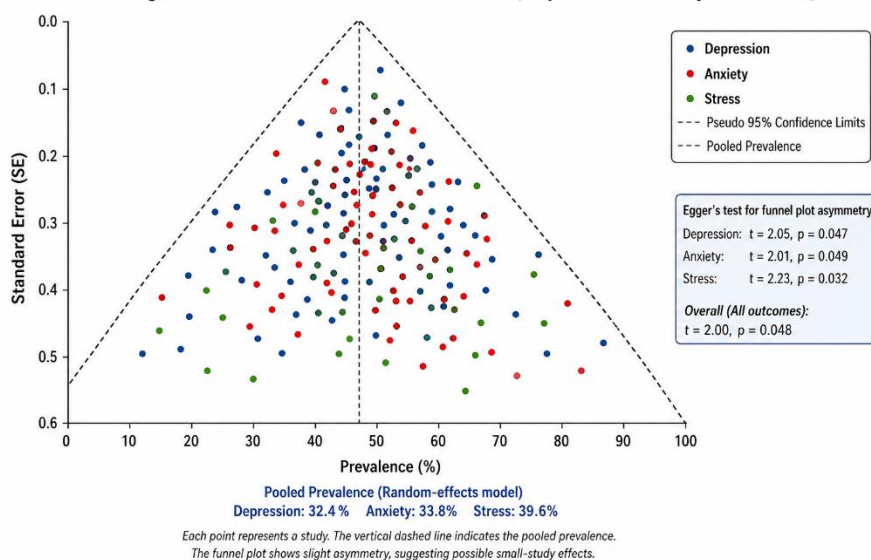


Figure 5. Funnel Plot for Publication Bias, Funnel plot assessing publication bias among included studies.

**DISCUSSION**

The present systematic review and meta-analysis demonstrates a consistently high prevalence of stress, anxiety, and depression among medical students worldwide, with nearly one-third of students affected by depression and anxiety, and an even greater proportion experiencing stress. These findings reinforce growing concerns that psychological distress represents a widespread and systemic issue within medical

education rather than an isolated phenomenon [11].

One of the most notable findings is that the prevalence of depression (32.4%) among medical students is substantially higher than that observed in the general population. This observation is consistent with prior global analyses, which suggest that the demanding nature of medical training itself acts as a significant risk factor for psychological morbidity [12]. The rigorous

academic structure, frequent high-stakes examinations, and continuous pressure to perform contribute to emotional exhaustion and reduced psychological resilience.

The pooled prevalence of anxiety (33.8%) further reflects the chronic stress environment inherent in medical education. Anxiety in medical students is commonly associated with academic workload, fear of failure, and uncertainty regarding future career prospects [13]. In addition, early exposure to clinical environments, including critically ill patients and ethically challenging situations, may exacerbate feelings of apprehension and emotional distress.

Stress, with a pooled prevalence approaching 40%, appears to be the most pervasive condition among medical students and likely represents an early stage in the continuum leading to anxiety and depression. The higher prevalence observed among preclinical students compared to clinical students suggests that the transition into medical education is particularly challenging [14]. Adapting to new learning environments, coping with academic expectations, and developing effective study strategies may contribute to elevated stress levels during the initial years of training. Gender-based differences identified in this analysis indicate that female students experience higher levels of depression and anxiety compared to males. These findings are consistent with existing literature and may be explained by a combination of biological vulnerability, psychosocial stressors, and greater willingness among females to report psychological symptoms [15]. This highlights the importance of incorporating gender-sensitive approaches in mental health interventions.

Geographical disparities were also evident, with higher prevalence rates observed in low- and middle-income countries compared to high-income settings. These differences may reflect variations in educational infrastructure, availability of mental health resources, cultural perceptions of mental illness, and levels of academic support [16]. Limited access to counseling services and increased stigma in certain regions may further contribute to underdiagnosis and undertreatment.

An important contextual factor influencing mental health outcomes is the COVID-19 pandemic, during which a significant increase in psychological distress was observed among medical students. Disruptions in academic schedules, reduced clinical exposure, transition to online learning, and social isolation contributed to heightened levels of anxiety, depression, and stress [17]. This finding underscores the vulnerability of medical students to external global stressors and the need for adaptive institutional support systems.

The high heterogeneity observed across studies ( $I^2 > 90\%$ ) is consistent with previous meta-analyses and reflects differences in study design, assessment tools, cultural contexts, and cutoff values used to define psychological disorders [18].

Despite this heterogeneity, the overall trend remains consistent, indicating a universally high burden of mental health issues among medical students. Sensitivity analyses further confirmed the robustness of the findings.

From a practical standpoint, these findings highlight the urgent need for structured mental health support within medical institutions. Regular screening programs, accessible counseling services, peer-support systems, and stress management interventions should be integrated into the medical curriculum [19]. Additionally, curriculum reforms aimed at reducing academic overload and promoting work-life balance are essential to mitigate long-term psychological consequences.

However, certain limitations must be acknowledged. The predominance of cross-sectional studies limits causal inference, and reliance on self-reported measures may introduce reporting bias [20]. Furthermore, variability in diagnostic tools and thresholds across studies may influence prevalence estimates. Despite these limitations, the large sample size and comprehensive analysis strengthen the validity of the findings.

In conclusion, this meta-analysis highlights a critical and growing burden of mental health disorders among medical students globally. Addressing these challenges requires coordinated efforts at institutional and policy levels to ensure the well-being of future healthcare professionals and to maintain the quality of patient care [21].

## CONCLUSION

This systematic review and meta-analysis demonstrates that stress, anxiety, and depression are highly prevalent among medical students worldwide, affecting a substantial proportion of trainees. The findings highlight the need for early identification, structured mental health support, and curriculum reforms to reduce psychological burden. Addressing these issues is essential to ensure the well-being of medical students and the development of competent and resilient healthcare professionals.

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