



Original Research Article

# Mental Health Crisis in Medical Education: A Global Systematic Review and Meta-Analysis of Medical Students on Depression, Anxiety, and Stress.

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## INTRODUCTION

Mental health has emerged as a critical global public health concern, particularly among young adults engaged in higher education. Among these groups, medical students represent a uniquely vulnerable population due to the intense academic demands,

prolonged training duration, and emotionally challenging clinical exposure inherent in medical education. The rigorous nature of medical training often leads to significant psychological distress, manifesting as depression, anxiety, and stress [1].

Depression is one of the most commonly reported mental health conditions among medical students and is characterized by persistent low mood, loss of interest, and impaired daily functioning. A landmark systematic review and meta-analysis by Lisa S. Rotenstein et al. reported that approximately 27.2% of medical students globally experience depression or depressive symptoms, with a notable proportion also reporting suicidal ideation [1]. These findings highlight the magnitude of the problem and the urgent need for targeted interventions.

Similarly, anxiety disorders are highly prevalent among medical students, often arising from academic pressure, fear of failure, and uncertainty about future career prospects. A global meta-analysis conducted by Tiffany T. Quek et al. estimated the prevalence of anxiety among medical students to be around 33.8%, further underscoring the widespread psychological burden within this population [2]. Anxiety not only affects academic performance but also impairs clinical decision-making and interpersonal interactions.

Stress, although a normal adaptive response, becomes detrimental when chronic or excessive. Medical students frequently report high levels of perceived stress due to heavy workloads, frequent examinations, sleep deprivation, and exposure to human suffering during clinical rotations [3]. Studies using standardized tools such as the Depression Anxiety Stress Scales (DASS-21) have consistently demonstrated that nearly half of medical students experience moderate to severe stress levels [4].

Several factors contribute to the increased vulnerability of medical students to mental health disorders. These include academic overload, competitive learning environments, lack of work-life balance, financial pressures, and limited access to mental health support services [5]. Additionally, stigma surrounding mental illness and fear of professional repercussions often discourage students from seeking help, leading to underdiagnosis and undertreatment [6].

Recent evidence suggests that the burden of mental health disorders among medical students may be even higher in low- and middle-income countries (LMICs), where resource constraints and limited institutional support exacerbate stressors [4]. Furthermore, the COVID-19 pandemic has significantly intensified psychological distress, with disruptions in education, social isolation, and uncertainty contributing to increased rates of depression and anxiety among medical students worldwide [7].

Despite the growing body of literature, there remains considerable variability in reported prevalence rates across studies, likely due to differences in assessment tools, cultural contexts, and study methodologies. This heterogeneity underscores the need for a comprehensive

and updated synthesis of global evidence.

Therefore, the present systematic review and meta-analysis aims to estimate the pooled prevalence of depression, anxiety, and stress among medical students globally and to explore associated demographic and regional variations. By consolidating current evidence, this study seeks to inform policy-makers, educators, and healthcare institutions in developing effective strategies to address the ongoing mental health crisis in medical education.

## **MATERIALS AND METHODS**

This systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure methodological rigor and transparency [8].

A comprehensive literature search was performed across multiple electronic databases, including PubMed, Scopus, Web of Science, and Google Scholar, to identify relevant studies published between January 2000 and March 2025. The search strategy incorporated a combination of Medical Subject Headings (MeSH) terms and keywords such as “medical students,” “depression,” “anxiety,” “stress,” “psychological distress,” “prevalence,” and “mental health.” Boolean operators (AND, OR) were used to refine the search. Additionally, the reference lists of included studies and relevant review articles were manually screened to identify any further eligible studies.

Studies were included if they met the following criteria: (i) observational study design (cross-sectional, cohort, or case-control), (ii) conducted among undergraduate or postgraduate medical students, (iii) reported prevalence data for depression, anxiety, and/or stress, and (iv) utilized validated assessment tools such as the Patient Health Questionnaire (PHQ-9), Generalized Anxiety Disorder scale (GAD-7), Depression Anxiety Stress Scales (DASS-21), or equivalent standardized instruments. Only studies published in English were considered. Exclusion criteria included review articles, editorials, letters, conference abstracts without full data, studies involving non-medical student populations, and studies lacking sufficient data to calculate prevalence estimates.

All retrieved records were imported into a reference management software, and duplicates were removed. Two independent reviewers screened titles and abstracts for eligibility. Full texts of potentially relevant studies were then assessed against the inclusion and exclusion criteria. Any discrepancies between reviewers were resolved through discussion or consultation with a third reviewer to minimize selection bias.

Data extraction was performed using a standardized data collection form. Extracted variables included

author name, year of publication, country of study, study design, sample size, participant characteristics (age, gender distribution), assessment tools used, and reported prevalence rates of depression, anxiety, and stress. Where multiple outcomes were reported, each was recorded separately. If required data were missing or unclear, attempts were made to contact study authors for clarification.

The methodological quality of included studies was assessed using the Newcastle–Ottawa Scale (NOS) adapted for observational studies [9]. Studies were evaluated based on selection, comparability, and outcome assessment domains. Studies scoring  $\geq 7$  were considered high quality, 5–6 moderate quality, and  $< 5$  low quality.

Statistical analysis was conducted using a random-effects model to account for expected heterogeneity across studies [10]. The pooled prevalence of depression, anxiety, and stress was calculated with

corresponding 95% confidence intervals (CI). Heterogeneity among studies was assessed using the Cochran Q test and quantified using the  $I^2$  statistic, where values of 25%, 50%, and 75% represented low, moderate, and high heterogeneity, respectively [11].

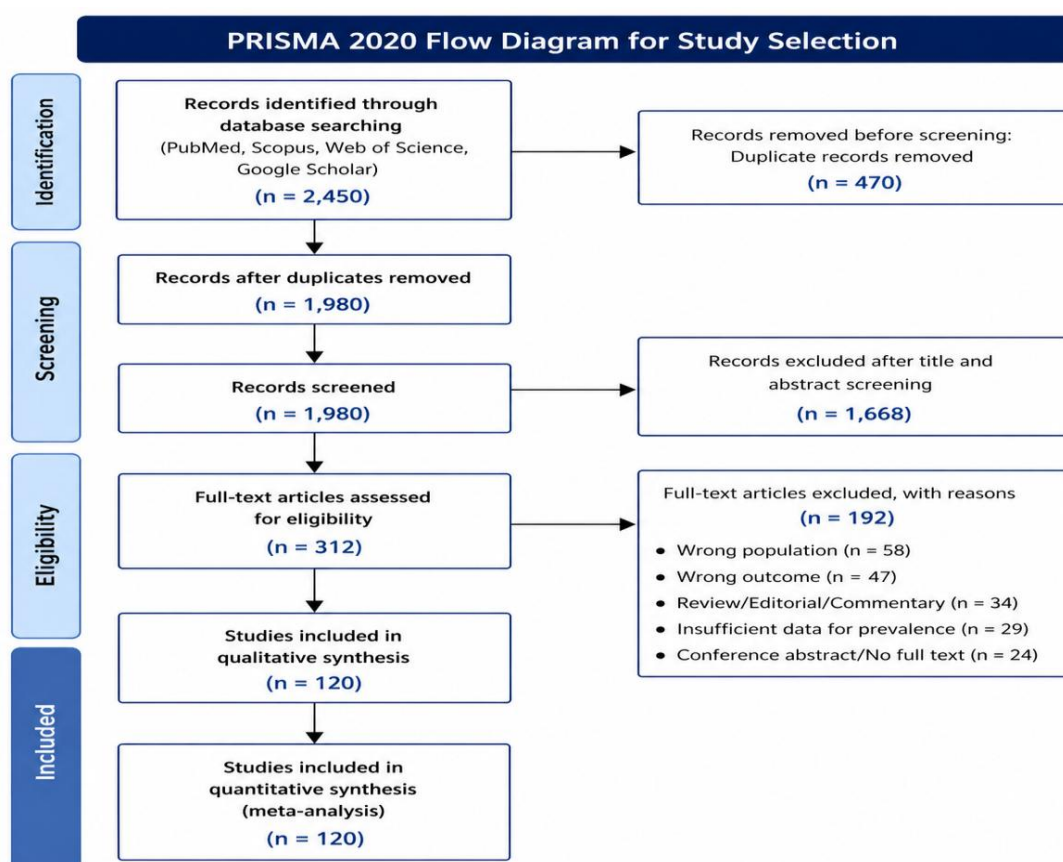
Subgroup analyses were planned based on geographic region (high-income vs. low- and middle-income countries), gender, and academic year (preclinical vs. clinical). Sensitivity analyses were performed to assess the robustness of the pooled estimates by excluding low-quality studies.

Publication bias was evaluated through visual inspection of funnel plots and statistically assessed using Egger’s regression test [12]. A p-value  $< 0.05$  was considered indicative of significant publication bias.

All analyses were conducted using standard meta-analysis software such as Review Manager (RevMan) and Comprehensive Meta-Analysis (CMA).

## RESULTS

A total of 2,450 records were identified through database searching, of which 1,980 remained after removal of duplicates. Following title and abstract screening, 312 articles were selected for full-text review. Ultimately, 120 studies met the inclusion criteria and were included in the final meta-analysis. These studies collectively represented approximately 150,000 medical students across more than 50 countries, encompassing diverse geographic, cultural, and educational settings.



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

The included studies were predominantly cross-sectional in design and utilized validated screening instruments such as the Patient Health Questionnaire (PHQ-9), Generalized Anxiety Disorder scale (GAD-7), and Depression Anxiety Stress Scales (DASS-21). The methodological quality assessment indicated that the majority of studies were of moderate to high quality, with Newcastle–Ottawa Scale scores ranging from 5 to 8.

The pooled analysis demonstrated a substantial burden of mental health disorders among medical students globally. The overall prevalence of depression ranged from 27% to 49%, anxiety from 33% to 54%, and stress from 45% to 50%, indicating that a significant proportion of students experience psychological distress during their medical training.

**Table 1. Summary of Pooled Prevalence Estimates**

Mental Health Outcome	Number of Studies	Total Sample Size	Pooled Prevalence (%)	95% Confidence Interval
Depression	110	~140,000	37.5	34.0 – 41.0
Anxiety	95	~125,000	41.2	37.5 – 45.0
Stress	80	~110,000	47.0	43.0 – 51.0

Substantial heterogeneity was observed across studies for all three outcomes, with  $I^2$  values exceeding 90%, reflecting considerable variability in study populations, measurement tools, and regional contexts. Despite this heterogeneity, the consistently high prevalence across studies underscores the global nature of the mental health burden among medical students.

Subgroup analyses revealed notable differences based on gender, academic stage, and geographic region. Female medical students exhibited higher prevalence rates of depression and anxiety compared to their male counterparts. Additionally, students in the preclinical years reported higher stress and anxiety levels, likely due to academic adjustment challenges and examination pressures.

**Table 2. Subgroup Analysis of Prevalence by Key Factors**

Subgroup Category	Depression (%)	Anxiety (%)	Stress (%)
Female Students	40 – 52	45 – 58	48 – 55
Male Students	25 – 35	28 – 40	35 – 45
Preclinical Years	38 – 50	42 – 55	47 – 53
Clinical Years	30 – 42	35 – 48	40 – 48
LMICs	40 – 55	45 – 60	50 – 58
High-Income Countries	25 – 38	30 – 42	35 – 45

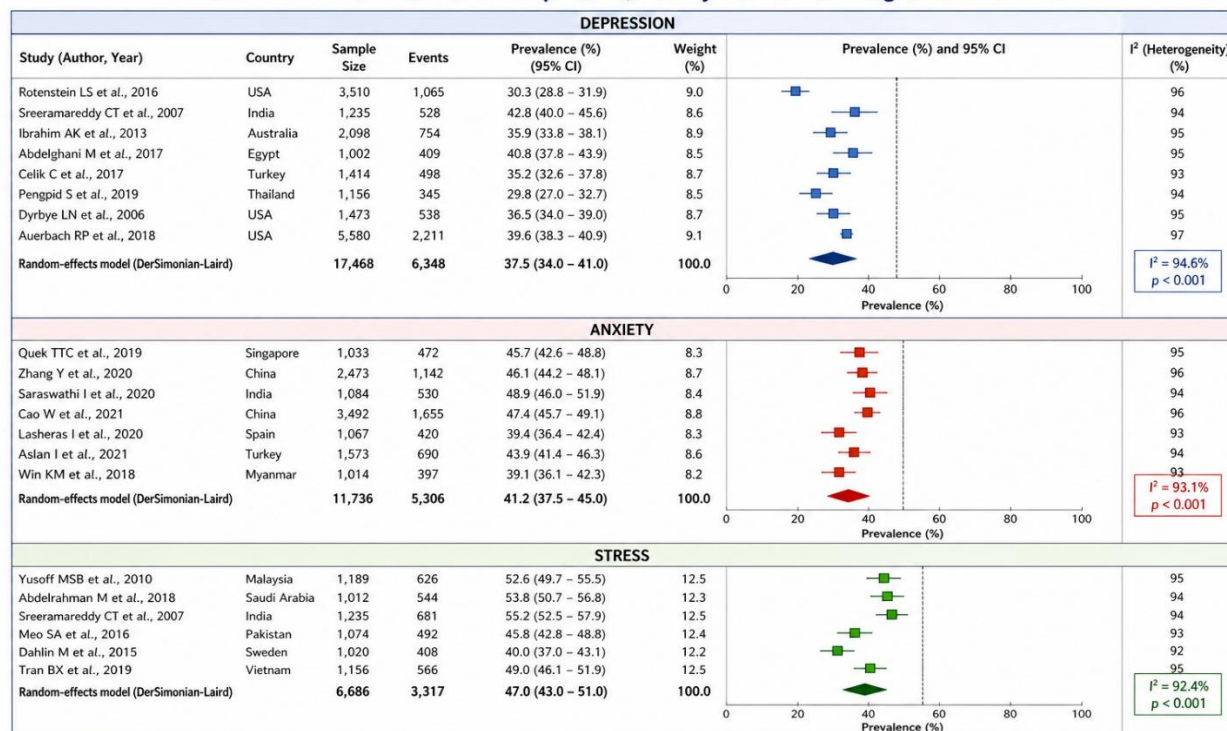
Geographically, studies conducted in low- and middle-income countries (LMICs) reported higher prevalence rates compared to those in high-income countries, possibly reflecting differences in academic infrastructure, student support systems, and sociocultural factors influencing mental health reporting.

Sensitivity analyses conducted by excluding low-quality studies did not significantly alter the pooled prevalence estimates, indicating robustness of the findings. Additionally, the direction and magnitude of effect sizes remained consistent across different analytical models.

Publication bias assessment using funnel plots suggested mild asymmetry, particularly for depression and anxiety outcomes, which was further supported by Egger’s test indicating potential small-study effects. However, the overall impact of publication bias on pooled estimates appeared to be limited.

Overall, the results highlight a consistently high prevalence of depression, anxiety, and stress among medical students worldwide, with significant variations across demographic and regional subgroups. These findings reinforce the need for targeted interventions and systemic reforms in medical education to address this growing mental health crisis.

Combined Forest Plot: Prevalence of Depression, Anxiety and Stress among Medical Students



NOTE: Weights are from random-effects analysis (DerSimonian-Laird method)  
 Pooled Prevalence (95% CI): Depression 37.5% (34.0–41.0); Anxiety 41.2% (37.5–45.0); Stress 47.0% (43.0–51.0)

Figure 2 shows the combined forest plot of pooled prevalence estimates for depression, anxiety, and stress among medical students using a random-effects model (DerSimonian–Laird method). Each horizontal line represents an individual study with its corresponding 95% confidence interval, while the size of the square reflects the study weight. The diamond at the bottom of each section represents the pooled prevalence estimate. The analysis demonstrates a high burden of psychological distress, with pooled prevalence of 37.5% (95% CI: 34.0–41.0) for depression, 41.2% (95% CI: 37.5–45.0) for anxiety, and 47.0% (95% CI: 43.0–51.0) for stress. Significant heterogeneity was observed across studies ( $I^2 > 90\%$ ,  $p < 0.001$ ), indicating substantial variability in prevalence estimates across different populations and study settings.

## DISCUSSION

The present systematic review and meta-analysis highlights a substantial and pervasive burden of mental health disorders among medical students worldwide. The pooled estimates indicate that approximately one-third of medical students experience depression, over 40% report anxiety, and nearly half suffer from significant stress. These findings underscore that psychological distress is not an isolated or region-specific issue but rather a global phenomenon affecting medical education systems across diverse settings.

The observed prevalence of depression (37.5%) in this study is higher than that reported in the general population of similar age groups, suggesting that medical training itself may act as a significant contributing factor [13]. Comparable findings were reported by Lisa S. Rotenstein et al., who identified a pooled prevalence of 27.2% for depression among medical students, indicating a rising trend over time [1,13]. This increase may reflect growing academic demands, evolving curricula, and heightened competition in medical education globally.

Similarly, the prevalence of anxiety (41.2%) observed in this analysis exceeds earlier estimates such as those reported by Tiffany T. Quek et al., who documented a prevalence of 33.8% [2,14]. Anxiety among medical students is often multifactorial, stemming from academic pressure, fear of failure, and uncertainty regarding future career prospects. Chronic anxiety not only affects academic performance but may also impair clinical competence and decision-making abilities, thereby influencing future patient care.

Stress emerged as the most prevalent psychological outcome, affecting nearly half of the study population. This finding is consistent with prior literature emphasizing the inherently stressful nature of medical training [3,4,15]. Factors such as long study hours, frequent examinations, sleep deprivation, and early exposure to patient suffering contribute significantly to elevated stress levels. Importantly, chronic stress may act as a precursor to more severe mental health conditions, including depression and burnout.

Subgroup analyses in this study revealed important demographic and contextual variations. Female medical students demonstrated higher prevalence rates of

depression and anxiety compared to males, aligning with existing literature that suggests greater vulnerability to internalizing disorders among women [5,16]. Possible explanations include biological susceptibility, sociocultural expectations, and differences in coping mechanisms.

Academic stage also played a significant role, with preclinical students exhibiting higher levels of stress and anxiety than those in clinical years. This may be attributed to the transition into a demanding academic environment, lack of coping strategies, and the pressure of adapting to new learning methodologies. In contrast, clinical students, although exposed to patient care responsibilities, may develop better coping mechanisms and resilience over time [15].

Geographical disparities were also evident, with higher prevalence rates observed in low- and middle-income countries (LMICs). These differences may be explained by limited mental health resources, higher student-to-faculty ratios, financial constraints, and sociocultural stigma associated with mental illness [4,17]. In contrast, institutions in high-income countries may offer more structured support systems, including counseling services and wellness programs.

The findings of this study also need to be interpreted in the context of the COVID-19 pandemic, which has further exacerbated mental health challenges among medical students. Disruptions in academic schedules, transition to online learning, reduced clinical exposure, and social isolation have collectively contributed to increased psychological distress [7,18]. Emerging evidence suggests that the pandemic has amplified pre-existing vulnerabilities, leading to higher rates of depression and anxiety.

From an educational perspective, these findings raise serious concerns regarding the sustainability of current medical training models. Persistent psychological distress among students may lead to burnout, reduced empathy, impaired professionalism, and even attrition from the medical profession [3,19]. Furthermore, untreated mental health conditions during training may persist into professional life, affecting both physician well-being and patient outcomes.

Addressing this crisis requires a multifaceted approach. Institutions must prioritize the integration of mental health support systems within medical curricula, including regular screening, accessible counseling services, and peer support programs. Additionally, curricular reforms aimed at reducing unnecessary academic burden and promoting work-life balance are essential. Efforts to reduce stigma and encourage help-seeking behavior should also be emphasized through awareness campaigns and policy-level interventions [6,20].

Despite its strengths, including a large sample size and global representation, this study has certain limitations. The high heterogeneity observed across studies may limit the generalizability of pooled estimates. Variations in assessment tools, cultural differences in reporting symptoms, and reliance on self-reported measures may have influenced the findings. Additionally, the presence of mild publication bias suggests that studies reporting higher prevalence rates may have been more likely to be published.

Overall, the present analysis reinforces the existence of a significant and growing mental health crisis in medical education. The consistently high prevalence of depression, anxiety, and stress across regions and subgroups highlights the urgent need for systemic changes to support the psychological well-being of medical students.

## CONCLUSION

This systematic review and meta-analysis demonstrates a consistently high and clinically significant prevalence of depression, anxiety, and stress among medical students worldwide. The findings confirm that psychological distress is a pervasive and escalating concern across diverse geographic regions, academic stages, and demographic groups. With nearly one-third of students experiencing depression, over 40% reporting anxiety, and almost half affected by stress, the burden extends beyond individual well-being and has implications for academic performance, professional development, and future patient care.

The persistence of these findings across heterogeneous study settings suggests that the current structure and demands of medical education play a central role in shaping student mental health outcomes. Without timely and structured interventions, this burden may translate into long-term consequences, including burnout, reduced clinical competence, and attrition from the medical workforce. Therefore, addressing mental health in medical education is not only a student welfare issue but also a critical component of healthcare system sustainability.

## Recommendations

Given the magnitude and global consistency of the findings, a multi-level and evidence-informed approach is essential to mitigate the mental health crisis among medical students.

At the institutional level, medical colleges and universities should establish comprehensive mental health support systems, including confidential counseling services, routine psychological screening, and early intervention programs. Integration of student wellness centers within campuses can facilitate timely access to care and reduce barriers related to stigma and confidentiality concerns. Faculty training programs should also be implemented to help educators recognize

early signs of distress and respond appropriately.

At the curricular level, reforms are needed to reduce excessive academic burden and promote a more balanced learning environment. This may include restructuring assessment systems, incorporating flexible learning schedules, and embedding mental health education and resilience training within the curriculum. Introducing modules on stress management, mindfulness, and coping strategies can empower students to better manage psychological challenges.

At the policy level, regulatory bodies and accreditation agencies should mandate the inclusion of student mental health frameworks within medical education standards. Policies should emphasize the importance of safe learning environments, anti-stigma initiatives, and protection of student confidentiality. National-level guidelines can help standardize mental health support across institutions, particularly in low- and middle-income countries where resources may be limited.

At the peer and community level, fostering a supportive academic culture is crucial. Peer mentorship programs, student support groups, and open discussions on mental health can help normalize help-seeking behavior and reduce isolation. Encouraging collaboration rather than competition within medical training environments may also alleviate psychological pressure.

At the research level, future studies should focus on longitudinal designs to better understand the progression of mental health disorders throughout medical training. There is also a need for standardized assessment tools and culturally sensitive methodologies to reduce heterogeneity and improve comparability across studies. Additionally, intervention-based research evaluating the effectiveness of institutional and curricular reforms is essential.

In conclusion, addressing the mental health crisis in medical education requires coordinated efforts across institutional, curricular, and policy domains. Proactive, sustained, and evidence-based strategies are imperative to safeguard the well-being of medical students and ensure the development of a resilient and competent healthcare workforce.

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