

The Impact of Fatigue on Academic Performance and Well Being in Undergraduate Medical Students: a Systematic Literature Review

Meilya Farika Indah¹, Evi Widowati¹, Yuni Wijayanti¹, and Mahmudah²

¹Department of Public Health, Faculty of Medicine, Universitas Negeri Semarang, Central Java, Indonesia

²Department of Public Health, Faculty of Public Health, University Islam Kalimantan MAB, South Kalimantan, Indonesia

Corresponding author: meilyafarika1@students.unnes.ac.id

Abstract. Medical education imposes exceptional cognitive, emotional, and physical demands that make medical students particularly vulnerable to fatigue and its detrimental consequences on learning and well-being. These factors contribute to fatigue, which may negatively affect both academic performance and psychological well-being. This systematic review aims to synthesize current evidence on the effects of fatigue on academic outcomes and well-being among medical students and to propose OHS-based recommendations to enhance student health and learning performance. A comprehensive literature search was conducted across four databases: PubMed, Scopus, EuropePMC, and OpenAlex. A total of 293 records were identified, with 149 screened after duplicate and irrelevant records were removed. Full-text assessment was performed on 121 articles, resulting in 34 studies. The PRISMA 2020 guidelines were followed to ensure methodological rigor. The review found consistent evidence that fatigue particularly mental and emotional exhaustion was associated with decreased academic performance, impaired concentration, and increased risk of burnout, anxiety, and depression. Several studies highlighted the lack of institutional support and coping strategies among students. Fatigue significantly affects both academic outcomes and psychological well-being in undergraduate medical students. A holistic, evidence-based strategy that connects educational innovation with psychological well-being is needed to address medical students' fatigue.

Keywords: fatigue, medical students, academic performance, well-being, burnout, systematic review, mental health, undergraduate education.

1 Introduction

Similar to hunger, thirst, and drowsiness, fatigue is a natural physiological defense mechanism to prevent the body further harm. In the business context, fatigue poses a serious challenge, as its effects can compromise individual performance and workplace safety, potentially leading to critical productivity losses. This issue is equally relevant in educational contexts, particularly in undergraduate medical education, where prolonged fatigue can impair learning outcomes and clinical decision-making. Medical education imposes exceptional cognitive, emotional, and physical demands that make medical students particularly vulnerable to fatigue and its detrimental consequences on learning and well-being [1]. Fatigue in medical students is not merely a temporary response to workload but a multidimensional phenomenon encompassing cognitive exhaustion, emotional strain, and behavioral disengagement [2,3].

According to the World Health Organization (WHO) and the World Federation for Medical Education (WFME), promoting student well-being and resilience is an essential component of medical education quality, as the future physician's mental and physical health directly influence

patient safety and healthcare quality [4,5]. However, despite global attention to the importance of student welfare, fatigue remains pervasive in medical schools worldwide.

The combination of academic pressure, clinical responsibilities, and limited rest time renders medical students highly vulnerable to fatigue, chronic stress, and psychological well-being disturbances [6]. These demands frequently lead to fatigue, a multidimensional construct encompassing physical, mental, and emotional exhaustion that results from sustained academic and psychological stressors [7]. The effects of mental fatigue have led to occupational errors and motorway accidents. Mental fatigue can be detrimental and affects individuals of varying backgrounds and age, be it a working adult or a young teen in the university [7].

The digital transformation of medical education and the adoption of Competency-Based Medical Education (CBME) have reshaped how students learn and are assessed. CBME promotes outcome-based, learner-centered, and personalized training aimed at ensuring measurable competence [8]. However, its success depends on maintaining constructive alignment between teaching, learning, and assessment. When contextual factors such as academic workload, student well-being, and fatigue are overlooked, the effectiveness of CBME implementation may be undermined, adversely affecting both learning outcomes and mental health.

Research on systematic literature reviews (SLRs) concerning fatigue among university students has been conducted previously [9]. However, studies that specifically focus on medical students remain relatively limited. Most existing SLRs tend to emphasize burnout [10], which, although related to fatigue, represents a distinct condition. Fatigue may contribute to the development of burnout, yet each has different characteristics and implications within academic and clinical contexts. This systematic review aims to synthesize current evidence on the effects of fatigue on academic outcomes and well-being among medical students and to propose OHS-based recommendations to enhance student health and learning performance.

2 Methods

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines. The review protocol was registered in an institutional repository prior to data extraction.

A comprehensive literature search was conducted across four electronic databases: Scopus (n = 42), PubMed (n = 73), Europe PMC (n = 43), and Open Alex (n = 135) as well as relevant research registers (n = 293). The search included articles published up to May 2025, with no restriction on region.

Search terms were constructed using Boolean operators and Medical Subject Headings (MeSH): ((“Fatigue”[MeSH] OR fatigue OR tiredness OR exhaustion OR “mental fatigue”))AND (“Academic Performance”[MeSH] OR academic performance OR GPA OR exam score OR grade OR scholastic achievement) AND (medical students OR “undergraduate medical student” OR “medical undergraduates” OR “students, medical”[MeSH] OR “students, health occupations”[MeSH]) AND (wellbeing OR “well-being” OR “quality of life” OR “mental health” OR “psychological health” OR “psychological well-being”)

Duplicate records (n = 11) and irrelevant items (n = 133) were removed before screening.

Table 1. Eligibility Criteria Based on the PICOS Framework

Component	Description
Population (P)	Undergraduate medical students enrolled in MBBS, MD, or equivalent programs.
Intervention/Exposure (I)	Fatigue (mental, physical, or sleep-related), measured through validated scales (e.g., Chalder Fatigue Scale, Fatigue Severity Scale, or sleep quality indices).
Comparator (C)	Students with lower or no fatigue levels, or baseline comparison groups.
Outcomes (O)	Primary: Academic performance (grades, GPA, exam results). Secondary: Psychological well-being (stress, depression, anxiety, life satisfaction, quality of life).
Study Design (S)	Quantitative observational or interventional studies (cross-sectional, cohort, or experimental). Qualitative studies, reviews, and editorials were excluded.

A standardized data-extraction form was developed to record study characteristics, including: author, publication year, country, sample size, study design, population characteristics, fatigue assessment tool, outcome measures, and main findings.

Data were extracted independently by two reviewers and cross-checked for accuracy.

Study quality and risk of bias were evaluated using the **Joanna Briggs Institute (JBI) Critical Appraisal Checklist** appropriate to each study design.

Each criterion was scored as “Yes,” “No,” Studies scoring $\geq 70\%$ of applicable items were rated as high quality, 50–69 % as moderate, and $< 50\%$ as low quality.

Disagreements were resolved by discussion. Due to heterogeneity in study designs, fatigue assessment tools, and reported outcomes, a narrative synthesis approach was employed.

Findings were grouped thematically into two domains:

1. *Impact of fatigue on academic performance* and
2. *Impact of fatigue on psychological well-being.*

As this review used publicly available data, no ethical approval was required.

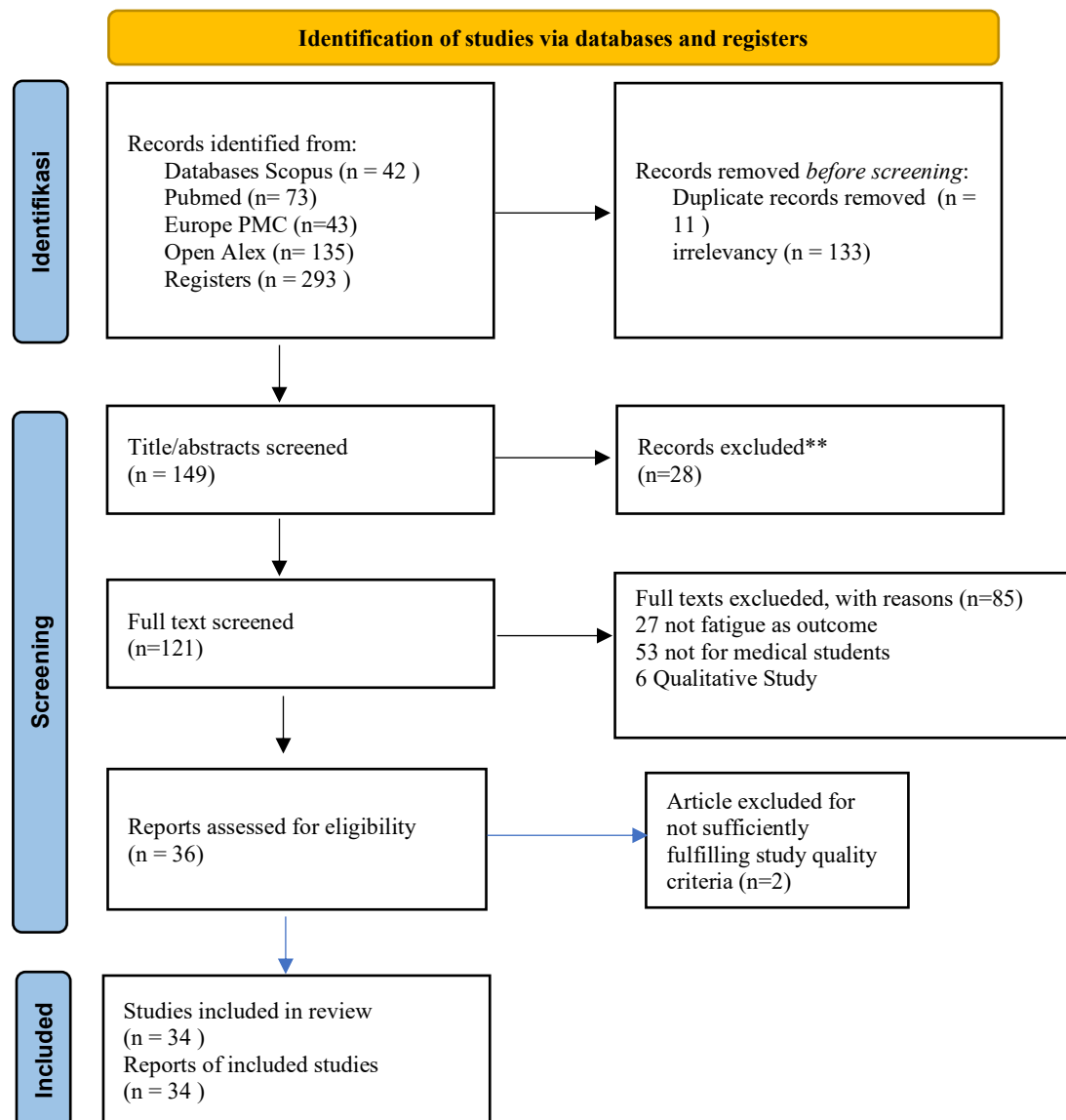


Fig. 1. Diagram of the Systematic Review

3 Results And Discussion

This systematic review followed the Preferred Reporting Items for Systematic Reviews (PRISMA 2020) guidelines. The review protocol was registered in an institutional repository prior to data extraction. A comprehensive literature search was conducted across four electronic databases Scopus (n = 42), PubMed (n = 73), Europe PMC (n = 43), and Open Alex (n = 135) — as well as relevant research registers (n = 293). The search included articles published up to May 2025, with no restriction on region or language.

Following the exclusion of 28 articles that did not meet inclusion criteria, 121 full texts were assessed for eligibility. A total of 85 full texts were excluded because: 27 did not assess fatigue as an outcome, 53 were not conducted in medical students, and 6 were qualitative studies. After quality appraisal, two additional articles were excluded for insufficient methodological rigor, leaving 36 studies included in the final synthesis (Figure 1). The 36 included studies, published between 2013 and 2025, covered a wide geographical distribution including Asia (n = 18), Europe (n = 8), North America (n = 5), and the Middle East or Africa (n = 5). Most studies were cross-sectional (n = 26), followed by longitudinal (n = 7) and interventional (n = 3) designs. Sample sizes ranged from 80 to 3,000 medical students, primarily in undergraduate programs. The most common instruments used to assess fatigue were: the Chalder Fatigue Scale (CFS), Fatigue Severity Scale (FSS), Pittsburgh Sleep Quality Index (PSQI), and Epworth Sleepiness Scale (ESS). Psychological outcomes were typically measured using the DASS-21, Beck Depression Inventory (BDI), Perceived Stress Scale (PSS), and WHO-5 Well-Being Index. Based on the Joanna Briggs Institute (JBI) critical appraisal checklist, 28 studies (82%) were rated as high quality, 4 studies (12%) as moderate quality, and 2 studies (6%) as low quality. Common limitations included small sample size, reliance on self-reported instruments, and cross-sectional design which limited causal inference.

3.1 Impact of Fatigue on Academic Performance

Across the reviewed studies, fatigue was consistently associated with decreased academic performance. Students reporting higher fatigue scores demonstrated lower GPA, poorer examination results, and reduced learning engagement [11–14]. Five longitudinal studies confirmed that persistent fatigue over the semester predicted declines in academic achievement and increased absenteeism [2,15]. One interventional study implementing a sleep-hygiene and workload management program showed a statistically significant improvement in GPA ($p < 0.05$) following reduced fatigue levels. Common contributing factors included insufficient sleep, extended study hours, and excessive curricular load, particularly during clinical rotations. According to Kunasegaran and colleagues, mental fatigue impairs executive functions such as attention, decision-making, and inhibition, which are crucial for learning, clinical judgment, and patient care. These cognitive declines mirror the mechanisms observed in high-pressure professions like surgeons and pilots, indicating that medical students experience similar neurocognitive overload due to prolonged study hours, clinical exposure, and emotional demands.

The increasing digitalization of medical education, accelerated by the COVID-19 pandemic, has intensified mental workload through continuous online engagement, constant screen exposure, and diminished social support [16,17,18]. These factors heighten the risk of digital fatigue—a subtype of mental fatigue characterized by attentional depletion and emotional exhaustion from digital learning environments. When unaddressed, chronic fatigue contributes to burnout, anxiety, and depression, impairing both academic performance and professional development [19, 20]. Studies in Asia and the Middle East further reveal that inadequate sleep and academic overload significantly predict poor academic outcomes and reduced well-being among medical students [21].

3.2 Impact of Fatigue on Psychological Well-Being

Fatigue showed a strong positive correlation with stress, depression, and anxiety in nearly all included studies ($r = 0.40–0.70$). Students with high fatigue levels were more likely to experience

emotional exhaustion, decreased self-efficacy, and lower satisfaction with life [22]. Several studies identified sleep deprivation and circadian disruption as mediators between fatigue and poor mental health outcomes. Moreover, gender differences were evident: female students exhibited higher fatigue and stress levels compared to males ($p < 0.01$)(23). A subset of studies linked chronic fatigue to reduced empathy and professional engagement, indicating early manifestations of burnout [24].

4. Conclusion

This comprehensive review about undergraduate medical students worldwide suffer from fatigue, a widespread and complex issue. Physical, cognitive, and emotional exhaustion have been consistently linked to poorer psychological well-being, decreased academic performance, and diminished focus, according to the reviewed studies. In addition to lowering motivation and learning effectiveness, chronic fatigue raises the risk of burnout, anxiety, despair, and impaired empathy, all of which can danger future clinical competency and the standard of patient care.

A holistic, evidence-based strategy that connects educational innovation with psychological well-being is needed to address medical students' fatigue. Institutions can foster academic success as well as resilient, humanistic future doctors by integrating wellness and fatigue avoidance techniques into the curriculum of contemporary medical education.

Table 2. Characteristics and Main Findings of Studies Examining Fatigue and Related Outcomes Among Medical Students

No.	Title	Last Name First Author & Year	Research Location	Research Design	Research Objective	Research Population / Subjects	Research Instrument	Main Outcome
1	High prevalence and risk factors of dropout intention among Chinese medical postgraduates	Peng, 2022	China (multi-site universities & hospitals)	Cross-sectional online survey	Compare prevalence of dropout intention and mental distress between medical vs. non-medical postgraduates; identify risk factors among medical postgrads	n=1,410 postgraduates (740 medical; 670 non-medical)	Online questionnaire: PHQ-9, GAD-7, PHQ-15, AUDIT-C, ESS, PSS; QOL & fatigue scales; MBI single-item burnout; healthcare-environment satisfaction	Medical postgrads had higher dropout intention (58.4% vs 48.4%). Independent factors: dissatisfaction with healthcare environment (OR 1.65), career-choice regret (OR 6.23), high perceived stress (OR 2.74).
2	Gender Disparities in Symptoms of Depression After Medical School Exams and Student Coping Strategies for Postexam Depression Symptoms	Arabatzis, 2022	USA (University of New England College of Osteopathic Medicine, ME)	Anonymous cross-sectional survey (REDCap) sent after exams across 2 consecutive exam periods	Determine gender differences in number of DSM-5 MDD symptoms after exams and describe coping strategies used	n=169/550 respondents (30.7%); 49 first-year, 42 second-year, 78 third-year; 103 female, 66 male	Author-designed questionnaire (DSM-5 MDD symptom items & coping checklist); SPSS (χ^2)	Females reported more post-exam depressive symptoms; five students (all female; 4.9% of females) met DSM-5 MDD criteria (>2 weeks). Top coping: social support, physical activity, hobbies; 90.2% felt coping helped.
3	Association of scopophobia with online learning fatigue among medical students in Brazil	Alencar, 2023	Brazil (multiple medical schools)	Cross-sectional, quantitative (online survey)	Assess association between scopophobia and online learning fatigue during COVID-19	n=283 medical students (median age 23; 64% female)	Custom scopophobia items + Zoom Exhaustion & Fatigue Scale (ZEF, 15 items, 5 domains); Google Forms; SPSS χ^2 & logistic regression	14.5% high risk of scopophobia; higher risk among females, lower income, living alone. Total ZEF and overall/visual/emotional domains associated; each ZEF point $\uparrow$ risk by 3%; overall domain 19%.

4	Association between impulsivity and cognitive capacity decrease is mediated by smartphone addiction, academic procrastination, bedtime procrastination, sleep insufficiency and daytime fatigue among medical students: a path analysis	Hamvai, 2023	Hungary (University of Szeged, international program)	Cross-sectional online survey with CFA & path analysis (AMOS)	Test impulsivity subtraits' direct & indirect effects (via smartphone addiction → procrastination → sleep insufficiency → fatigue) on cognitive capacity decrease	n=211 medical students (mean age 22.15±3.47; 71.6% women)	ABIS, BPS, SAS-SV, APS-SF; weekly sleep insufficiency, fatigue, subjective cognitive capacity decrease	Attentional impulsivity ↑ cognitive capacity decrease ($\beta=0.33$, $p<.001$); non-planning ↓ it ($\beta=-0.19$, $p<.01$). Significant indirect effects through smartphone addiction → academic procrastination → bedtime procrastination → sleep insufficiency → fatigue. Sleep insufficiency strongly predicted fatigue ($\beta=0.62$) and cognitive capacity decrease ($\beta=0.27$). Fatigue also predicted cognitive capacity decrease ($\beta=0.27$).
5	Fatigue and the psychological characteristics of medical students	Walkiewicz, 2023	Poland (Medical University of Gdańsk)	Cross-sectional quantitative study	Examine links between fatigue and EI, sense of coherence, QoL, stress, satisfaction with studying medicine	n=566 second-year medical students (60% female)	Chalder Fatigue Scale; Schutte Self Report EI Test; SoC-29; author-designed QoL/stress/satisfaction items	Fatigue ↓ with EI (using emotions), SoC-comprehensibility, QoL, satisfaction; ↑ with EI (recognising emotions) and stress. Regression ($R^2=0.28$): low SoC-comprehensibility, low EI-using, high stress, low QoL predict higher fatigue; no gender difference.

6	Psychological impact and coping mechanisms among Sudanese medical students: a study on anxiety, depression, behavioral, and cognitive changes post COVID-19 lockdown and ongoing conflict	Saeed, 2025	Sudan (Khartoum State; multiple universities)	Descriptive cross-sectional online survey (stratified sampling); Apr 1–May 30, 2024; SPSS 27; χ^2 & Pearson correlation	Assess anxiety & depression, behavioral/cognitive changes, and coping strategies among medical students during ongoing conflict and post-COVID-19; examine associations with psychological distress	n=393 medical students (67.7% female; mostly age 20–22; various faculties/years)	Online questionnaire: demographics; PHQ-4; validated 10-item Indicators of Change scale ($\alpha=0.74$); coping strategies checklist	94.7% had psychological distress (PHQ-4 mild–severe); 71.0% anxiety-positive; 64.1% depression-positive. 96.9% fatigue/low energy; 78.5% sleep problems; 74.2% reported >5 changes. Pharmacological coping common (nicotine 45%, sleeping aids 41.7%); non-pharmacological: exercise 54.5%, socializing 50.9%. Distress level associated with coping choice ($\chi^2=18.42$, $p<0.001$) and difficulty obtaining medications ($p<0.001$).
7	Fatigue Syndrome among Medical Students in Saudi Arabia: A Cross-Sectional Study on Depression and Anxiety	Alkhamees, 2025	Saudi Arabia (nationwide medical colleges)	Observational cross-sectional study (Feb–Jul 2023) using online survey	Determine prevalence of fatigue syndrome (FS) and its association with depression and anxiety among Saudi medical students	n = 740 medical students (69.7% female; majority aged 18–24; 92.8% Saudi)	Pretested questionnaire: Sociodemographic data, 11-item Chalder Fatigue Questionnaire (CFQ), 9-item PHQ-9, and GAD-7; distributed via Google Forms	FS prevalence = 56.4%; higher in females (69.7%)

8	Zoom fatigue related to online learning among medical students in Thailand: Prevalence, predictors, and association with depression	Charoenporn, 2024	Thailand (Thammasat University)	Cross-sectional online survey (Jan–Jul 2022)	Assess prevalence of Zoom fatigue, identify associated factors, and explore its correlation with depression among Thai medical students during COVID-19	n = 386 medical students (57.3% female; mean age 20.6; years 1–6)	Online questionnaire including demographics, Thai PHQ-9, and Thai version of Zoom Exhaustion & Fatigue Scale (ZEF-T)	Prevalence of Zoom fatigue: 9.6% very/extremely high, 36.3% moderate, 54.1% slight or none. Depression prevalence = 61.9%, significantly associated with Zoom fatigue ($p = 0.004$). Predictors of higher ZEF scores: lower academic year (coef -2.44 , $p < 0.001$), higher number of Zoom sessions per day (coef 2.72 , $p < 0.001$). Regular exercise was protective (coef -5.27 , $p = 0.009$).
9	<i>The role of self-compassion and compassion toward others in burnout syndrome in a sample of medical students</i>	Ramos-Vidal, I. & Ruiz, E. (2023)	Colombia (Universidad Pontificia Bolivariana, Caribbean region)	Quantitative, cross-sectional study using cluster and regression analyses	To determine the effects of self-compassion and compassion toward others on the dimensions of burnout (emotional exhaustion, depersonalization, personal accomplishment) among medical students	235 undergraduate medical students (61.7% women), aged 16–32 years, in 2nd and 5th years of study	Maslach Burnout Inventory (Colombian adaptation); Compassion for Self and Others Scale (Gilbert et al., 2017)	Identified three student profiles based on burnout: (1) low involvement, (2) positive adaptation, (3) high demand. Self-compassion showed a protective role, while compassion toward others increased emotional exhaustion and depersonalization.

10	<i>Sleep patterns and quality among Nigerian medical students: A cross-sectional study</i>	Aderinto, N. et al. (2024)	Nigeria (University of Ilorin, LAUTECH, UNIOSUN)	Cross-sectional observational study	To assess sleep patterns and quality among Nigerian medical students and explore associations with academic performance and lifestyle factors	802 undergraduate medical students (56.9% female) from 3 universities	Structured online questionnaire based on DSM-IV and PSQI	Mean sleep duration 5.74 h/night. 29.7% reported poor sleep quality. Irregular sleep, late-night caffeine, and stress correlated with poor academic performance.
11	<i>Emotional Intelligence, Perceived Stress, and Burnout in Undergraduate Medical Students: A Cross-Sectional Correlational Study</i>	Schumann, M. et al. (2025)	Egypt (Alexandria Faculty of Medicine)	Cross-sectional correlational study	To explore relationships between emotional intelligence, perceived stress, and burnout among medical students in a competency-based curriculum	264 undergraduate medical students (50.4% male)	Mind Tools Emotional Intelligence Test, Perceived Stress Scale, MBI-SS	30.3% met burnout criteria. Perceived stress strongly correlated with emotional exhaustion and depersonalization. Emotional intelligence related positively to personal accomplishment.
12	<i>Exploring the interplay of stress, fatigue, and empathy: The mediating role of cognitive flexibility in enhancing the well-being of university students in medical and social disciplines</i>	Rudnik, A. et al. (2025)	Poland (Medical University of Gdańsk & University of Gdańsk)	Cross-sectional quantitative study	To examine how cognitive flexibility mediates the relationship between stress, fatigue, and empathy among students	1,701 university students (81% female; 1,001 medical, 700 non-medical)	Perceived Stress Scale, Chalder Fatigue Questionnaire, Empathy Quotient, Cognitive Flexibility Inventory	Cognitive flexibility negatively correlated with stress and fatigue, and positively with empathy. It mediated the relationship between fatigue and empathy. Enhancing cognitive flexibility supports empathy and well-being.

13	<i>Prevalence and clinical characteristics of headache among medical students of Nepal: A cross-sectional study</i>	Bhattarai, A.M. et al. (2022)	Nepal (Nepalese Army Institute of Health Sciences, Kathmandu)	Cross-sectional study	To determine the prevalence, clinical features, and triggers of headache among medical students	242 undergraduate MBBS students (all years)	Semi-structured questionnaire based on International Headache Society criteria	26.9% reported headache disorders, mainly tension-type (69.2%) and migraine (21.5%). Stress/anxiety (75.4%) was the most common trigger. 63% reported interference with daily activities, and 53.9% used self-medication (NSAIDs). Headache significantly affected quality of life and study performance.
14	<i>Educational and Personal Opportunity Costs of Medical Student Preparation for the United States Medical Licensing Examination Step 1 Exam: A Single-Center Study</i>	Cortes-Penfield, 2020	University of Nebraska Medical Center (UNMC), Omaha, USA	Cross-sectional survey (single-center online)	To assess how much medical students disengage from curriculum and extracurricular activities to prepare for USMLE Step 1, and how that affects their well-being.	211 of 388 medical students who had taken USMLE Step 1 (response rate 54%).	Anonymous online questionnaire with multiple-choice & open-ended questions on demographics, skipped activities, and health effects; analyzed using SPSS v26.	79 % reported burnout, 61 % anxiety/depression, 31 % sought mental healthcare. Many skipped lectures (44 %) and research/community service (53 %, 39 %) to study. Step 1 prep viewed as both educationally useful and harmful to well-being.

15	<i>Association Between Ramadan Fasting, Sleep Disturbances, Fatigue, and Academic Performance Among Iraqi University Students: A Cross-Sectional Study</i>	Attash, 2025	Iraq (Universities of Mosul, Ninevah, Baghdad, and Al-Noor)	Cross-sectional web-based survey	To investigate effects of Ramadan fasting on sleep, fatigue, and academic performance among Iraqi medical students.	922 undergraduate medical students (65.8 % female; mean age 21.8 ± 3.4 years) from medicine, pharmacy, dentistry, and nursing programs.	Arabic Epworth Sleepiness Scale (ESS-AR), Arabic Fatigue Questionnaire (FQ-AR), and culturally adapted 6-item Academic Performance Scale; analyzed with SPSS v25 using non-parametric tests and logistic regression.	90.1 % reported fasting-related sleep disturbance. Fatigue (physical aOR = 0.72; mental aOR = 0.60) negatively associated with academic performance, while stress (aOR = 1.68) and sleep disturbance (aOR = 2.54) showed positive association—likely reflecting high-achiever coping patterns. Fasting significantly affected sleep and fatigue with mixed impacts on performance.
----	--	--------------	---	----------------------------------	---	---	--	--

16	<i>The Role of Self-Compassion and Compassion Toward Others in Burnout Syndrome in a Sample of Medical Students</i>	Ramos-Vidal, 2024	Universidad Pontificia Bolivariana, Montería, Colombia	Cross-sectional quantitative study using cluster and regression analysis	To determine the effects of self-compassion and compassion toward others on burnout dimensions (emotional exhaustion, depersonalization, and personal accomplishment) among medical students.	235 Colombian medical students (61.7 % women), aged 16–32 years ($M = 19.82 \pm 2.37$); participants from 2nd and 5th years of study.	Maslach Burnout Inventory (Colombian adaptation), and Compassion Scales by Gilbert et al. (2017) measuring self-compassion and compassion toward others. Data analyzed with K-means cluster analysis, Kruskal-Wallis tests, and regression modeling.	Identified three burnout profiles: (1) Low involvement – low depersonalization and low self-compassion; (2) Positive adaptation – high self-compassion, low depersonalization, high accomplishment; (3) High demand – medium-high exhaustion with high accomplishment. Self-compassion showed protective effects on personal accomplishment, while compassion toward others related to higher emotional exhaustion. Findings suggest differential effects of compassion types on burnout risk.
----	---	-------------------	--	--	---	---	--	--

17	<i>Stress, Anxiety, and Depression among a Cohort of Health Sciences Undergraduate Students: The Prevalence and Risk Factors</i>	Fauzi, 2021	Universiti Teknologi MARA (UiTM), Puncak Alam, Malaysia	Cross-sectional quantitative study	To determine the prevalence and risk factors associated with stress, anxiety, and depression (SAD) among health sciences undergraduates.	449 undergraduate students (90.1% female) from Medical Laboratory Sciences, Medical Imaging, and Nursing programs (mean age = 21.86 ± 1.76).	Self-administered sociodemographic questionnaire and Depression Anxiety Stress Scale-21 (DASS-21). Data analyzed using chi-square tests and logistic regression.	Prevalence: 65% stress, 85.1% anxiety, 51.4% depression. Anxiety was most common and moderate to severe in 74.6% of students. Fatigue and poor sleep quality were major predictors of anxiety and depression; frequent headaches and low-grade fever predicted stress and anxiety. Medical Imaging students had the highest levels of SAD. Findings highlight need for screening and intervention strategies to address psychological distress among health students.
----	--	-------------	---	------------------------------------	--	---	--	---

18	<i>Motivation to Impact: Medical Student Volunteerism in the COVID-19 Pandemic</i>	Phillips, 2022	Stony Brook University School of Medicine, New York, USA	Cross-sectional online survey	To examine medical student motivations for volunteering during the COVID-19 pandemic and assess how these motivations relate to physical, psychosocial, and emotional outcomes.	53 medical student volunteers (MS1–MS4 and MD/PhD students) from Stony Brook University; data drawn from 94 respondents across all class years.	Online survey including the Volunteer Functions Inventory (VFI, 30-item Likert scale) and self-reported Physical, Psychosocial, and Emotional Outcomes (PSEOs); analyzed using ANOVA, t-tests, and Spearman correlation via SPSS 27.	Altruistic and humanitarian (values-centric) motivation predicted positive outcomes such as increased emp
----	--	----------------	--	-------------------------------	---	---	--	---

19	<i>Burnout among Medical Students During the First Years of Undergraduate School: Prevalence and Associated Factors</i>	Boni, 2018	Barretos School of Health Sciences, Dr. Paulo Prata, São Paulo, Brazil	Cross-sectional quantitative study	To evaluate the prevalence and possible factors associated with burnout among medical students in the first years of undergraduate medical education.	265 medical students (from the first to fourth years) of a private medical school using active teaching methodologies (response rate 80.3%).	Sociodemographic questionnaire, Daily Life of Medical Students survey (school/personal/outside-school domains), and Maslach Burnout Inventory–Student Survey (MBI-SS, Portuguese version). Data analyzed using χ^2 test and multiple logistic regression.	Burnout prevalence was 44.9% (two-dimensional) and 26.4% (three-dimensional). First-year students showed the highest burnout rates. Poor self-perception of health, lack of optimism, low study motivation, and exhaustive study routines were key predictors. Positive health perception, optimism, and non-exhaustive routines were protective. Findings emphasize the need for early preventive measures targeting first-year medical students.
----	---	------------	--	------------------------------------	---	--	--	--

20	<i>The Relationships Between Mental Health and Social Media Addiction, and Between Academic Burnout and Social Media Addiction Among Chinese College Students: A Network Analysis</i>	Feng, 2025	Air Force Medical University, Shaanxi, China	Cross-sectional quantitative study using network analysis	To explore the interrelationships between social media addiction, mental health (anxiety, depression, stress), and academic burnout among Chinese college students using a network analysis framework.	431 undergraduate, master's, and doctoral students (139 males, 292 females; mean age = 27.3 ± 2.7 years) from Air Force Medical University.	Depression Anxiety and Stress Scale (DASS-21), Academic Burnout Inventory, and Bergen Social Media Addiction Scale (BSMAS); analyzed using Gaussian Graphical Model and LASSO-based network analysis in R.	“Depression” was identified as the most central factor linking social media addiction, academic burnout, and stress. Excessive social media use was positively associated with higher anxiety, depression, and academic burnout. The nodes “difficulty concentrating due to short video apps” and “feeling exhausted after academic work” acted as key bridge symptoms. Results highlight the need for interventions to reduce social media dependence and improve mental health and academic performance.
----	---	------------	--	---	--	---	--	--

21	<i>Factors Associated with Mental Distress among Undergraduate Students in Northern Tanzania</i>	Mboya, 2020	Kilimanjaro Christian Medical University College (KCMUCo), Moshi, Tanzania	Cross-sectional institutional-based study	To determine the prevalence and factors associated with mental distress among undergraduate students in northern Tanzania.	402 undergraduate students (mean age 24 ± 2.4 years; 60.4% male; 50.5% medical program).	Self-Reporting Questionnaire (SRQ-20) for mental distress, Social Support Questionnaire (SSQ), and structured demographic form. Data analyzed using STATA v15.1 with multivariable logistic regression.	13.9% of students screened positive for mental distress. Residing off-campus (OR = 0.44) and having social support (OR = 0.22) reduced odds of distress, while family history of mental illness (OR = 2.6) and decreased grades than anticipated (OR = 3.6) increased odds. Study highlights need for awareness, counseling, and social support to improve students' mental health and academic well-being.
----	--	-------------	--	---	--	--	---	---

22	<i>Burnout Prevalence and Associated Factors Among Brazilian Medical Students</i>	Barbosa, 2018	Centro Universitário de Anápolis (Unievangélica), Goiás, Brazil	Cross-sectional institutional-based study	To identify the prevalence and associated factors of burnout among Brazilian medical students.	399 medical students (mean age = 21 years; 55.6% female) from the first to eighth year of study.	Maslach Burnout Inventory–Student Survey (MBI-SS, Portuguese version) and socio-demographic questionnaire. Data analyzed with SPSS 20 using Pearson correlation and stepwise linear regression.	Overall burnout prevalence was 12%. Women (8%) and fifth-year students (27.1%) had higher rates. Emotional exhaustion was the most affected dimension (63.2%), showing a significant correlation with disbelief ($r = 0.51$, $p = 0.001$). Problem-Based Learning (PBL) methodology and proximity to family were suggested as protective factors. Preventive strategies should focus on female students and those in mid-course training years.
----	---	---------------	---	---	--	--	---	--

23	<i>Stress and Burnout in Chiropractic Students of European Chiropractic Colleges: A Cross-Sectional Study</i>	Perelló Rank, 2021	Four European Chiropractic Colleges (Spain, UK, Denmark, France)	Cross-sectional quantitative study	To investigate stress and burnout levels among students from European chiropractic colleges and compare results with other health science students.	121 chiropractic students from 4 European colleges (C1–C4), ages 18–64, 62% female.	Maslach Burnout Inventory–Student Survey (MBI-SS) and Perceived Stress Scale (PSS-10); analyzed with SPSS 23 using t-test, ANOVA, and Pearson correlation.	26.4% reported high emotional exhaustion, 18.2% high cynicism, and 43.8% low academic efficacy. Mean perceived stress score = 17.3 (moderate stress). Female students and non-working students showed higher stress. Burnout and stress levels were comparable to medical students, indicating the need for institutional support to improve student well-being and academic resilience.
----	---	--------------------	--	------------------------------------	---	---	--	--

24	<i>Risk and Protective Factors of Student Burnout among Medical Students: A Multivariate Analysis</i>	Kiss, 2025	University of Szeged, Hungary	Cross-sectional quantitative study using multivariate and logistic regression analysis	To explore the role of depression, anxiety, academic motivation, and resilience as risk and protective factors influencing student burnout among Hungarian medical students.	214 medical students (73.8% female; mean age 21.82 ± 2.63 years) from preclinical and clinical years.	Maslach Burnout Inventory–Student Survey (MBI-SS), Beck Depression Inventory–Short Form, Spielberger State-Trait Anxiety Inventory, Academic Motivation Scale, and Academic Resilience Scale. Data analyzed using SPSS 25 (MANOVA and logistic regression).	65% of students showed moderate to high emotional exhaustion and 61.7% moderate/high cynicism; depression, anxiety, and amotivation predicted higher burnout, while intrinsic motivation (achievement and stimulation) acted as protective factors. Clinical-year students experienced significantly higher burnout. Findings underscore the need to strengthen motivation and resilience to prevent academic burnout.
25	<i>Brain Fog: Impact on Mental Health and Academic Performance Among Medical Students</i>	Tanveer, E. (2025)	Karachi, Pakistan	Cross-sectional study	To examine the correlation between brain fog and its impact on students' mental health and academic performance.	345 undergraduate medical students aged 18–25 years from MBBS, DPT, and BDS programs.	Brain Fog Scale (BFS), General Health Questionnaire (GHQ-12), Academic Performance Scale (APS).	79.1% had moderate-to-severe brain fog; significant association with psychological distress and reduced academic performance. Highlights need for cognitive and mental well-being interventions.

26	<i>Measuring the Effects of Sleep Quality and Psychological Distress on Medical Students' Academic Performance at Imam Muhammad Bin Saud Islamic University, Riyadh, Saudi Arabia</i>	Alshammri, M. (2025)	Riyadh, Saudi Arabia	Cross-sectional study	To measure the effects of sleep quality and psychological distress on medical students' academic performance.	101 medical students (38 males, 63 females), aged 18–25.	Pittsburgh Sleep Quality Index (PSQI), Kessler 10 (K10).	76.2% slept after midnight; earlier sleep time correlated with higher GPA ($p=0.031$). Fatigue and anxiety common but not statistically linked to GPA. Emphasizes sleep hygiene and stress management.
27	<i>Determining Major Stressors for Students at a Private Medical College in Lahore, Pakistan, Using MSSQ</i>	Zaidi, S.H.R. (2021)	Lahore, Pakistan	Descriptive cross-sectional study	To determine the major stressors faced by medical students.	346 MBBS students (1st–3rd year) from University College of Medicine and Dentistry.	Medical Student Stressor Questionnaire (MSSQ).	Academic and teaching-learning stressors were dominant. Female and 2nd-year students had higher stress. Urges creation of supportive learning environments.
28	<i>Emotional Burnout Syndrome in Medical Students: Challenges Amidst the War</i>	Fedchyshyn, N.O. (2024)	Ternopil, Ukraine	Cross-sectional survey study	To determine the impact of emotional burnout syndrome on medical students during wartime.	180 medical students (aged 17–19) from Ivan Horbachevsky Ternopil National Medical University.	Self-administered burnout questionnaire.	38% had high burnout, 19% very high; females more affected. Symptoms: fatigue, insomnia, anxiety, apathy. Only 6.3% sought help; highlights need for preventive support systems.

29	<i>A Cross-Sectional Survey Assessing Mental Health, Fatigue and Sleep Among Male Medical Students in Western Saudi Arabia During and After Examination Periods</i>	Khan, W.A. (2025)	Mecca, Saudi Arabia	Cross-sectional survey	To assess mental health, fatigue, and sleep during and after exam periods.	109 male medical students from Umm Al-Qura University.	DASS-21, Epworth Sleepiness Scale (ESS), Fatigue Severity Scale (FSS), Insomnia Severity Index (ISI).	Depression and anxiety rose significantly during exams ($p<0.001$). Sleep time decreased; fatigue and insomnia increased. Highlights need for sleep and stress management programs.
30	<i>A Cross-Sectional Study on the Prevalence of Nomophobia and Its Impacts on Quality of Life Among Medical Students in Shimoga, Karnataka</i>	Aseeba, O.P.K. (2024)	Shimoga, Karnataka, India	Cross-sectional study	To estimate prevalence of nomophobia and its impact on quality of life among medical students.	250 medical students (equal male–female) from Shimoga Institute of Medical Sciences.	Nomophobia Questionnaire (NMP-Q), SF-36 Quality of Life Questionnaire.	69.6% had moderate nomophobia; negatively correlated with emotional well-being ($r=-0.316$), fatigue ($r=-0.296$), and social functioning ($r=-0.263$).
31	<i>Mental Health and Chronic Fatigue Syndrome: Is Mental Health the Culprit Behind Your Fatigue?</i>	Raza, T. (2020)	Lahore, Pakistan	Cross-sectional descriptive study	To determine the relationship between mental health and chronic fatigue syndrome.	270 MBBS students from CMH Lahore Medical College (1st–5th year).	DASS-21, Chalder Fatigue Scale.	91.1% reported fatigue; strong association with depression, anxiety, and stress ($p<0.001$). Females more affected. Suggests mental distress as major fatigue factor.

32	<i>Hubungan Kualitas Tidur dengan Subjective Well-Being pada Mahasiswa Kedokteran dalam Menghadapi Pembelajaran Tatap Muka di Bandar Lampung</i>	Fauziah, S.A. (2023)	Bandar Lampung, Indonesia	Quantitative analytic cross-sectional study	To determine the relationship between sleep quality and subjective well-being among medical students.	139 medical students from Universitas Malahayati & Universitas Lampung.	Pittsburgh Sleep Quality Index (PSQI), SWLS, PANAS.	59.7% had moderate sleep quality; 67.6% had moderate subjective well-being. Positive correlation between sleep quality and well-being ($r=0.404$, $p=0.000$).
33	<i>The Role of Resilience as an Emotional Protective Factor to Mental Fatigue During the COVID-19 Lockdown: The Experience of Undergraduate Medical Students in Oman</i>	Simon, M.A. (2023)	Sohar, Oman	Cross-sectional online survey	To assess prevalence of mental fatigue and role of resilience as protective factor during lockdown.	169 undergraduate medical students from COMHS, Oman.	Mental Fatigue Scale (MFS), Brief Resilience Scale (BRS).	Mild mental fatigue (MFS mean=11.59); normal resilience (mean=3.02). Significant negative correlation between resilience and fatigue ($r=-0.369$, $p<0.01$). Gender moderately predicted fatigue.
34	<i>Personality Traits and Quality of Life Among Lebanese Medical Students: Any Mediating Effect of Emotional Intelligence? A Path Analysis Approach</i>	Maalouf, E. (2022)	Lebanon	Descriptive cross-sectional study	To investigate whether emotional intelligence mediates between personality traits and quality of life.	293 medical students (43.9% male) from 7 Lebanese medical faculties.	Big Five Personality Test, Quick EI Self-Assessment, WHO-5 Well-Being Index.	EI mediated link between conscientiousness–QOL ($\beta=0.17$, $p=0.037$) and openness–QOL ($\beta=0.30$, $p=0.04$). EI explained 42.9% and 31.6% of associations, respectively.

Table 3. Methodological Quality Assessment and Risk of Bias of Included Studies Using the JBI Critical Appraisal Checklist

No	Author Name	Title	JBI Critical Appraisal Checklist								bias value	Bias risk
			Inclusion criteria clearly described	Subjects and setting described in detail	Exposure measurement valid and reliable	Standard and objective criteria used to measure the condition	Confounding factors identified	Strategies to deal with confounding factors described	Outcome measurement valid and reliable	Appropriate statistical analysis used		
1	Cortes-Penfield N.W., Khazanchi R., Talmon G. (2020)	<i>Educational and Personal Opportunity Costs of Medical Student Preparation for the USMLE Step 1 Exam: A Single-Center Study</i>	✓ Yes	✓ Yes	✗ Tidak	✗ Tidak	✓ Yes	✗ Tidak	✗ Tidak	✓ Yes	4/8 (50%)	High
2	Rudnik A., Sobczak K., Sawicki A., Zdun-Ryżewska A. (2025)	<i>Exploring the Interplay of Stress, Fatigue, and Empathy: The Mediating Role of Cognitive Flexibility in Enhancing the Well-being of University Students in Medical and Social Disciplines</i>	✓ Yes	✓ Ya	✓ Ya	✓ Ya	✓ Ya	✗ Tidak	✓ Yes	✓ Yes	7/8 (87.5%)	low

3	Attash H.M., Dawood O.T., Aladul M.I., Essa N.S. (2025)	<i>Association Between Ramadan Fasting, Sleep Disturbances, Fatigue, and Academic Performance Among Iraqi University Students: A Cross- Sectional Study</i>	✓ Yes	✓ Ya	✓ Ya	✓ Ya	✓ Ya	✓ Ya	✓ Yes	✓ Yes	7/8 (87.5%)	low
4	Ramos-Vidal I., Ruíz E. (2024)	<i>The Role of Self- Compassion and Compassion Toward Others in Burnout Syndrome in a Sample of Medical Students</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low
5	Fauzi M.F., Anuar T.S., Teh L.K., Lim W.F., James R.J., Ahmad R., Mohamed M., Abu Bakar S.H., Yusof F.Z.M., Salleh M.Z. (2021)	<i>Stress, Anxiety and Depression among a Cohort of Health Sciences Undergraduate Students: The Prevalence and Risk Factors</i>	✓ Yes	✓ Ya	✓ Ya	✓ Ya	✓ Ya	✓ Ya	✓ Yes	✓ Yes	8/8 (100%)	low

6	Phillips H.E., Jennings R.B., Outhwaite I.R., Grosser S., Chandra M., Ende V., Post S.G. (2022)	<i>Motivation to Impact: Medical Student Volunteerism in the COVID-19 Pandemic</i>	✓ Yes	✓ Ya	✓ Ya	✓ Ya	✓ Ya	✗ Tidak	✓ Yes	✓ Yes	7/8 (87.5%)	low
7	Boni R.A.S., Paiva C.E., de Oliveira M.A., Lucchetti G., Fregnani J.H.T.G., Paiva B.S.R. (2018)	<i>Burnout Among Medical Students During the First Years of Undergraduate School: Prevalence and Associated Factors</i>	✓ Yes	✓ Ya	✓ Ya	✓ Ya	✓ Ya	✓ Ya	✓ Yes	✓ Yes	8/8 (100%)	low
8	Feng T., Wang B., Mi M., Ren L., Wu L., Wang H., Liu X., Wang X. (2025)	<i>The Relationships Between Mental Health and Social Media Addiction, and Between Academic Burnout and Social Media Addiction Among Chinese College Students: A Network Analysis</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low
9	Mboya I.B., John B., Kibopile E.S., Mhando L., George J., Ngocho J.S. (2020)	<i>Factors Associated with Mental Distress Among Undergraduate Students in Northern Tanzania</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low

10	Barbosa M.L., Ferreira B.L.R., Vargas T.N., da Silva G.M.N., Nardi A.E., Machado S., Caixeta L. (2018)	<i>Burnout Prevalence and Associated Factors Among Brazilian Medical Students</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low
11	Perelló Rank M., Pérez de la Ossa P. (2021)	<i>Stress and Burnout in Chiropractic Students of European Chiropractic Colleges: A Cross-Sectional Study</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low
12	Kiss H., Pikó B.F. (2025)	<i>Risk and Protective Factors of Student Burnout Among Medical Students: A Multivariate Analysis</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low
13	Arabatzis et al. (2022)	<i>“Gender Disparities in Symptoms of Depression After Medical School Exams and Student Coping Strategies for Postexam Depression Symptoms”</i>	✓ Yes	✓ Yes	✗ Tidak	✓ Yes	✓ Yes	✗ Tidak	✗ Tidak	✓ Yes	5/8 (62.5%)	Moderate

14	Hamvai et al. (2023)	“Association between impulsivity and cognitive capacity decrease is mediated by smartphone addiction, academic procrastination, bedtime procrastination, sleep insufficiency and daytime fatigue among medical students: a path analysis”	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low
15	Walkiewicz et al. (2023)	<i>Fatigue and Psychological Characteristics of Medical Students (Poland)</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ Tidak	✓ Yes	✓ Yes	7/8 (87.5%)	low
16	Saeed A.A., Al Zamel A.M., Abass A.A., Abdalh F.A., Ali H.E., Hassan N.M., Osman R.M., Mohammed T.A., Yousif A.O., Eisa L.B. (2025)	<i>Psychological impact and coping mechanisms among Sudanese medical students during COVID-19 lockdown and ongoing conflict</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low

17	Alkhamees et al. (2025)	<i>Fatigue Syndrome, Depression, and Anxiety in Medical Students (Saudi Arabia)</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low
18	Peng et al. (2022)	<i>“High prevalence and risk factors of dropout intention among Chinese medical postgraduates” Postgraduates</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low
19	Alencar et al. (2023)	<i>Association of Scopophobia with Online Learning Fatigue among Medical Students in Brazil</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low
20	Charoenporn V., Hanvivattanakul S., Jongmekwamsuk K., Lenavat R., Hanvivattanakul K., Charernboon T. (2024)	<i>Zoom fatigue related to online learning among medical students in Thailand: prevalence, predictors, and association with depression</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low

21	Ramos-Vidal & Ruíz (2023)	<i>The role of self-compassion and compassion toward others in burnout syndrome in medical students (Kolombia)</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low
22	Aderinto et al. (2024)	<i>Sleep patterns and quality among Nigerian medical students (Nigeria)</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	8/8 (100%)	low
23	Schumann et al. (2025)	<i>Emotional Intelligence, Perceived Stress, and Burnout in Undergraduate Medical Students (Mesir)</i>	✓ Yes	✓ Yes	✗ Tidak	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	7/8 (87,5%)	low
24	Bhattarai et al. (2022)	<i>Prevalence and clinical characteristics of headache among medical students (Nepal)</i>	✓ Yes	✓ Yes	✗ Tidak	✗ Tidak	✗ Tidak	✓ Yes	✓ Yes	✓ Yes	✓ Yes	5/8 (62,5%)	Moderate

25	Tanveer et al. (2025)	<i>Brain Fog: Impact on Mental Health and Academic Performance among Medical Students (Pakistan)</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ Tidak	✗ Tidak	✓ Yes	✓ Yes	6/8 (75%)	Moderate
26	Alshammri et al. (2025)	<i>Measuring the effects of sleep quality and psychological distress on medical students' academic performance (Saudi Arabia)</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ Tidak	✗ Tidak	✓ Yes	✓ Yes	6/8 (75%)	Moderate
27	Zaidi et al. (2021)	<i>Determining Major Stressors for Students at a Private Medical College in Lahore, Pakistan, Using MSSQ</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ Tidak	✓ Yes	✓ Yes	7/8 (87,5%)	low
28	Fedchyshyn et al. (2024)	<i>Emotional Burnout Syndrome in Medical Students: Challenges Amidst the War (Ukraine)</i>	✓ Yes	✓ Yes	✗ Tidak	✗ Tidak	✗ Tidak	✗ Tidak	✗ Tidak	✓ Yes	3/8 (37,5%)	High

29	Khan WA, Shah MN, Al-Ghamdi MA, Al-Zahrani AKM, Al-Khathami AM, Al-Hutairishi AM, Badri HM, Natto HA, Elamin MO, Milibari AA, Ekram R (2025)	<i>A Cross-Sectional Survey Assessing Mental Health, Fatigue and Sleep Among Male Medical Students in Western Saudi Arabia During and After Examination Periods</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ Tidak	✓ Yes	✓ Yes	7/8 (87,5%)	low
30	Aseeba O.P.K., Praveen Kumar N., Chandana M. (2024)	<i>A Cross-Sectional Study on the Prevalence of Nomophobia and Its Impacts on Quality of Life Among Medical Students in Shimoga, Karnataka</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ Tidak	✓ Yes	✓ Yes	7/8 (87,5%)	low
31	Raza T., Chaudhry M.A., Masud A., Ahmed M.G., Ahmed M., Amin B. (2020)	<i>Mental Health and Chronic Fatigue Syndrome: Is Mental Health the Culprit Behind Your Fatigue?</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ Tidak	✓ Yes	✓ Yes	7/8 (87,5%)	low

32	Simon M.A., Al Raisi A.I., Al Ashkhari F.A.B., Al Jahwari N.A.H., Elsheshtawy E. (2023)	<i>The Role of Resilience as an Emotional Protective Factor to Mental Fatigue During the COVID-19 Lockdown: The Experience of Undergraduate Medical Students in Oman</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ Tidak	✓ Yes	✓ Yes	7/8 (87,5%)	low
33	Maalouf et al. (2022)	<i>Personality Traits, Emotional Intelligence, and QoL in Medical Students (Lebanon)</i>	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ Tidak	✓ Yes	✓ Yes	7/8 (87.5%)	low
34	Fauziah et al. (2023)	“Hubungan Kualitas Tidur dengan Subjective Well-Being pada Mahasiswa Kedokteran dalam Menghadapi Pembelajaran Tatap Muka di Bandar Lampung”	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ Tidak	✓ Yes	✓ Yes	7/8 (87.5%)	low

References

1. Quek TTC, Tam WWS, Tran BX, Zhang M, Zhang Z, Ho CSH, et al. The global prevalence of anxiety among medical students: A meta-analysis. Vol. 16, *International Journal of Environmental Research and Public Health*. MDPI AG; 2019.
2. Hamvai C, Kiss H, Vörös H, Fitzpatrick KM, Vargha A, Pikó BF. Association between impulsivity and cognitive capacity decrease is mediated by smartphone addiction, academic procrastination, bedtime procrastination, sleep insufficiency and daytime fatigue among medical students: a path analysis. *BMC Med Educ*. 2023 Dec 1;23(1).
3. Alkhamees AA, Algubllan LA, Alsughier N, Alwashmi AH, Alamr DT, Alharbi AM, et al. Fatigue Syndrome among Medical Students in Saudi Arabia: A Cross-Sectional Study on Depression and Anxiety. *J Pharm Bioallied Sci*. 2024 Dec;16(Suppl 5):S4623–7.
4. WHO. Global Competency Framework for Universal Health Coverage.
5. WFME. BASIC MEDICAL EDUCATION WFME GLOBAL STANDARDS FOR QUALITY IMPROVEMENT The 2020 Revision www.wfme.org admin@wfme.org Basic Medical Education WFME Global Standards 2020 ©WFME 2 [Internet]. Available from: www.wfme.org
6. Rotenstein LS, Ramos MA, Torre M, Bradley Segal J, Peluso MJ, Guille C, et al. Prevalence of depression, depressive symptoms, and suicidal ideation among medical students a systematic review and meta-analysis. Vol. 316, *JAMA - Journal of the American Medical Association*. American Medical Association; 2016. p. 2214–36.
7. Kunasegaran K, Ismail AMH, Ramasamy S, Gnanou JV, Caszo BA, Chen PL. Understanding mental fatigue and its detection: a comparative analysis of assessments and tools. *PeerJ*. 2023;11.
8. Van Melle E, Frank JR, Holmboe ES, Dagnone D, Stockley D, Sherbino J. A Core Components Framework for Evaluating Implementation of Competency-Based Medical Education Programs. *Academic Medicine*. 2019 Jul 1;94(7):1002–9.
9. Rahmanian El Barusi A, Kurniawati F. Systematic Literature Review: A Study of Academic Burnout among Undergraduate Students in Universities. *International Journal of Science Education and Cultural Studies*. 2024 Jan 25;3(1):1–18.
10. Madigan DJ, Kim LE, Glandorf HL. Interventions to reduce burnout in students: A systematic review and meta-analysis. Vol. 39, *European Journal of Psychology of Education*. Springer Science and Business Media B.V.; 2024. p. 931–57.
11. Khan WA, N. Shah M, Al-Ghamdi MA, Al-Zahrani AKM, Al-Khathami AM, Al-Hutairishi AM, et al. A Cross-Sectional Survey Assessing Mental Health, Fatigue and Sleep Among Male Medical Students in Western Saudi Arabia During and After Examination Periods. *Journal of Pioneering Medical Sciences*. 2025 Feb 28;14(2):59–64.
12. Attash HM, Dawood OT, Aladul MI, Essa NS. Association between ramadan fasting, sleep disturbances, fatigue, and academic performance among Iraqi university students: A cross-sectional study. *BMC Public Health*. 2025 Dec 1;25(1):3105.
13. Bergmann C, Muth T, Loerbroks A. Medical students' perceptions of stress due to academic studies and its interrelationships with other domains of life: a qualitative study. *Med Educ Online*. 2019 Jan 1;24(1).
14. Prof. Erum Tanveer, Hamza Ahmed, Ullah ZK, Ullah SAA, Ullah MKJ, Ullah AH, et al. Brain Fog: Impact on Mental Health and Academic Performance Among Medical Students. *Physical Education, Health and Social Sciences* [Internet]. 2025 Aug 10;3(3):198–204. Available from: <https://journal-of-social-education.org/index.php/Jorunal/article/view/603>
15. Khan H, Ain-Ul-momina, Sarwar MZ. IMPACT OF PSYCHOLOGICAL HEALTH ON ACADEMIC PERFORMANCE OF MEDICAL STUDENTS. WHERE DO WE STAND? *Journal of University Medical and Dental College*. 2020 Jul 1;11(3):31–8.
16. Charoenporn V, Hanvivattanakul S, Jongmekwamsuk K, Lenavat R, Hanvivattanakul K, Charernboon T. Zoom fatigue related to online learning among medical students in Thailand: Prevalence, predictors, and association with depression. *F1000Res*. 2024 Jun 11;13:617.

17. O. P. K. A, N. PK, M. C. A cross-sectional study on the prevalence of nomophobia and its impacts on quality of life among medical students in Shimoga, Karnataka. *Int J Community Med Public Health*. 2024 Nov 29;11(12):4835–8.
18. Alencar MS, Kubrusly M, de Oliveira CMC, de Aquino BOA, Viana IN, Morais PI, et al. Association of scopophobia with online learning fatigue among medical students in Brazil. *BMC Med Educ*. 2023 Dec 1;23(1).
19. Ramos-Vidal I, Ruíz É. The role of self-compassion and compassion toward others in burnout syndrome in a sample of medical students. *Psych J*. 2024 Feb 1;13(1):113–23.
20. Fauzi MF, Anuar TS, Teh LK, Lim WF, James RJ, Ahmad R, et al. Stress, anxiety and depression among a cohort of health sciences undergraduate students: The prevalence and risk factors. *Int J Environ Res Public Health*. 2021 Mar 2;18(6):1–14.
21. Rudnik A, Sobczak K, Sawicki A, Zdun-Ryżewska A. Exploring the interplay of stress, fatigue, and empathy: The mediating role of cognitive flexibility in enhancing the well-being of university students in medical and social disciplines. *PLoS One*. 2025 Apr 1;20(4 April).
22. Maalouf E, Hallit S, Obeid S. Personality traits and quality of life among Lebanese medical students: any mediating effect of emotional intelligence? A path analysis approach. *BMC Psychol*. 2022 Dec 1;10(1).
23. Arabatzis TJ, Marsidi J, Ashraf M, Supino C, Smith R. Gender Disparities in Symptoms of Depression After Medical School Exams and Student Coping Strategies for Postexam Depression Symptoms. *J Med Educ Curric Dev*. 2022 Jan;9.
24. Fedchyshyn NO, Shulhai AH, Klishch HI, Sas LM. EMOTIONAL BURNOUT SYNDROME IN MEDICAL STUDENTS: CHALLENGES AMIDST THE WAR. *Медична освіта*. 2025 Feb 28;(4):82–7.