World Journal of Current Medical and Pharmaceutical Research
Content available at www.saap.org.in ISSN: 2582-0222

PREVALENCE AND DETERMINANTS OF BURNOUT AMONG UNDERGRADUATE MEDICAL STUDENTS IN A TERTIARY CARE TEACHING HOSPITAL: A CROSS-SECTIONAL STUDY

ATUL G. AGRAWAL[1*], KANWALJIT KAUR[2], MANISH KUMAR[3], RUTHIKA BASA[3], ANKITA AGRAWAL[3], JASMIN ROUT[4]

[1]*Professor and Head, Department of Community Medicine, Surabhi Institute of Medical Sciences, Siddipet, Telangana, India*
[2]*Professor, Department of Pathology, Maharaja Agrasen Kedarnath Medical College, Bahadurgarh, India*
[3]*Assistant Professor, Department of Community Medicine, Armed Forces Medical Services, India*
[3]*MBBS Final Year Part 2 student, Surabhi Institute of Medical Sciences, Siddipet, Telangana, India.*
[3]*Consultant Physiotherapist and Researcher, Shree Sathya Sai Sanjeevani Mother and Child Hospital, Yavatmal, Maharashtra, India*
[4]*MBBS Second Year Student, Surabhi Institute of Medical Sciences, Siddipet, Telangana, India.*

DOI: https://doi.org/10.37022/wjcmpr.v8i3.478

ARTICLE HISTORY
Received on: 11-08-2026
Revised on: 16-10-2026
Accepted on: 21-11-2026

Keywords: *Burnout; Medical students; Maslach Burnout Inventory – Student Survey; Sleep; Physical activity; Yoga*

Corresponding Author
Atul G. Agrawal
Professor and Head, Department of Community Medicine, Surabhi Institute of Medical Sciences, Siddipet, Telangana, India – 502375

ABSTRACT

Background: Burnout, characterised by emotional exhaustion, cynicism and reduced professional efficacy, is common among medical students and may affect wellbeing and learning. We estimated its prevalence and determinants among undergraduate medical students at a tertiary care teaching hospital.

Methods: In this cross-sectional study conducted in March 2026, 359 MBBS students from the first to the final year were analysed. Burnout was measured with the Maslach Burnout Inventory – Student Survey (MBI-SS) and defined as high emotional exhaustion and high cynicism. Socio-demographic, sleep, physical activity and yoga data were collected with a structured questionnaire. Associations were analysed with chi-square tests and multivariable logistic regression.

Results: of 400 students approached, 372 consented and 359 completed the questionnaire (response 89.8%). The prevalence of burnout was 31.2% (95% CI 26.6–36.2); high emotional exhaustion 47.6%, high cynicism 42.6% and low professional efficacy 35.4%. Burnout differed by year of study (20.8% to 46.8%; p = 0.002). In multivariable analysis, sleeping less than 6 hours (aOR 2.95, 95% CI 1.80–4.84) and being in the third year (aOR 3.42, 95% CI 1.72–6.81) were associated with higher odds of burnout, whereas regular physical activity or yoga was associated with lower odds (aOR 0.44, 95% CI 0.27–0.73).

Conclusions: Burnout was present in 31.2% of undergraduate medical students, and short sleep, third-year study and absence of regular physical activity or yoga were independently associated with it. These cross-sectional associations are not causal; attention to workload, sleep promotion and physical activity or yoga programmes is recommended.

This article is licensed under a Creative Commons Attribution-Non-commercial 4.0 International License.
Copyright © 2026 Author(s) retains the copyright of this article.

1. INTRODUCTION

Burnout is a syndrome of emotional exhaustion, cynicism (detachment) and a reduced sense of professional efficacy [1]. The World Health Organization describes burn-out in the International Classification of Diseases as an occupational phenomenon arising from chronic workplace stress that has not been successfully managed [2]. In students the construct is most often measured with the Maslach Burnout Inventory – Student Survey (MBI-SS), which was validated in university students across three countries [3,4].

Medical students face a heavy academic load, frequent assessment, clinical responsibility and contact with illness and death [5]. A meta-analysis of 24 studies estimated the pooled prevalence of burnout before residency at 44.2% (95% CI 33.4–55.0%), 6 and a later meta-analysis of 42 studies (26,824 students) gave 37.2% (95% CI 32.7–42.1%).7 A 2024 systematic review of 64 studies reported a range of 5.6% to 88%, with most studies cross-sectional and the Maslach inventory the most frequently used tool [8]. This range reflects differences in settings, instruments and definitions, so local estimates remain useful [9, 10]. Distress starts early: matriculating students already reported more

distress than their general-population peers [11], and US students reported more burnout than age-matched peers [12], a meta-analysis also reported depressive symptoms in 27.2% and suicidal ideation in 11.1% of medical students [13].

In India, a meta-analysis of undergraduate medical students reported pooled prevalence of 48% for depression, 54% for anxiety, 50% for stress and 21% for suicidal ideation [14], A nationally accessible online survey using the Oldenburg inventory reported exhaustion in 80% and disengagement in 86% of respondents [15], but a self-selected survey with a different instrument cannot be compared directly with MBI-SS estimates. Single-centre Indian studies using the MBI-SS differ widely: among 100 first-year students, burnout was found in 62% by a two-dimension and 30% by a three-dimension criterion [16], in a western Uttar Pradesh medical college (220 students), most students reported high academic burnout and low professional efficacy [17]. In eastern India, 36.8% of first-semester students had depressive symptoms within three months of joining [18]. Such heterogeneity is why institution-level data are needed.

Several modifiable factors may be relevant. A systematic review of 15 studies (10,500 medical students) found physical activity negatively associated with burnout, with signs of a dose–response pattern [19]. Sleep problems are common in medical students: a meta-analysis in the Middle East and North Africa found sleep disorders to be prevalent [20], a global meta-analysis reported poor sleep quality in about 40% and insufficient sleep duration in about 29% of medical students [21], and among 300 nursing and medical students in Peru, sleep hygiene knowledge and physical activity were both associated with sleep quality [22], Yoga interventions in medical and dental students are associated with lower stress and anxiety [23], a systematic review of yoga in healthcare workers found it effective for stress management but called for stronger studies [24], six weeks of supervised yoga improved sleep quality, heart rate variability and cognition in 50 medical students [25], and a meta-analysis in students reported lower anxiety and better heart rate variability [26], Mindfulness-based interventions reduced burnout symptoms in a meta-analysis of nine studies (810 students) [27], Social factors matter too: at Mahidol University a sense of belonging was weakly and inversely related to burnout ($r = -0.25$) [28]. Most of these studies measured stress, sleep or physiological outcomes rather than burnout, so the association of everyday habits with burnout in Indian medical students needs direct study.

We therefore aimed to estimate the prevalence of burnout among undergraduate medical students at a tertiary care teaching hospital and to identify socio-demographic and lifestyle factors independently associated with it.

2. METHODS

2.1 Study design, setting and study period

This was an institution-based cross-sectional study at a tertiary care teaching hospital (Surabhi Institute of Medical Sciences, Siddipet, Telangana, India), reported according to the STROBE statement [29]. The study was conducted over a period of one month, in March 2026. Institutional Ethics Committee approval was obtained on 22 February 2026, and data collection was carried out from 1 March 2026 to 31 March 2026.

2.2 Study population

All undergraduate MBBS students enrolled from the first year to the final year (Part II) were eligible. Students who gave written informed consent were included. Students with a previously diagnosed psychiatric illness before admission, those on long-term psychiatric medication, and those who declined consent were excluded.

2.3 Sample size and sampling

The sample size for a single proportion was calculated as $n = Z^2p\ (1 - p)/d^2$, where $Z = 1.96$ for 95% confidence, p is the expected prevalence and d is the absolute precision [30]. With $p = 30\%$ (close to the three-dimension estimate in Indian first-year students 16) and $d = 5\%$, $n = 323$; allowing for 10% non-response ($323 / 0.9$) gives a target of 359. Because all eligible students were invited (a census), the calculation served as a check that the available population could give acceptable precision. In total 400 students were approached, 372 consented and 359 completed questionnaires and were analysed (Figure 01). Because d enters the formula as a square, halving the allowed error from 10% to 5% roughly quadruples the required sample size, which is a particular constraint for small institutions.

2.4 Study instruments and variables

Data were collected with a self-administered, pre-tested, anonymous questionnaire in two parts. Part I recorded age, gender, year of study, residence, sleep duration, physical activity and yoga. Part 2 was the 15-item MBI-SS, [3,4], which scores each item from 0 (never) to 6 (every day). The MBI-SS comprises emotional exhaustion (5 items; score range 0–30), cynicism (4 items; 0–24) and professional efficacy (6 items; 0–36). Use of the MBI-SS requires a licence from the copyright holder (Mind Garden).

2.5 Definition of burnout

Subscale scores were categorised as high or low using cut-offs fixed before analysis. No single cut-off is universally accepted. The definition matters: in 511 Brazilian students the same instrument gave 44.8%, 37.0% and 31.1% burnout when one, two or three dimensions were required [31]. Here, overall burnout was defined as high emotional exhaustion and high cynicism, a two-dimension rule.

2.6 Data collection

Students were approached in classrooms after teaching hours, the purpose was explained, and consenting students completed the questionnaire on the spot without writing their names. Completed forms were placed in a sealed box to protect anonymity. Incomplete forms were excluded.

2.7 Statistical analysis

Data were entered in Microsoft Excel and analysed in Python (SciPy and statsmodels). Continuous variables are summarised as mean and standard deviation and categorical variables as numbers and percentages. Prevalence is reported with 95% Wilson confidence intervals [32], Associations between burnout and each factor were tested with the chi-square test. Variables with p less than 0.20 in the bivariate analysis were entered into a multivariable logistic regression, a screening threshold commonly used in purposeful variable selection [33], keeping at least ten burnout events per variable entered [34]. The ten-events rule is a guide rather than a law, and violations do not always bias estimates.35 Adjusted odds ratios (aOR) are reported with 95% confidence intervals, and fit was

assessed with the Hosmer–Lemeshow test [36]. A two-sided p less than 0.05 was considered significant.

2.8 Ethical considerations

The study protocol was approved by the Institutional Ethics Committee, Surabhi Institute of Medical Sciences (reference IEC/SIMS/2026/02, dated 22 February 2026). Participation was voluntary, written informed consent was obtained before questionnaire administration, and responses were anonymous.

3. RESULTS

3.1 Participants

of 400 students approached, 372 consented and 359 returned complete questionnaires (response 89.8%); all 359 were analysed (Figure 01). The mean age was 20.3 ± 1.7 years and 50.1% were female (Table 01).

Table 01: Characteristics of participants (n = 359)

Characteristic	Category	n	%
Age (years)	Mean ± SD	20.3 ± 1.7	—
Gender	Male	179	49.9
	Female	180	50.1
Year of study	1st MBBS	101	28.1
	2nd MBBS	95	26.5
	3rd MBBS (Part I)	79	22.0
	Final MBBS (Part II)	84	23.4
Residence	Hostel	214	59.6
	Day scholar	145	40.4
Average sleep	Less than 6 h/night	125	34.8
	6 h or more/night	234	65.2
Physical activity / yoga	Regular (≥3 sessions/week)	155	43.2
	Irregular / none	204	56.8

SD, standard deviation; MBBS, Bachelor of Medicine and Bachelor of Surgery.

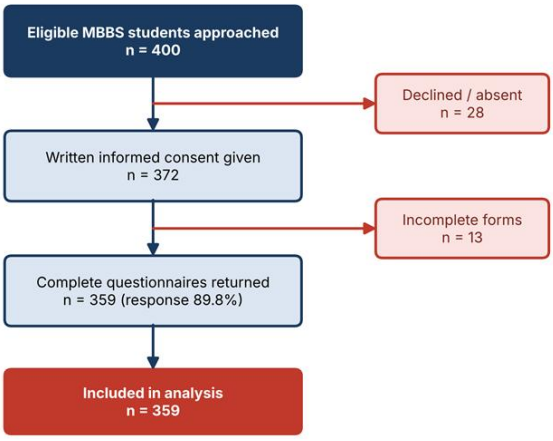

Figure 01: Flow of participants. of 400 eligible MBBS students approached, 28 declined or were absent and 13 returned incomplete forms; 359 questionnaires were analysed (response 89.8%).

3.2 Prevalence of burnout

Overall, 112 of 359 students (31.2%, 95% CI 26.6–36.2) met the definition of burnout (Table 02). High emotional exhaustion was the most frequent domain (47.6%, 95% CI 42.5–52.8), followed by high cynicism (42.6%, 95% CI 37.6–47.8) and low professional efficacy (35.4%, 95% CI 30.6–40.5).

Table 02: Prevalence of burnout and MBI-SS domains, overall and by year of study

Group	n	High exhaustion, % (95% CI)	High cynicism, % (95% CI)	Low efficacy, % (95% CI)	Overall burnout, % (95% CI)
Overall prevalence	359	47.6 (42.5–52.8)	42.6 (37.6–47.8)	35.4 (30.6–40.5)	31.2 (26.6–36.2)
1st MBBS	101	41.6	35.6	30.7	20.8
2nd MBBS	95	40.0	37.9	38.9	27.4
3rd MBBS (Part I)	79	59.5	57.0	34.2	46.8
Final MBBS (Part II)	84	52.4	42.9	38.1	33.3

MBI-SS, Maslach Burnout Inventory–Student Survey; CI, confidence interval (Wilson). Overall burnout was defined as high emotional exhaustion and high cynicism.

3.3 Burnout by year of study

By year of study, burnout prevalence rose from 20.8% in the first year to 27.4% in the second year and 46.8% in the third year, and was 33.3% in the final year (Table 2, Figure 2A). High exhaustion and high cynicism were also highest in the third year (59.5% and 57.0%).

3.4 Bivariate analysis

Factors associated with burnout in the bivariate analysis are in Table 3. Burnout was significantly associated with year of study ($p = 0.002$), sleep duration ($p < 0.001$) and physical activity or yoga ($p < 0.001$). Residence ($p = 0.774$) and gender ($p = 0.517$) were not associated with burnout. Burnout was found in 46.4% of students sleeping less than 6 hours and 23.1% of those sleeping 6 hours or more, and in 21.3% of regularly active students against 38.7% of those not regularly active. Combining the two lifestyle factors (descriptively; no interaction was tested), burnout was most frequent in students who slept less than 6 hours and were not regularly active (52.9%, 45/85), followed by short sleepers who were regularly active (32.5%, 13/40) and adequate sleepers who were not regularly active (28.6%, 34/119), and least frequent in adequate sleepers who were regularly active (17.4%, 20/115) (Figure 2B).

Table 03: Bivariate association of burnout with study factors

Factor	Category	Total, n	Burnout, n (%)	χ^2 (df)	p value
Year of study	1st MBBS	101	21 (20.8)	14.92 (3)	0.002
	2nd MBBS	95	26 (27.4)		
	3rd MBBS (Part I)	79	37 (46.8)		
	Final MBBS (Part II)	84	28 (33.3)		
Sleep	Less than	125	58 (46.4)	20.6	<0.00

	6 h			5 (1)	1
	6 h or more	234	54 (23.1)		
Physical activity / yoga	Regular	155	33 (21.3)	12.47 (1)	<0.001
	Irregular / none	204	79 (38.7)		
Residence	Hostel	214	68 (31.8)	0.08 (1)	0.774
	Day scholar	145	44 (30.3)		
Gender	Male	179	53 (29.6)	0.42 (1)	0.517
	Female	180	59 (32.8)		

Pearson chi-square without continuity correction; df, degrees of freedom. Values recalculated from the group counts.

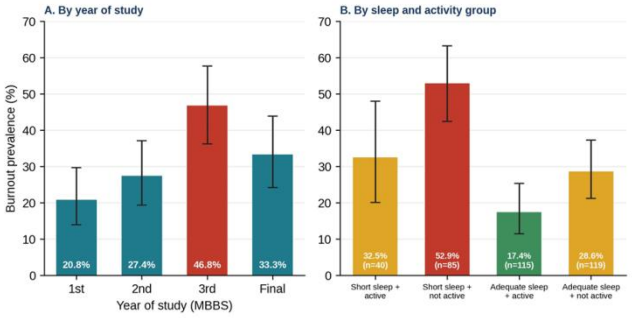

Figure 02: Burnout prevalence by year of study and by sleep and activity group. (A) Burnout prevalence by year of study with 95% Wilson confidence intervals. (B) Burnout prevalence by combined sleep and physical activity/yoga group (n shown in bars). The combination is descriptive; no interaction was tested.

3.5 Multivariable analysis

Year of study, sleep duration and physical activity or yoga ($p < 0.20$) were entered into the multivariable model (112 events; five model parameters, about 22 events per parameter). After adjustment (Table 04, Figure 03), sleeping less than 6 hours was associated with about three times the odds of burnout (aOR 2.95, 95% CI 1.80–4.84), and regular activity or yoga with lower odds (aOR 0.44, 95% CI 0.27–0.73). Compared with first-year students, odds were higher in the third year (aOR 3.42) and the final year (aOR 2.47); the second-year estimate was imprecise and its interval included 1 (aOR 1.66, 95% CI 0.83–3.31). The model fitted adequately (Hosmer–Lemeshow $\chi^2 = 9.28$, 8 df, $p = 0.32$).

Table 04: Multivariable logistic regression of factors associated with burnout

Variable	Adjusted OR	95% CI	p value
2nd MBBS (vs 1st MBBS)	1.66	0.83–3.31	0.150
3rd MBBS Part I (vs 1st MBBS)	3.42	1.72–6.81	<0.001
Final MBBS Part II (vs 1st MBBS)	2.47	1.22–4.98	0.012
Sleep less than 6 h (vs 6 h or more)	2.95	1.80–4.84	<0.001
Regular activity / yoga (vs irregular / none)	0.44	0.27–0.73	0.001

OR, odds ratio; CI, confidence interval. Reference categories: 1st MBBS, sleep 6 h or more, and irregular or no activity. Hosmer–Lemeshow p = 0.32.

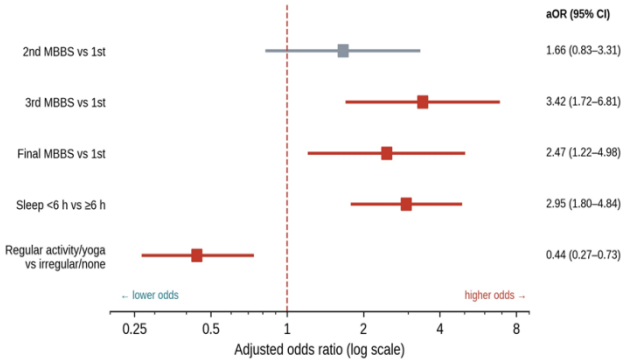

Figure 03: Forest plot of adjusted odds ratios. Squares indicate estimates, lines indicate 95% confidence intervals, and the vertical dashed reference line indicates no association (OR = 1).

4. DISCUSSION

In this study, 31.2% of students met the burnout definition, and short sleep, year of study and lack of regular physical activity or yoga were each independently associated with it. The estimate is lower than the pooled prevalence of 44.2% from a meta-analysis before residency [6], and the 37.2% from a larger later meta-analysis [7], and lies well within the reported range of 5.6% to 88% [8], Differences in instruments, cut-offs and definitions are a major reason why estimates differ, so comparison is meaningful only when definitions are comparable: a national Indian survey used the Oldenburg inventory [15], and a first-year study reported 62% or 30% depending on whether two or three dimensions were required [16].

Burnout prevalence was lowest in the first year (20.8%), highest in the third year (46.8%) and somewhat lower again in the final year (33.3%). The rise is consistent with accumulating academic and clinical load [5], yet a cross-sectional survey compares different students at one time and cannot show how individuals change. The fall in the final year should not be over-interpreted either, because the most affected students may respond differently.

Students sleeping less than 6 hours had about three times the adjusted odds of burnout. Cross-sectional data cannot show whether short sleep leads to burnout or burnout disrupts sleep, and both directions are plausible. Sleep disorders are prevalent among medical students in other regions [20], poor sleep is common worldwide [21], and sleep quality has been linked to both sleep hygiene knowledge and physical activity [22], which suggests that sleep, activity and burnout may be interconnected. A small yoga study improved sleep quality and heart rate variability [25], but that does not show that changing sleep changes burnout.

Regular physical activity or yoga was associated with lower odds of burnout (aOR 0.44). This agrees in direction with a systematic review that found physical activity negatively associated with burnout in medical students, with a weak-to-moderate effect size [19], but that review, like the present study, is largely observational. Evidence for yoga concerns stress, anxiety and physiological measures [23,26], not burnout itself. Students who are less burned out may simply have more energy to exercise (reverse causation), and unmeasured factors such as workload or social support may influence both; a sense of belonging, for example, was inversely related to burnout in a Thai study [28]. Residence ($p = 0.774$) and gender ($p = 0.517$) showed no association

here. Absence of evidence in one sample is not evidence of no difference, and the study may have been too small to detect modest effects. Earlier work reported higher stress and depression among female students [37], and a meta-analysis found older age and female sex to be significant predictors of burnout [7], so these comparisons remain worth reporting.

4.1 Strengths and limitations

Strengths of the design include a student-specific instrument that has been used across several countries, coverage of all four professional years, and adjustment for measured confounders. Limitations are the cross-sectional design (no causal inference), self-reported sleep and activity (recall and social desirability bias), a single institution (limited generalisability), the absence of universally accepted MBI-SS cut-offs, a two-dimension burnout definition that is not directly comparable with three-dimension studies, residual confounding because only three variables entered the model, and non-response (28 students declined or were absent, and 13 of 372 consenting students returned incomplete forms).

4.2 Implications

Institutions could consider accessible counselling, attention to sleep and workload in the third year, and opportunities for physical activity and yoga. Mindfulness-based programmes have reduced burnout symptoms in a meta-analysis of small studies [27], but these suggestions remain hypotheses; intervention trials are needed to show that any of them reduces burnout. Future work should use a multicentre design, validated cut-offs, objective or validated measures of sleep and activity, and longitudinal follow-up of the same students across the four professional years.

5. CONCLUSION

Burnout was present in 31.2% of undergraduate medical students, and short sleep, third-year study and absence of regular physical activity or yoga were independently associated with it. Because the design is cross-sectional, these are associations, not causes. The findings point to academic progression (particularly the third year), short sleep and physical inactivity as areas for attention; institutional strategies on workload management, sleep promotion and physical activity or yoga programmes are recommended and should be evaluated in longitudinal and interventional studies.

6. ABBREVIATIONS

aOR, adjusted odds ratio; CI, confidence interval; MBBS, Bachelor of Medicine and Bachelor of Surgery; MBI-SS, Maslach Burnout Inventory – Student Survey; OR, odds ratio; SD, standard deviation; STROBE, Strengthening the Reporting of Observational Studies in Epidemiology.

7. ACKNOWLEDGEMENTS

The authors thank all participating medical students for their cooperation and time during data collection.

8. FUNDING

None

9. CONFLICT OF INTEREST

None declared

10. ETHICAL APPROVAL

Ethical clearance for this study was granted by the Institutional Ethics Committee of Surabhi Institute of Medical Sciences (protocol reference IEC/SIMS/2026/02, dated 22 February 2026). Written informed consent was obtained from all participating students before questionnaire administration, and confidentiality and anonymity were maintained throughout the study.

11. DATA AVAILABILITY

The dataset generated and analysed during the current study is available from the corresponding author on reasonable request.

12. AUTHOR CONTRIBUTIONS

AGA: conceptualisation, methodology, formal analysis, supervision, writing – original draft. KK: critical review and editing of the manuscript. MK, RB, JR and AA: literature review, validation, visualisation, writing – review and editing. All authors approved the final manuscript.

13. REFERENCES

1. Maslach C, Leiter MP. Understanding the burnout experience: recent research and its implications for psychiatry. World Psychiatry. 2016;15(2):103–11.
2. World Health Organization. Burn-out an "occupational phenomenon": International Classification of Diseases. Geneva: WHO; 2019. Available at: https://www.who.int/news/item/28-05-2019-burn-out-an-occupational-phenomenon-international-classification-of-diseases. Accessed 12 October 2026.
3. Maslach C, Jackson SE, Leiter MP. Maslach Burnout Inventory Manual. 4th ed. Menlo Park, CA: Mind Garden; 2016.
4. Schaufeli WB, Martinez IM, Pinto AM, Salanova M, Bakker AB. Burnout and engagement in university students: a cross-national study. J Cross Cult Psychol. 2002;33(5):464–81.
5. Dyrbye LN, Thomas MR, Shanafelt TD. Medical student distress: causes, consequences, and proposed solutions. Mayo Clin Proc. 2005;80(12):1613–22.
6. Frajerman A, Morvan Y, Krebs MO, Gorwood P, Chaumette B. Burnout in medical students before residency: a systematic review and meta-analysis. Eur Psychiatry. 2019;55:36–42.
7. Almutairi H, Alsubaiei A, Abduljawad S, Alshatti A, Fekih-Romdhane F, Husni M, et al. Prevalence of burnout in medical students: a systematic review and meta-analysis. Int J Soc Psychiatry. 2022;68(6):1157–70. doi:10.1177/00207640221106691.
8. Di Vincenzo M, Arsenio E, Della Rocca B, Rosa A, Tretola L, Toricco R, et al. Is there a burnout epidemic among medical students? Results from a systematic review. Medicina (Kaunas). 2024;60(4):575. doi:10.3390/medicina60040575.
9. Erschens R, Keifenheim KE, Herrmann-Werner A, Loda T, Schwille-Kiuntke J, Bugaj TJ, et al. Professional burnout among medical students: systematic literature review and meta-analysis. Med Teach. 2019;41(2):172–83.
10. IsHak W, Nikravesh R, Lederer S, Perry R, Ogunyemi D, Bernstein C. Burnout in medical students: a systematic review. Clin Teach. 2013;10(4):242–5.

11. Brazeau CM, Shanafelt T, Durning SJ, Massie FS, Eacker A, Moutier C, et al. Distress among matriculating medical students relative to the general population. Acad Med. 2014;89(11):1520–5.
12. Dyrbye LN, West CP, Satele D, Boone S, Tan L, Sloan J, et al. Burnout among U.S. medical students, residents, and early career physicians relative to the general U.S. population. Acad Med. 2014;89(3):443–51.
13. Rotenstein LS, Ramos MA, Torre M, Segal JB, Peluso MJ, Guille C, et al. Prevalence of depression, depressive symptoms, and suicidal ideation among medical students: a systematic review and meta-analysis. JAMA. 2016;316(21):2214–36.
14. Kaur H, Gupta V, Garg A, Sangeeta, Padhi BK. Prevalence of depression, anxiety, stress and suicide ideation among undergraduate medical students in India: a systematic review and meta-analysis. Natl J Community Med. 2024;15(10). doi:10.55489/njcm.151020244529.
15. Philip S, Molodynski A, Barklie L, Bhugra D. Psychological well-being and burnout amongst medical students in India: a report from a nationally accessible survey. Middle East Curr Psychiatry. 2021;28:54.
16. Nebhinani N, Kuppili PP, Mamta. Stress, burnout, and coping among first-year medical undergraduates. J Neurosci Rural Pract. 2021;12(3):483–9.
17. Batra S, Bano T, Jain S, Singh G, Kumar S, Gautam NS. Academic burnout and coping: a questionnaire-based cross-sectional study among undergraduate students of a medical college in western Uttar Pradesh. Indian J Community Health. 2025;37(6):919–24. doi:10.47203/IJCH.2025.v37i06.007.
18. Sahoo S, et al. Perceived stress and coping skills in the newly joined medical undergraduate students: an exploratory study from Eastern India. J Ment Health Hum Behav. 2021.
19. Taylor CE, Scott EJ, Owen K. Physical activity, burnout and quality of life in medical students: a systematic review. Clin Teach. 2022;19(6):e13525. doi:10.1111/tct.13525.
20. Chaabane S, Chaabna K, Khawaja S, Aboughanem J, Mittal D, Mamtani R, et al. Sleep disorders and associated factors among medical students in the Middle East and North Africa: a systematic review and meta-analysis. Sci Rep. 2024.
21. Seoane HA, Moschetto L, Orliacq F, Orliacq J, Serrano EA, Cazenave MI, et al. Sleep disruption in medicine students and its relationship with impaired academic performance: a systematic review and meta-analysis. Sleep Med Rev. 2020;53.
22. Saintila J, Javier-Aliaga D, del Carmen Galvez-Diaz N, Barreto-Espinoza LA, Buenano-Cervera NA, Calizaya-Milla YE. Association of sleep hygiene knowledge and physical activity with sleep quality in nursing and medical students: a cross-sectional study. Front Sports Act Living. 2025;7:1453404.
23. Maity S, Abbaspour R, Bandelow S, Pahwa S, Jha AK, et al. The psychosomatic impact of yoga in medical education: a systematic review and meta-analysis. Med Educ Online. 2024;29(1):2364486. doi:10.1080/10872981.2024.2364486.
24. Cocchiara RA, Peruzzo M, Mannocci A, Ottolenghi L, Villari P, Polimeni A. The use of yoga to manage stress and burnout in healthcare workers: a systematic review. J Clin Med. 2019;8(3).
25. Mishra P, Singh A, Agarwal P, Mathur MK, Bhandari B. Modulation of sleep quality, cardiac autonomic activity, and cognition by yoga in medical students. Ann Natl Acad Med Sci (India). 2024;60:267–72.
26. Sharma S, Kaushik D, Saini S, Sharma H, Metri K. Effect of yoga-based interventions on heart rate variability and anxiety among students: a systematic review and meta-analysis. Ann Neurosci. 2025. doi:10.1177/09727531251394924.
27. Wang Z, Wu P, Hou Y, Guo J, Lin C. The effects of mindfulness-based interventions on alleviating academic burnout in medical students: a systematic review and meta-analysis. BMC Public Health. 2024;24:1414.
28. Puranitee P, Kaewpila W, Heeneman S, et al. Promoting a sense of belonging, engagement, and collegiality to reduce burnout: a mixed methods study among undergraduate medical students in a non-Western, Asian context. BMC Med Educ. 2022;22. doi:10.1186/s12909-022-03380-0.
29. von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007;370(9596):1453–7.
30. Naing L, Winn T, Rusli BN. Practical issues in calculating the sample size for prevalence studies. Arch Orofac Sci. 2006;1:9–14.
31. Vale TCB, Paiva JHHGL, et al. Factors behind burnout increase in medical students. Are the criteria so important? Rev Bras Educ Med. 2021;45(2).
32. Brown LD, Cai TT, DasGupta A. Interval estimation for a binomial proportion. Stat Sci. 2001;16(2):101–33.
33. Bursac Z, Gauss CH, Williams DK, Hosmer DW. Purposeful selection of variables in logistic regression. Source Code Biol Med. 2008;3:17.
34. Peduzzi P, Concato J, Kemper E, Holford TR, Feinstein AR. A simulation study of the number of events per variable in logistic regression analysis. J Clin Epidemiol. 1996;49(12):1373–9.
35. Vittinghoff E, McCulloch CE. Relaxing the rule of ten events per variable in logistic and Cox regression. Am J Epidemiol. 2007;165(6):710–8.
36. Hosmer DW, Lemeshow S, Sturdivant RX. Applied Logistic Regression. 3rd ed. Hoboken, NJ: Wiley; 2013.
37. Dahlin M, Joneborg N, Runeson B. Stress and depression among medical students: a cross-sectional study. Med Educ. 2005;39(6):594–604.