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Original Research Article

Health-Risking and Health-Promoting Behaviors among MBBS Students in a Medical College of Bengaluru Rural District: A Cross-Sectional Study

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ABSTRACT

Background: Non-communicable diseases (NCDs) present a significant global health burden, heavily driven by modifiable behavioral risk factors. Comprehensive data from rural medical colleges is still lacking, despite the fact that healthy habits among medical students enhance future patient counseling credibility and promote personal well-being. This study assessed the prevalence and socio-demographic factors associated with health-risking and health-promoting behaviors among MBBS students in a rural district of Karnataka, India.
Methods: A cross-sectional study was conducted between June and December 2025 at a Medical College and Research Hospital, Bengaluru rural district. A pretested, self-administered questionnaire was completed by 429 MBBS students spanning all academic phases. Composite scores were calculated to evaluate health-risking behaviors (e.g., substance use, skipping meals, and caffeine intake) and health-promoting behaviors (e.g., physical activity, adequate sleep, balanced diet).
Results: Most students (64.1%) failed to meet the recommended ≥150 minutes of weekly moderate-intensity physical activity, and 50.8% slept <7 hours per night. Conversely, 43.6% reported skipping meals due to academic stress and 74.4% consumed caffeine. Tobacco (6.8%) and alcohol use (3.5%) were relatively low. Multiple health-risking behaviors were associated with older age (23-26 years; p=0.001) and advanced academic years (MBBS Phase 3 Part 1 and interns; p=0.002). Good health-promoting behaviors were associated with students residing at home compared to hostellers or paying guests (p=0.022).
Conclusions: Medical students at this rural institution exhibit a high burden of health-risking behaviors alongside insufficient health-promoting practices. The results highlight the need to incorporate structural support systems and focused institutional wellness programs.

Keywords: *Physical Inactivity, Academic Stress, Sleep quality, Medical students, Health behaviours.*

INTRODUCTION

Non-communicable diseases (NCDs) primarily cardiovascular diseases, cancers, diabetes mellitus and chronic respiratory diseases are the leading causes of death worldwide, accounting for 43 million deaths in 2021, equivalent to 75% of all non-pandemic-related global mortality. The majority of NCD burden are caused due to the modifiable behavioral risk factors such as tobacco use, harmful alcohol consumption, physical inactivity and unhealthy diet. [1] Physical inactivity alone affects approximately 1.8 billion adults globally (31.3% in 2022), a figure that has risen by five percentage points since 2010 and is projected to reach 35% by 2030 if current trends continue. South Asia, the region to which India belongs, records among the highest rates of physical inactivity worldwide at 45%, highlighting the disproportionate burden borne by this region.[2] Alongside physical risk factors, poor sleep, high academic stress, and inadequate engagement in health-promoting behaviors such as fruit and vegetable consumption are increasingly recognized as determinants of long-term health outcomes, particularly among young adults in higher education.[3]

India is experiencing a well-documented epidemiological transition. The India State-Level Disease Burden Initiative (ICMR, 2017) reported that the total percentage of disease burden attributable to NCDs rose from 30% to 55% between 1990 to 2016, while the NCD-attributable share of deaths increased from 37.9% to 61.8% over the same period.[4] In current context, behavioral risk factors among Indian medical students represent a specific and growing concern. A systematic review and meta-analysis of 65 studies involving over 20,000 Indian MBBS students found pooled prevalence rates of tobacco use at 21.9% (95% CI: 18.5-25.3%) and alcohol use at 27.1% (95% CI: 23.0-31.1%), with male students ten and five times more likely to use tobacco and alcohol respectively compared to females.[5] A cross-sectional study among 400 undergraduate medical students in Gujarat (2023) documented that 63% had lower levels of physical inactivity, 54% had poor sleep quality, and 85% had inadequate fruit and vegetable intake, with hostel residence, male sex, and lower socioeconomic status were associated with multiple risk factors.[6] A 2024 survey across all six government medical colleges of Himachal Pradesh similarly found clustering of poor dietary patterns, sleep deprivation, and sedentary behavior among MBBS students, underscoring, the patterns are not limited to urban or private institutions.[7] The need of studying health behaviors in medical students extends beyond their personal wellbeing. Longitudinal study shows that health behaviors both protective and harmful, established during medical training tend to track into clinical practice. Physicians who practice healthy behaviors are more likely to counsel patients on lifestyle modification and are perceived as more credible health advisors. [8] Despite this evidence, most Indian studies on medical student health behavior have focused narrowly on individual risk factors particularly substance use in isolation, and have predominantly been conducted in urban, single-institution settings. Studies that simultaneously study both health-risking and health-promoting behaviors across all MBBS years remain limited. This study was undertaken with the following objectives:

1. To determine the prevalence of health-risking behaviors and health-promoting behaviors among the study participants.
2. To identify the socio-demographic and academic factors associated with health-risking and health-promoting behaviors among the study participants.

MATERIALS & METHODS

Study Design:

A cross-sectional survey was conducted among MBBS students at a Medical College and Hospital situated in Bengaluru rural district, Karnataka, India over a period of six months from June 2025 to December 2025.

Study population comprised MBBS students enrolled across all academic years (Phase I through Phase III Part II and house surgeons) during the study period.

Inclusion Criteria

- MBBS student enrolled at this institution during the data collection period.
- Students who were present on the day(s) of data collection in the institution.
- Students providing written informed consent prior to participation.

Exclusion Criteria

- Students submitting incomplete questionnaires
- Students unwilling to participate in the study.

Sample Size was calculated using the standard formula for estimation of a single proportion: $n=Z^2pq/d^2$, where Z=1.96 at a 95% confidence level, p=0.50, q=0.50 (assumed prevalence of 50%), and absolute precision d=5%. The sample size calculated was 384 students. However, a total of 429 students were included finally. A non-probability convenience sampling method was used to select study participants.

Data collection was done using a pretested, semi-structured, self-administered questionnaire developed by the investigators through review of relevant literature. To comprehensively assess health-risking and health-promoting behaviors among medical students, questionnaire was designed with the following domains:

- Socio-demographic characteristics (age, sex, MBBS year, residential status, family background)
- Dietary habits (frequency of fruit and vegetable consumption, fast-food intake, meal skipping)
- Physical activity patterns (duration, type, and frequency of activity per week)
- Sleep patterns (average nightly sleep duration, sleep quality)
- Stress-related behaviors and coping mechanisms (academic stress, use of relaxation techniques)
- Substance use behavior (tobacco and alcohol use in the past 1 month)

Data collection was carried among students who were present during scheduled academic hours, after explaining the purpose and voluntary nature of the study.

The Perceived Stress Scale (PSS) score was calculated using four main items assessing the frequency of feeling nervous or stressed, inability to control important aspects of life, confidence in handling personal problems, and feeling overwhelmed by difficulties. Responses were recorded on a Likert scale(5-point) ranging from 0 (never) to 4 (very often). The positively worded item assessing confidence in handling personal problems was reverse scored before computing the total score. The total PSS score ranged from 0 to 16, with higher scores indicating greater perceived stress. Based on the total score, participants were classified into low stress (0-5), moderate stress (6-10), and high stress (11-16).

Health-risking behaviors: Behaviors that increase the risk of adverse health outcomes, including: Current use of tobacco or alcohol; physical inactivity; unhealthy dietary practices (frequent fast-food intake, meal skipping).

Health-promoting behaviors: Behaviors that enhance health and well-being, including: regular physical activity (≥150 minutes/week of moderate-intensity activity); consumption balanced diet including fruits and vegetables on ≥5 days per week; adequate sleep (≥7 hours per night); and engagement in stress management practices such as yoga or meditation.

Current substance use: Use of tobacco or alcohol on at least one occasion in the past 30 days preceding the survey date.

Physical inactivity: Failure to meet the World Health Organization (WHO)-recommended levels of physical activity for adults (i.e., < 150 minutes of moderate-intensity aerobic activity or less than 75 minutes of vigorous-intensity activity per week).

The composite health risk score was calculated by assigning weighted scores to selected risk behaviors. One point each was assigned for skipping meals, use of caffeine products, and unsafe screen time, while alcohol consumption and tobacco use were assigned two points each due to their relatively higher health risk. The total score ranged from 0 to 7, with higher scores indicating greater engagement in unhealthy behaviors. Based on the cumulative burden of risk behaviors, participants were categorized into fewer risk behaviors (0-2) and multiple risk behaviors (3-7) groups for analysis.

Similarly, a composite health-promoting behavior score ranging from 0 to 4 was calculated by assigning one point each for adherence to a balanced diet, regular physical activity, adequate sleep, and engagement in relaxation practices. Higher scores indicated better adoption of health-promoting behaviors. Based on overall adherence to healthy lifestyle practices, participants were categorized into poor health-promoting behavior (0-2) and good health-promoting behavior (3-4) groups.

The dependent variables included composite health risk behavior status and composite health-promoting behavior status. The composite health risk behavior status was categorized as fewer risk behaviors or multiple risk behaviors based on participant's engagement in skipping meals, caffeine product use, unsafe screen time, alcohol use, and tobacco use. The composite health-promoting behavior status was categorized as poor or good health-promoting behavior based on adherence to balanced diet, regular physical activity, adequate sleep, and relaxation practices. The independent variables included socio-demographic factors such as age, sex, MBBS academic year, and residential status (hosteller/day scholar)

Statistical Analysis

Descriptive statistics, including frequencies and percentages, were used to summarize socio-demographic characteristics and the distribution of composite health risk and health-promoting behavior categories. Associations between independent variables (socio-demographic, academic) and dependent variables (composite health risk behavior status and health-promoting behavior status) were assessed using Chi-square test or Fisher's exact test. Associations were considered significant on the basis, if p-value of < 0.05. After data entry and cleaning in Microsoft Excel spreadsheet, JAMOVI Statistical Software version 2.7 (The Jamovi Project, 2024) was used to perform statistical analysis.

Ethical approval- The Institutional Ethics Committee approved the study; vide letter number MVJMCRH/IEC/42/2024 dated 14.02.2025.

RESULT

Total 429 medical students participated in this study. The descriptive statistics for the primary continuous variables as follows, mean daily study hours reported by participants were 2.90 ± 1.82 hours. The Modified Perceived Stress Scale mean score of 8.72 ± 2.90. Mean duration of Physical activity per week was 3.36 ± 1.81 days and mean sleep duration was 6.43 ± 1.19 hours per night.

The mean age of study participants was 21.4 ± 2.03 years, with the majority (66.4%) falling in the 18-22 years age group and 33.6% in the 23-26 years group. The study sample was predominantly female (71.3%), while males constituted 28.7% of participants. Regarding year of study, the largest proportion was enrolled in MBBS Phase 3 Part 1 (35.9%). Almost half of the participants resided in hostel accommodation (48.3%). Nutritional status assessed using BMI classification for Indians (ICMR), study revealed that more than half of the participants were underweight (54.5%), while 35.0% had a normal BMI. The mean BMI of was 18.6 ± 3.45 kg/m². The socio-demographic characteristics are summarized in Table 1.

Table-1: Socio-demographic Characteristics of the Study Participants (N = 429)

Variable	n	%
Age Group in Years		
Early Emerging Adults (18–22)	285	66.4
Late Emerging Adults (23–26)	144	33.6
Gender		
Female	306	71.3
Male	123	28.7
Year of Study		
MBBS Phase 1	100	23.3
MBBS Phase 2	40	9.3
MBBS Phase 3 Part 1	154	35.9
MBBS Phase 3 Part 2	53	12.4
Interns	82	19.1
Place of Residence		
Hostel	207	48.3
Home	185	43.1
Paying Guest	37	8.6
BMI Category*		
Underweight	234	54.5
Normal	150	35.0
Overweight	22	5.1
Obese	23	5.4

***BMI as per Indian Council of Medical Research (ICMR) criteria for Indians.**

Table 2 presents the distribution of academic stress and psychological parameters. Majority of students (79.0%) reported experiencing academic pressure, while 52.9% reported that they were capable of balancing between academic and personal life. Perceived stress level mean score was 8.72 ± 2.90. Based on PSS categorization, moderate stress was the most prevalent affecting 60.6% of participants.

Table 2. Academic Stress and Psychological Characteristics among Medical Students (n= 429)

Variable	n	%
Experiencing academic Pressure	339	79.0
Ability to Balance Academics and Personal Life	227	52.9
Stress Level (Modified PSS)		
Low Stress (0–5)	54	12.6
Moderate Stress (6-10)	260	60.6
High Stress (11-16)	115	26.8

Health promoting behaviors among students is summarized in Table 3. Out of total, 43.6% students reported engaging in regular physical activity and only 26.8% achieving 150-300 minutes/week. Physically active mean days per week were 3.36 ± 1.81, and the mean daily physical activity duration was 38.8 ± 25.1 minutes.

Regarding sleep, 64.6% of students perceived their sleep as adequate; half of the participants (50.8%) slept <7 hours per night, with mean sleep duration of 6.43 ± 1.19 hours and 55.2% of students rated their sleep quality as moderate. A balanced diet was consumed by 58.5% of participants. However, fruit and vegetable intake was notably low, with 69.5% consuming 1 serving a day and 3.0% meeting the recommended 3 or more servings a day. The majority of students (87.9%) reported taking time to relax daily.

Table 3. Health-Promoting Behaviors among Medical Students (n = 429)

Variable	n	%
Regular Physical Activity	187	43.6
Weekly Physical Activity Duration*		
<150 min/week	275	64.1
150–300 min/week	115	26.8
>300 min/week	39	9.1
Sleep Adequate	277	64.6
Sleep Duration		
<7 hours	218	50.8
≥7 hours	211	49.2
Sleep Quality		
Excellent	33	7.7
Good	140	32.6
Moderate	237	55.2
Poor	19	4.4
Balanced Diet Consumption	251	58.5
Fruit and Vegetable Intake		
1 serving/day	298	69.5
2 servings/day	113	26.3
≥3 servings/day	13	3.0
None	5	1.2
Takes time to relax daily	377	87.9

***Physical activity- WHO Global Guidelines (150-300 min/week of moderate-intensity activity).**

Table 4 presents the prevalence of health-risking behaviors. Meal skipping due to academic stress or study demands was reported among 43.6% of participants. Junk food consumption was prevalent among 35.0% consuming 3-4 days/week; the mean frequency was 3.21±1.92 days/week. Caffeine consumption was reported by nearly three-quarters of participants (74.4%). Around 6.8% of students self-reported the Tobacco use, while alcohol consumption was among 3.5% and 49.4% students reported 3-5 hours of daily non-academic screen exposure; the mean screen time was 4.2 ± 2.1 hours/day.

Table 4. Health-Risking Behaviors among Medical Students (N = 429)

Variable	n	%
Meal Skipping Due to Stress/Study	187	43.6
Junk Food Consumption (days/week)		
0–2 days	175	40.8
3–4 days	150	35.0
≥5 days	104	24.2
Alcohol Consumption	15	3.5
Tobacco Use	29	6.8
Caffeine Consumption	319	74.4
Daily Screen Time (Nonacademic)		
≤2 hours/day	122	28.4
3–5 hours/day	212	49.4
≥6 hours/day	95	22.1

Table 5 Factors associated with composite health risk behaviors among MBBS students

Variable	Fewer n (%)	Multiple n (%)	p-value
Age Group in Years			
Early Emerging Adults (18-22)	219 (76.8)	66 (23.2)	**0.001**
Late Emerging Adults (23-26)	89 (61.8)	55 (38.2)	
Year of study			
MBBS Phase 1	85 (85.0)	15 (15.0)	**0.002**

MBBS Phase 2	33 (82.5)	7 (17.5)	
MBBS Phase 3 Part 1	99 (64.3)	55 (35.7)	
MBBS Phase 3 Part 2	34 (64.2)	19 (35.8)	
Intern	57 (69.5)	25 (30.5)	
Residence			
Home	136 (73.5)	49 (26.5)	0.561
Hostel	148 (71.5)	59 (28.5)	
Paying guest	24 (64.9)	13 (35.1)	
Gender			
Female	221 (72.2)	85 (27.8)	0.756
Male	87 (70.7)	36 (29.3)	

Among the socio-demographic variables studied, age group and year of study showed an association which was statistically significant composite health risk behavior status. Participants belonging to the late emerging/young adult age group (23-26 years) had a higher proportion of multiple risk behaviors compared to early emerging adults (18-22 years) (38.2% vs. 23.2%; χ^2=10.68, p=0.001). Similarly, year of study was associated with health risk behavior status (χ^2=16.90, p=0.002, significant), with higher proportions of multiple risk behaviors observed among students in MBBS Phase 3 Part 1 and interns. (Table-5)

Table-6: Factors associated with health-promoting behaviors among MBBS students

Variable	Good n (%)	Poor n (%)	p-value
Age group in years			
Early Emerging Adults (18-22)	152 (53.3)	133 (46.7)	0.978
Late Emerging/Adults (23-26)	77 (53.5)	67 (46.5)	
Year of study			
MBBS Phase 1	55 (55.0)	45 (45.0)	0.424
MBBS Phase 2	24 (60.0)	16 (40.0)	
MBBS Phase 3 Part 1	76 (49.4)	78 (50.6)	
MBBS Phase 3 Part 2	33 (62.3)	20 (37.7)	
Intern	41 (50.0)	41 (50.0)	
Residence			
Home	112 (60.5)	73 (39.5)	**0.022**
Hostel	102 (49.3)	105 (50.7)	
Paying guest	15 (40.5)	22 (59.5)	
Gender			
Female	158 (51.6)	148 (48.4)	0.253
Male	71 (57.7)	52 (42.3)	

Among the socio-demographic variables studied, place of residence showed a statistically significant association with health-promoting behavior status (χ^2=7.66, p=0.022). Students residing at home demonstrated a higher proportion of good health-promoting behaviors (60.5%) compared to hostellers (49.3%) and paying guests (40.5%). (Table-6)

DISCUSSION

This cross-sectional study examined the stress burden, health-promoting behaviors, and health-risk behaviors among 429 undergraduate medical students using validated instruments and Indian-specific anthropometric criteria. The mean modified Perceived Stress Scale (PSS) score of 8.72 ± 2.90, with 60.6% of students in the moderate stress category and 26.8% in the high-stress range, is consistent with the broader literature on medical students in India. In comparison with south India study prevalence of stress was 11% and Almost 95% of students experienced moderate-to-severe stress in the last one month. [9]

Notably, 79.0% of our participants reported experiencing academic pressure, while fewer than half (52.9%) perceived themselves as able to balance academic and personal life. Sungoh D et.al. study (2024) revealed that 46.8% of first year and 47.2% of final year students had high academic stress. [(10)] Burnout, which worsens significantly across medical school years, may explain why moderate stress at baseline can translate into clinically significant distress by the clinical phases. [(11)]

The high prevalence in our cohort may reflect a combination of chronic dietary restraint and food access limitations, particularly among those in paying guest accommodation. Meal skipping attributed to academic stress affected 43.6% of students. Paradoxically, 58.5% self-reported consuming a balanced diet, while only 3.0% met the recommended three or more fruit and vegetable servings per day. Caffeine consumption was prevalent (74.4%), reinforcing cross-cultural evidence that medical students increasingly use stimulants as a stress-coping strategy, with consumption rising across clinical years. [(12,13)]

Half the cohort (50.8%) slept fewer than seven hours per night, below the WHO-recommended minimum, with a mean of 6.43 ± 1.19 hours. Longitudinal Indian data have demonstrated that progressive sleep curtailment from approximately 6.8 to 5.9 hours across a single academic phase is independently associated with deterioration in attention, working memory and academic performance, even after controlling for stress and screen time.[(14)] An observation in our study is the perception reality gap i.e. 64.6% of students considered their sleep adequate, yet more than half objectively slept under seven hours and over half rated quality as only moderate. This mismatch suggests students may be normalizing chronically insufficient sleep as an occupational expectation of medical training, an adaptation that carries long-term cognitive and clinical risk. [(15)]

Physical activity, only 26.8% met the WHO-recommended 150-300 minutes per week of moderate-intensity activity. This is lower than the 40.5% reported among medical students in Sudan and consistent with the observation that academic burden is the principal barrier to regular physical activity across medical training contexts globally. [(16)]

High non-academic screen time (mean 4.2 ± 2.1 hours/day, with 49.4% spending 3-5 hours daily) likely displaces time for both sleep and exercise, creating compounding deficits in health-promoting behaviors. In Nair R et al. study, 77% of participants reported screen time as four to six hours per day. [(17)]

Two socio-demographic associations stood out as statistically significant. First, late-emerging adults (23–26 years) were significantly more likely to cluster multiple health-risk behaviors compared with early-emerging adults (38.2% vs. 23.2%; $\chi^2=10.68$, $p=0.001$). Second, year of study was significantly associated with Health Risk Behavior burden ($\chi^2=16.90$, $p=0.002$), with MBBS Phase 3 Part 1 and interns carrying the highest multiple-risk-behavior load. This is consistent with longitudinal evidence showing that burnout worsens significantly toward the end of medical school, particularly during clinical transitions. [(11)]

Place of residence showed a statistically significant association with Health-Promoting Behaviors status ($\chi^2=7.66$, $p=0.022$). Students living at home demonstrated the highest proportion of good Health-Promoting Behaviors (60.5%), followed by hostellers (49.3%), while those in paying-guest accommodation fared worst (40.5%). This finding is consistent with data from Rishikesh, India, where hostel residence was independently associated with unhealthy lifestyles among health-profession students. [(18)]

Strengths, Limitations and Recommendations

This study's strengths include an adequate sample size, the use of a validated modified PSS, and the application of ICMR-specific BMI criteria, which are more appropriate for Indian populations than WHO universal thresholds. The cross-sectional design, however, precludes causal inference, and self-reported data carry inherent recall and social-desirability bias. Generalizability is limited by the single-institution setting and the predominantly female sample (71.3%), though this reflects the enrollment pattern of many South Indian medical colleges.

From a public health standpoint, the findings call for a phased, residence-sensitive wellness strategy. Hostel authorities and college administrations should partner to improve on-campus dietary options and provide dedicated physical activity spaces accessible during clinical posting hours. Mental health screening should be integrated at Phase 3 entry, and structured peer-support programs should be piloted for interns. Future longitudinal research should track behavior trajectories from Phase 1 through internship to establish causal pathways and identify critical intervention windows.

CONCLUSION

Undergraduate medical students at a rural-district medical college in Bengaluru exhibit a high prevalence of suboptimal health-promoting behaviors and a substantial burden of health-risking behaviors including physical inactivity, inadequate sleep, poor dietary quality, meal skipping, and excessive caffeine consumption. Age group and year of study were statistically associated with health risk categorization; Student's residence with health-promotion behavior. Our study findings enhance evidence in existing literature by providing institution-specific data from an underrepresented rural setting and urges need for targeted, evidence-based health promotional activities among students.

Declaration by Authors

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