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Behind the White Coat: Burning Bright or Burning Out? An Observational Study

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Abstract

Background: Depressive symptoms in medical students are a recent public health issue, and academic pressure, emotional exhaustion, and disturbances in lifestyle are very strong predisposing factors. *Aim and Objective:* To determine the trend and prevalence of depressive symptoms among undergraduate medical students by academic years, age, and gender using the PHQ-9 questionnaire. *Methods:* Cross-sectional observational study was conducted by using the PHQ-9 questionnaire. Information was collected from 100 students of 2nd, 4th, and final years. Age and gender profile was also noted. PHQ-9 (Patient Health Questionnaire-9) is a 9-item instrument to measure depressive symptoms during the past two weeks. Each item scored from 0 ("Not at all") to 3 ("Nearly every day"), with a total score ranging from 0 to 27. A higher score reflects more severity of depression. *Results:* Highest mean scores on PHQ-9 were among 5th-year students (females: 1.52, males: 1.46), reflecting a greater burden of depressive symptoms in final-year students. There was a statistically significant correlation between depression scores and academic year (Kruskal-Wallis H = 466.38, p < 0.0001), gender (Mann-Whitney U = 50863, p < 0.00001), and age (Spearman correlation = 0.41, p < 0.0001). The trend was graphically depicted with the violin, jitter and bubble plots. Fisher's Exact Test was applied for categorical comparisons. *Conclusion:* This study's findings provide that depressive symptoms are observed with greater frequency among final-year students and women. These findings emphasize the necessity of initiating early screening processes and psychological counselling for medical students. Longitudinal studies, proactive guidance, and organizational changes that address mental health requirements should be included in future interventions.

Keywords: *Depression, PHQ-9, Medical Students, Gender, Age Group, Academic Year, Observational Study.*

Introduction

Depression is a complex psychological disorder with characteristics of chronic sadness, anhedonia, fatigue, and decreased cognitive function [1]. Over the past decades, depression has become one of the top causes of the global disease burden, and medical students have been identified as a vulnerable group. The medical student group has academic stress like rigid schedule with minimum breaks academic burnout and fear of exam failure [2]. There is also a time deficit due to the absence of coordination among them and also absence of time allocation for self-recreation [3]. There is also clinical stress among the students and also fear of making errors in a clinical setting along with career insecurity. Departure from home also is an important reason. Some students have cultural shame and fear of being judged [4]. Important financial stress also causes depression. Some students also have internal pressure due to intrinsic personality traits. Research has repeatedly demonstrated that medical students have a higher rate of depression compared to their non-medical peers. Not only does depression interfere with academic performance and capacity for learning, but also with empathy and communication skills demanded of future physicians. Depression in medical school may be a predictor of burnout, anxiety disorders, substance abuse, and even suicidal ideation. Despite growing awareness, many students remain undiagnosed due to stigma, lack of access to mental health care, or fear of academic penalty.

In the Indian medical education setup, pressure is compounded by competitive exams, fewer seats available in postgraduate training, and longer academic periods. Limited studies, however, have assessed how depression changes over the medical curriculum and whether academic year, gender, or age predict symptom burden. This study was created to investigate these factors using the PHQ-9 screening tool and reporting both quantitative and visual interpretation of results [5]. Through learning differences in depression by year, this study aims to inform early interventions and support systems consistent with students' academic path.

Methodology

This study was a cross-sectional observational study conducted among undergraduate medical students of a single institution. The study used the PHQ-9 (Patient Health Questionnaire-9), a validated questionnaire to evaluate depression. The data were obtained anonymously from students in 2nd, 4th, and 5th year of study.

Eligibility Criteria

Inclusion Criteria

- 2nd year, 4th year, and final year undergraduate medical students
- Obtained informed consent and thorough responses.

Exclusion Criteria:

- Recognized psychiatric disorder or under psychiatric treatment
- Inaccurate or incomplete questionnaires

Sample Size Calculation: Referring to the systematic review of Rotenstein *et al.* in 2016, published in JAMA, which placed an estimated global prevalence of depression in medical students at about 27%, the minimal required sample size for this study- calculated at a 95% confidence level and at a 5% margin of error- was around 303 participants. Due to logistic constraints, time constraints, and resource limitations, however, a convenience sample of 100 students was utilized. Although this is less than the ideal target, it is sufficient for exploratory analysis, hypothesis generation, and the identification of significant trends in subgroups. The results must thus be interpreted as suggestive rather than conclusive, and it is suggested that larger multicentre samples are employed in follow-up studies to confirm these results.

Data Collection: PHQ-9 questionnaires were completed by students. Age group and gender demographic information was noted. Individual item scores (0–3) were added and tabulated for individual PHQ-9 scores. Group level means were calculated and contrasted.

Sample size calculation

The sample size was obtained using the formula for estimation of a proportion [6]

$$N= \frac{Zcrit^2 * P * (1-2)}{D^2}$$

Where,

N = Number of participants

Z crit = the standard normal deviate, corresponding to a significance criterion of

0.05 (95) = 1.960

D = Amount of error we will tolerate = +/− 5%

P = Pre-study estimate of the global prevalence of depression among medical students, 27% as reported in a systematic review study [6].

N = 303, final sample size considered = 100

Results

PHQ-9 scores by year and gender were summarized (**Table 1**). Likewise, age group distribution by year and gender were summarized too (**Table 2**). Mean PHQ-9 scores were highest among final-year students, especially females (mean score 1.52). The lowest mean scores were found among 2nd-year students. There was a gender difference in all the years, with females having more depressive symptoms in general. The violin plot showed a skewed distribution towards higher scores in the senior years (**Figure 1**). The 5th year students (female and male) have higher and more spread distribution, especially females. The 2nd and 4th year students had low, tightly clustered distributions, showing lower severity of depression. The female group had higher mean PHQ-9 scores in 2nd and 5th years compared to males. Overlap between male and female distributions was minimal in the 5th year, showing gender divergence in depression.

Jitter plot identified age-stratification (**Figure 2**). Participation by females was more but was weighted equally.

The bubble meta-regression graph illustrated a pattern of rising depression graphically with age and year (**Figure 3**).

Linear regression was used to model the trend line over academic years. The equation representing PHQ-9 score (y) was 0.55x−0.72 with the slope being 0.55. For every academic year that passed, the average PHQ-9 score rose by 0.55 points, showing a positive relationship between academic stress and depression level. The y-intercept was -0.72. Being in the 5th year was the best predictor of higher depression scores. Gender and age had weaker, but significant, roles. The R^2 was 0.991 and accounted for 99.1% of PHQ-9 score variance.

All nine items on the PHQ-9 were rated from 0–3. With 100 subjects, the maximum possible score for all items was 300. These ratings indicated that fatigue and hopelessness are most commonly reported depressive symptoms, followed by sleep disturbance and failure feelings (**Table 3**). Suicidal ideation, although present, had the lowest all-around rating but is clinically important. Though the total rating for this item was 111 on a potential 300, which represents mild to moderate levels of distress, it also doesn't necessarily mean active suicidal intent. Based on participant behaviour, history, and known risk factors, it is likely that responses represent transient emotional overwhelm, inferiority complex, or mental fatigue as opposed to clinical crisis.

Various statistical tests were conducted and revealed that females were more affected, depression scores increased with year of study and gender, age and year of study had a positive correlation with depression (**Table 4**).

Table 1: PHQ-9 Scores by Year and Gender

Year	Gender	Total PHQ-9 Score	Responses	Average PHQ-9 Score
2nd	Female	86	187	0.46
2nd	Male	44	97	0.45
4th	Female	68	190	0.36
4th	Male	63	123	0.51
5th	Female	164	108	1.52
5th	Male	121	83	1.46

Table 2: Age Group Distribution by Year and Gender

Year	Gender	20–22	23–25	>25	Total
2nd	Female	27	3	0	30
2nd	Male	9	1	0	10
4th	Female	6	18	0	24
4th	Male	2	10	1	13
5th	Female	0	8	5	13
5th	Male	0	3	7	10

Table 3: Total PHQ-9 Item Scores Across All Participants

PHQ-9 Item	Total Score (out of 300)
1. Little interest/pleasure	118
2. Feeling down/hopeless	129
3. Sleep disturbances	126
4. Fatigue/little energy	130
5. Appetite issues	121
6. Feeling like a failure	125
7. Trouble concentrating	122
8. Restlessness/anxiety	123
9. Suicidal ideation	111

Table 4: Statistical Tests

| Test	Statistic / Value	p-value	Interpretation
Chi-Square (Age × Year × Gender)	$\chi^2 = 82.97$, df = 10	1.31×10^{-13}	Highly significant: Age varies significantly across groups
Kruskal-Wallis (Yearwise PHQ-9)	H = 466.38	4.09×10^{-101}	Highly significant: Year affects depression scores
Mann-Whitney U (Gender PHQ-9)	U = 50,863.0	1.24×10^{-13}	Significant: Female > Male in depression scores
Fisher's Exact (Gender × Severity)	—	1.40×10^{-37}	Significant: Gender associated with depression severity
Spearman Correlation (Age ↑ vs. PHQ-9 ↑)	$\rho = \mathbf{0.41}$	2.23×10^{-5}	Positive correlation: Older students report higher depression scores
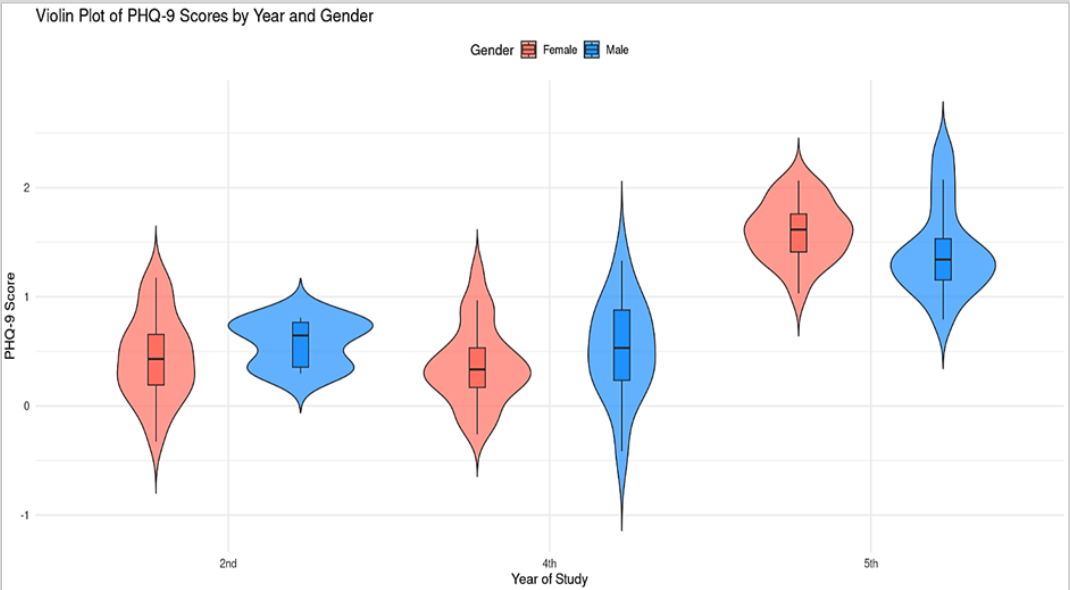
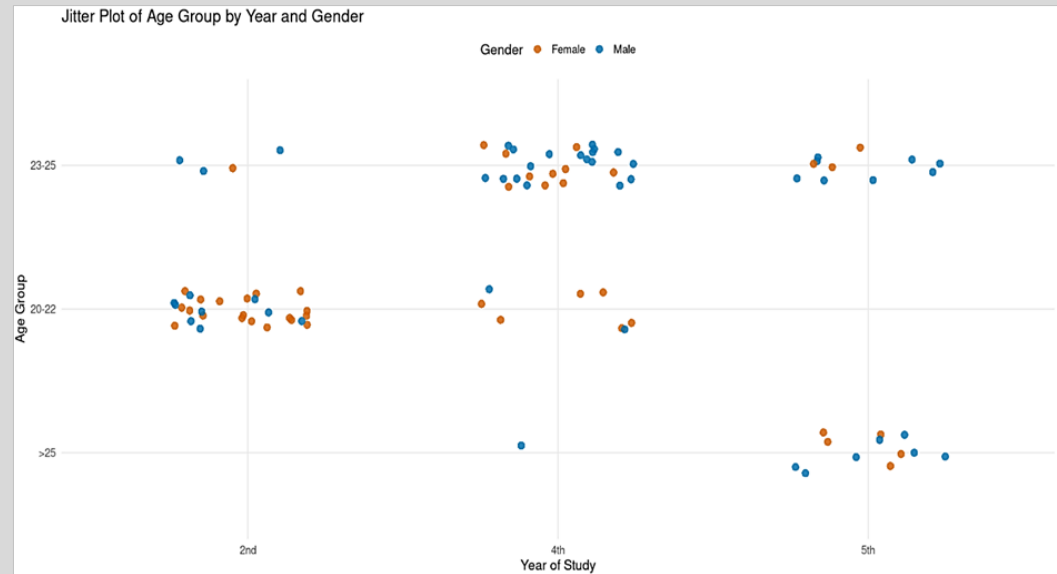**Figure 1: Violin plot of PHQ-9 Scores by Year and Gender**

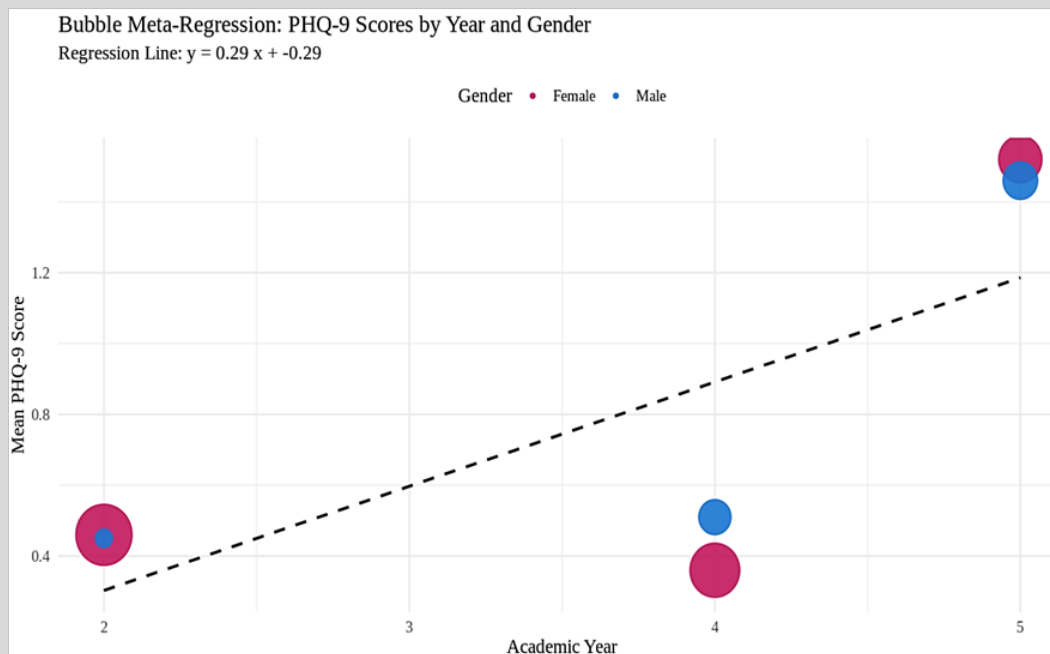**Figure 2: Jitter plot of age group by year and gender**

Figure 3: Bubble meta regression plot for PHQ-9 scores by year and gender

Figure 4: Triggering factors of depression

Discussion

This study revealed noteworthy results on the trend of depression among medical undergraduate students. The most striking observation was the dramatic increase in PHQ-9 scores among 5th-year students, especially females, reflecting aggregate academic pressure and subsequent career changes might be the main contributing factors. Medical education is identified as a most demanding and stressful academic course of study, frequently associated with high rates of psychological distress, such as depression and anxiety, compared to the general population or other student groups [7,8]. This is in agreement with findings that mental health issues like depression and anxiety in medical students might worsen during the initial year of their medical school program [9]. Medical students are inclined to face additional difficulties in terms of burnout, stress, and mental health, a challenge that can start before entering medical school [10]. The psychological well-being of medical students is a growing concern issue [11].

These students are confronted with clinical workload, entry tests, and transition stress, all of which increase emotional and psychological tension.

Female learners exhibited consistently higher scores, which is in agreement with the current literature reporting gender-specific vulnerability to emotional and academic stressors [12].

Additionally, medical student cohorts with older age had a greater prevalence of depressive symptoms, emphasizing the cumulative load of extended academic engagement and life stressors [13]. Contrary to this, another study did not reveal any significant differences in academic burnout and loneliness measurements across various academic terms [14].

The interaction between sex, academic development, and age appears to be largely responsible for the mentioned mental

health outcomes. This was also confirmed by the bubble meta-regression plot, whose positive slope between advancing years of academic progress and PHQ-9 severity was proven. Medical students are typically faced with numerous stressors such as challenging curricula and fear of performance, leading to a decrease in leisure and sleep time [15].

It is also interesting to note that we received more responses from female students within our sample. This is a greater level of participation than any sampling bias, but it could also be indicative of greater mental health help-seeking behaviour or awareness among female students—a variable that could be addressed in future research. This imbalance was controlled in statistical analysis.

Second, while group trends and average scores are helpful, follow-up analyses can be strengthened by adding total scores on all PHQ-9 items to better capture the effect of individual symptoms.

The findings of this study highlight the need for constant mental health support systems in medical schools, and particularly for final-year medical students. Therefore, the early implementation of wide-reaching intervention programs, such as stress management programs designed specifically to meet the particular challenges faced by medical students, and gender-sensitive counseling, are required to minimize the possibility of depression and burnout among tomorrow's doctors [15,16]. Such programs must tackle the mental well-being of not only those facing the challenges of clinical practice and academic pressures but also those facing the daunting pressures of the transition from medical school to residency [17].

Institutions must not only react to academic challenges but also offer emotional resilience training, conduct early psychological screening, and offer counselling services without stigma. This process entails mandated organizational and cultural changes in educational institutions, the facilitation of resources, reduction of stigma in mental disorders, and promotion of psychological well-being factors [18]. High prevalence of major depressive disorders among medical students was noted in one study, where the presence of chronic illness, major life events, female gender, and admission at the clinical level were related factors [19]. While Item 9 of the PHQ-9 assesses suicidal ideation, the answers must be read within an appropriate context. The total of this item was 111 out of 300 and reflected mild to moderate distress but no active suicidal intent. Based on participant behaviour, their history, and known risk factors, it is likely that the answers reflect temporary emotional overload, feelings of inferiority, or mental fatigue rather than clinical crisis. Despite these considerations, any suggestion of suicidal ideation requires close attention and immediate intervention. Ethical principles demand that any suggestion of self-harm risk be met with the utmost seriousness and thus requiring further assessment, support, and referral to mental health services as appropriate.

Like most self-report scales, these items can potentially measure generalized distress as opposed to specific psychiatric symptoms.

The different determinants of the development of depression among medical students were illustrated (**Figure 4**). The study paves the way for greater multi-centre studies concerning the development of evidence-based prevention and treatment strategies for the overall health of medical students. The study flags mental health support systems and facilities as a priority among medical students, especially during intensive study periods. A study illustrated the critical need for the introduction of measures to safeguard the psychological health of premedical students, as they are at a higher risk for depression and burnout [20]. The conclusions of this research serve as a stimulus for student welfare committees and curriculum planners. Medical student problems call for the adoption of strategies to improve their education, physical, mental, and professional health [21].

Strengths and limitations

This study included a roughly middle-sized and representative sample size across all three major academic terms. Use of validated measures and multi-dimensional analysis increases credibility. Limitations include single-institution sampling, use of self-report data, and lack of clinical diagnosis. Gender imbalance may impact generalizability but was accounted for in analysis. PHQ-9 Item 9 responses might have overestimated suicidal ideation as the item may also represent emotional exhaustion or nonspecific psychological distress. No participants reported or were observed to have active suicidal behaviour.

Declarations

Ethical Approval:

Was obtained from our institute and the questionnaire was distributed in a way the students could keep their names anonymous.

Conflicts of Interests

The authors report no conflict of interest.

Author Contributions

Conceptualization and methodology G.V., and D.S.; Formal analysis, G.V., and D.S.; Visualization and writing -original draft G.V., V.T. and D.S.; Writing -review and editing G.V., D.S., V.T. and J.H. All authors have read and agreed to the final version of the manuscript.

Article Category

Observational cross-sectional study based on PHQ-9 questionnaire

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