e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(5); 141-145

Original Research Article

Comparative Assessment of Perceived Stress among Medical Students during Online and Offline Teaching in the COVID-19 Era

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Received: 01-02-2026 /Revised: 15-03-2026 / Accepted: 21-04-2026

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Conflict of interest: Nil

Abstract

Background: The COVID-19 pandemic brought about an abrupt shift from face-to-face teaching to digital platforms, profoundly affecting the learning environment and mental well-being of students. Medical education, being highly rigorous and interactive, was especially disrupted. This study assesses perceived stress levels among medical students, compares stress during online and offline classes, and identifies contributing factors.

Objectives: To compare perceived stress levels during online and offline teaching and identify associated stressors.

Methods: A cross-sectional comparative study was conducted among 150 first-year MBBS (Bachelor of Medicine, Bachelor of Surgery) students using the Perceived Stress Scale (PSS-10). The mean stress scores during online and offline modes were compared using the paired Student's t-test. Ethical approval was granted by the Institutional Ethics Committee.

Results: Mean PSS scores were significantly higher during online classes (24.85 ± 5.27) compared to offline sessions (18.01 ± 6.49) ($p < 0.01$). Severe stress was observed in 33% of students during online learning versus 10% during in-person classes. Gender differences were not statistically significant.

Conclusion: Perceived stress was significantly higher during online learning, likely due to limited peer and teacher interaction, reduced academic engagement, and difficulty adapting to e-learning platforms. Although stress declined during offline teaching, persistent moderate stress highlights the need for hybrid teaching approaches supported by regular mentoring and psychological support services.

Keywords: COVID-19, Medical Students, Psychological Stress, Online Learning, Perceived Stress Scale, Academic Stress.

DOI: 10.25258/ijcpr.18.5.21

Introduction

The emergence of COVID-19 in late 2019 resulted in an unprecedented global public health crisis, profoundly affecting multiple sectors, including medical education. Traditional methods of teaching, which relied heavily on face-to-face interaction, bedside clinical training, and peer collaboration, were rapidly replaced by online learning platforms. Although this transition ensured academic continuity, it introduced significant psychological, social, and technological challenges among medical students.

Stress is a complex physiological and psychological response mediated primarily through activation of the hypothalamic–pituitary–adrenal (HPA) axis and sympathetic nervous system. Chronic stress has been shown to impair cognitive performance, memory, and learning efficiency, all of which are critical for medical education.[1] Medical students are inherently at higher risk of stress compared to their non-medical peers due to demanding academic schedules, competitive environments, and clinical responsibilities.[2] During the COVID-19 pandemic, these baseline stressors were further amplified. Several studies conducted in India have reported moderate to severe stress levels among undergraduate medical students. One study observed that nearly 85% of students in Karnataka experienced moderate stress, attributing it to poor concentration and examination anxiety.[3]

Similarly, another study reported that approximately 81% of students in the Delhi-NCR region exhibited moderate perceived stress, with social isolation, academic uncertainty, and financial strain identified as major contributing factors.[4]

Globally, the pandemic intensified psychological distress among students by disrupting academic routines and limiting clinical exposure. Cao et al. demonstrated increased anxiety levels among college students, primarily due to academic delays and concerns regarding future career prospects.[5] Studies from premier institutions such as AIIMS Bhubaneswar revealed that nearly 47.6% of medical students experienced heightened psychological pressure due to fear of infection, lack of clinical exposure, and financial insecurity.[6,7]

The Perceived Stress Scale (PSS), developed by Cohen, Kamarck, and Mermelstein, remains one of the most widely used and validated tools for assessing perceived stress in diverse populations.[8]

The abrupt transition to digital pedagogy during the pandemic exposed several systemic gaps in medical education, particularly in developing countries like India. The absence of clinical exposure further compounded stress levels and affected skill acquisition.

Although numerous studies have assessed psychological stress among medical students during the pandemic, most have focused on stress during the lockdown period without distinguishing between different teaching modalities. Direct quantitative comparisons between stress levels during online and offline teaching remain limited.

Therefore, the present study aims to compare perceived stress levels among first-year MBBS students during online and offline teaching and to identify the factors contributing to stress in both settings. The findings will help inform evidence-based interventions to improve student well-being and optimize medical education.

Materials and Methods

This study was designed as a cross-sectional comparative observational study conducted in the Department of Physiology at Bowring and Lady Curzon Medical College and Research Institute, Bengaluru, Karnataka. The study was carried out over a period of 3 months, following approval from the Institutional Ethics Committee. The study population consisted of first-year MBBS students, with a total sample size of 150 participants selected based on feasibility and prior similar studies. All students enrolled in the first-year MBBS course who were willing to participate and provided written informed consent were included in the study. Students with a known history of psychiatric illness, those currently receiving psychiatric medications, or those unwilling to participate were excluded to minimize confounding variables that could influence stress perception. Perceived stress levels were assessed using the Perceived Stress Scale (PSS-10), a standardized and widely validated instrument developed by Cohen, Kamarck, and Mermelstein.[8] The PSS-10 consists of 10 items that measure the degree to which individuals perceive their life situations as unpredictable, uncontrollable, and overloaded during the previous one month. Each item is scored on a 5-point Likert scale ranging from 0 (never) to 4 (very often), with four positively stated items requiring reverse scoring. The total score ranges from 0 to 40, with higher scores indicating greater perceived stress. Based on established cut-offs, stress levels were categorized as low (0–13), moderate (14–26), and high (27–40). The scale has been extensively validated in diverse populations, including students, and demonstrates good internal consistency and reliability.

Data collection was carried out using structured, pre-validated questionnaires administered to all participants in a controlled academic setting. Each participant completed the PSS-10 on two separate occasions: first, by retrospectively assessing their stress levels during the period of exclusively online classes, and second, by evaluating their stress levels after the resumption of conventional offline, face-to-face classes. Adequate instructions were provided to ensure accurate understanding of the questionnaire, and participants were encouraged to respond honestly based on their experiences. Confidentiality and anonymity were strictly maintained throughout the study to minimize response bias.

Statistical analysis was performed using GraphPad Prism software. Quantitative data were expressed as mean ± standard deviation (SD). The comparison of perceived stress scores between online and offline learning periods was performed using the paired Student's t-test, as the same group of participants was assessed under two different conditions. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 150 first-year MBBS students were included in the study. Perceived stress was assessed during both online and offline classes using the Perceived Stress Scale (PSS). The study found that perceived stress was significantly higher among medical students during online classes compared to offline classes. The mean PSS score was 24.85 ± 5.27 during online classes and 18.01 ± 6.49 during offline classes, with a statistically significant difference ($p < 0.01$). During online classes, 65% of students had moderate stress and 33% had severe stress, whereas during offline classes, 51% had

moderate stress and only 10% had severe stress. Gender-wise analysis showed no significant difference in stress levels between male and female students. The major stressors during online classes were lack of direct interaction with teachers and peers and difficulty adapting to digital learning platforms, while during offline classes, fear of COVID-19 infection was the major stressor.

Table 1: Comparison of Perceived Stress Scores During Online and Offline Classes

Teaching Mode	Mean PSS Score ± SD
Online	24.85 ± 5.27
Offline	18.01 ± 6.49
p-value	< 0.01

The distribution of stress severity demonstrates a clear shift toward higher stress levels during online classes. Severe stress was reported in 33% of students during online learning compared to only 10% during offline classes. In contrast, mild stress was substantially more common during offline classes (39%) than during online classes (2%). Moderate stress remained the predominant category in both modes, affecting 65% of students during online classes and 51% during offline classes (Figure 1).

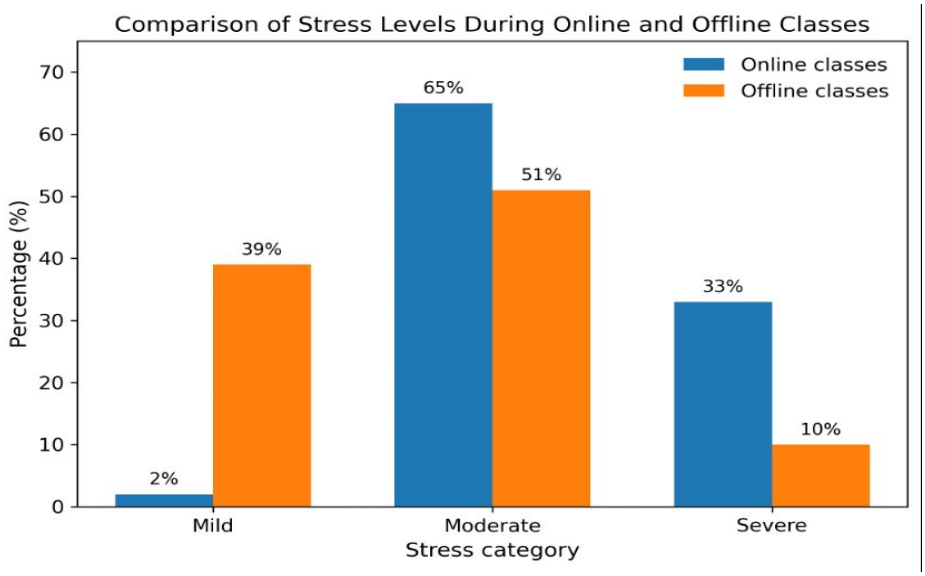

Figure 1: Comparison of stress levels (mild, moderate, severe) during online and offline classes

Gender-wise Interpretation of Stress Pattern: Gender-wise analysis revealed no statistically significant difference in stress levels between male and female students during either online or offline teaching modes, suggesting that the impact of teaching modality on perceived stress was uniform across genders (Figure 2).

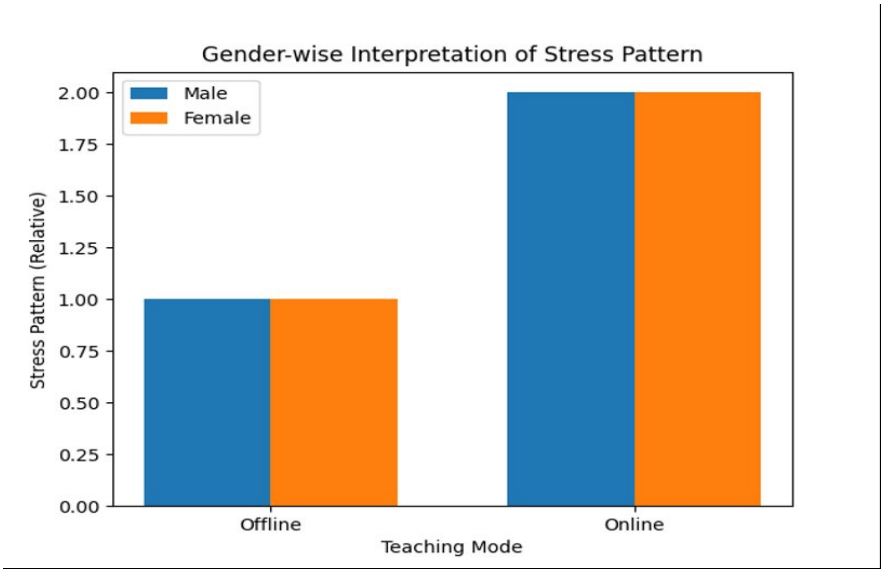

Figure 2: Gender-wise interpretation of stress pattern during online and offline classes

Major Stressors During Online and Offline Classes: The study identified distinct stressors associated with both online and offline modes of teaching. During online classes, the major contributors to stress included lack of peer interaction, reduced direct interaction with teachers, and difficulty in adapting to e-learning platforms and newer digital technologies. In contrast, during offline classes, the primary stressors were the fear of contracting COVID-19 and the possibility of transmitting the infection to family members. During online classes, more than 50% of students identified lack of direct interaction with peers and teachers and difficulty adjusting to e-learning techniques as major stressors.

Discussion

The present study demonstrates significantly higher perceived stress among first-year MBBS students during online learning compared to offline classroom teaching, as reflected by elevated PSS scores. A greater proportion of students experienced moderate to severe stress during online classes, whereas offline teaching was associated with a shift toward milder stress levels. This difference can be attributed to the lack of direct interaction with peers and faculty, reduced academic engagement, difficulty adapting to digital platforms, and disruption of structured learning routines during online education. Additionally, prolonged screen exposure and technological challenges likely contributed to mental fatigue, decreased concentration, and increased psychological burden.

Although stress levels declined with the resumption of offline classes, moderate stress persisted in a subset of students. During the COVID-19 pandemic, stress in offline settings was largely driven by fear of infection and concerns about transmitting the virus to family members. However, with the reduction of such health-related anxieties in the post-pandemic period, offline teaching provides a more supportive and interactive learning environment, making it a more effective and supportive mode of instruction. The absence of significant gender differences suggests that these stressors affect students uniformly. Overall, these findings highlight the importance of prioritizing in-person teaching, supplemented by targeted psychological support and selective integration of online methods, to optimize both learning outcomes and student well-being.

Limitations

The present study has certain limitations that should be considered while interpreting the results. Being a single-centre study conducted among first-year MBBS students, the findings may not be generalizable to students from other academic years or institutions. The cross-sectional design limits the ability to establish a causal relationship between teaching modality and stress levels. Although the Perceived Stress Scale (PSS-10) is a validated tool, reliance on self-reported responses may introduce minimal response bias. Additionally, factors such as individual coping strategies and prior exposure to online learning were not specifically analysed. The study also did not assess long-term psychological outcomes, which could provide further insight into the sustained effects of stress.

Conclusion

Perceived stress levels among medical students were significantly higher during online learning compared to offline classroom teaching, indicating that the shift to digital education, while necessary, imposed a considerable psychological burden. Factors such as reduced peer and teacher interaction, difficulty adapting to e-learning platforms, prolonged screen exposure, and disruption of routine academic structure likely contributed to this increased stress. Although stress levels declined with the resumption of offline classes, a notable proportion of students continued to experience moderate stress, suggesting that the impact of the pandemic and altered learning environments may persist. These findings highlight the need for educational institutions to adopt balanced and student-centered approaches, including hybrid education models that integrate both online and face-to-face learning, along with interactive teaching strategies to enhance engagement. Furthermore, the incorporation of early stress-management programs, regular psychological counseling, and supportive academic environments is essential to promote mental well-being and ensure effective learning among medical students in the evolving post-pandemic era.

Acknowledgements: The authors acknowledge the first-year MBBS students of SABVMCRI, Bengaluru, for their willing participation in this study, and the Department of Physiology for institutional support.

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