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Psychological Impact of Medical Education: Stress, Anxiety, Burnout, and the Mediating Role of Coping Mechanisms Among Medical Students

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ABSTRACT

Medical education is widely recognized as one of the most psychologically demanding academic fields, exposing students to heavy workloads, frequent examinations, and clinical responsibilities. This study examined the relationships among stress, anxiety, burnout, and coping mechanisms among undergraduate medical students, and tested coping mechanisms as a mediator of the stress–anxiety relationship. A quantitative, cross-sectional survey was administered to 300 undergraduate medical students (46.0% male, 54.0% female) across academic years at medical colleges in Khyber Pakhtunkhwa, Pakistan, recruited via purposive sampling. Stress and anxiety were assessed with the Depression Anxiety Stress Scale-21, burnout with the Maslach Burnout Inventory, and coping mechanisms with the Brief COPE Scale. Stress was significantly positively correlated with anxiety ($r = .49$, $p < .001$) and burnout ($r = .48$, $p < .001$), and significantly positively correlated with coping mechanisms ($r = .33$, $p < .001$), while coping mechanisms were significantly negatively correlated with anxiety ($r = –.18$, $p = .002$). Regression analysis showed stress significantly predicted anxiety ($\beta = .49$, $R^2 = .24$, $p < .001$) and burnout ($\beta = .48$, $R^2 = .23$, $p < .001$). Mediation analysis (Hayes' PROCESS Model 4) confirmed that coping mechanisms partially mediated the relationship between stress and anxiety (indirect effect $B = –0.11$, 95% CI [–0.17, –0.07]), with a significant direct effect remaining ($B = 0.57$, $p < .001$). Findings underscore the considerable psychological burden of medical education and support the integration of early mental health screening, stress management programs, coping-skills training, and institutional counseling services in medical colleges.

Keywords: *medical education, stress, anxiety, burnout, coping mechanisms, medical students, psychological distress*

INTRODUCTION

Medical education is consistently identified as one of the most academically and psychologically demanding fields of study, characterized by intense workloads, frequent high-stakes examinations, and demanding clinical duties (Dyrbye et al., 2006). Reported rates of psychological distress among medical students are consistently higher than among students in other academic disciplines, with international meta-analytic evidence indicating that anxiety alone affects roughly a third of medical students worldwide, with rates exceeding 40% in some national contexts (Quek et al., 2019).

When academic and personal stressors overwhelm a student's capacity to cope, chronic stress can escalate into anxiety—a persistent state of worry, nervousness, and fear rooted in academic competition and concerns about professional competence (Dyrbye et al., 2006)—and, without adequate management, into burnout: a syndrome combining emotional exhaustion, depersonalization, and a diminished sense of personal accomplishment (Maslach & Jackson, 1981). Burnout has drawn particular concern in medical training because it affects not only students' immediate mental health and motivation but also their longer-term professional behavior and quality of patient care (Fares et al., 2016; Ishak et al., 2013).

Coping lies at the center of how stress translates—or fails to translate—into psychological distress. The Transactional Model of Stress and Coping (Lazarus & Folkman, 1984) holds that stressors are cognitively appraised, after which individuals deploy problem-focused or emotion-focused coping strategies to manage them (Carver et al., 1989). Problem-focused strategies—such as active coping, planning, and seeking social support—have been associated with fewer psychological difficulties and better academic adjustment, whereas avoidant strategies such as denial and behavioral disengagement may relieve distress briefly but often increase it over time (Al-Dubai et al., 2011; Fares et al., 2016).

Despite growing recognition of these issues, comprehensive research examining stress, anxiety, burnout, and coping together—rather than in isolation—remains limited, particularly within South Asian medical education contexts. Understanding how these constructs interrelate, and specifically whether coping mechanisms buffer the psychological impact of stress, is essential for identifying at-risk students and designing effective institutional interventions (Dyrbye et al., 2006; Quek et al., 2019). The present study addresses this need by examining the interplay of stress, anxiety, burnout, and coping mechanisms among undergraduate medical students in Khyber Pakhtunkhwa, guided by the following hypotheses:

- H1: Stress is positively associated with anxiety among medical students.
- H2: Stress is positively associated with burnout among medical students.
- H3: Stress is significantly related to coping mechanisms among medical students.
- H4: Coping mechanisms are significantly associated with anxiety levels among medical students.
- H5: Coping mechanisms mediate the relationship between stress and anxiety among medical students.

METHOD

Design

A quantitative, cross-sectional survey design was used to examine the relationships among stress, anxiety, burnout, and coping mechanisms among medical students, allowing data to be collected directly from students' self-reported experiences without experimental manipulation of their environment.

Participants

Participants were 300 undergraduate medical students recruited via purposive sampling from various medical colleges in Khyber Pakhtunkhwa, Pakistan. The sample comprised 46.0% male and 54.0% female students, distributed across the first year (17.3%), second year (19.3%), third year (22.0%), fourth year (20.0%), and final year (21.3%) of study. Data were collected via paper-and-pencil questionnaires (61.3%) administered in person in classrooms and lecture halls, and via an online survey (38.7%) for students on clinical rotations or in remote hostels. Inclusion required current enrollment and active attendance in an undergraduate medical program; postgraduate trainees, non-medical students, and incomplete or improperly completed responses were excluded.

Measures

Stress and anxiety were assessed using the relevant subscales of the 21-item Depression Anxiety Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995), each comprising 7 items rated on a 4-point severity/frequency scale. **Burnout** was assessed with the 22-item Maslach Burnout Inventory (MBI; Maslach & Jackson, 1981), covering emotional exhaustion, depersonalization, and personal accomplishment, rated on a 7-point frequency scale. **Coping mechanisms** were assessed with the 28-item Brief COPE Scale (Carver, 1997), covering 14 subscales of problem- and emotion-focused coping strategies (e.g., active coping, planning, denial, self-blame), combined into a total coping score for the primary analyses.

Procedure

After providing informed consent, participants completed a survey packet containing the DASS-21, MBI, and Brief COPE Scale, taking approximately 5 to 10 minutes to complete. All responses were collected and processed anonymously and confidentially for academic research purposes.

Data Analysis

Data were analyzed in SPSS. Descriptive statistics and reliability analysis (Cronbach's alpha) characterized the sample and study measures. Pearson correlations examined bivariate associations among stress, anxiety, burnout, and coping mechanisms. Linear regression analyses tested stress as a predictor of anxiety and burnout. Mediation was tested using Hayes' PROCESS Macro (Model 4), examining coping mechanisms as a mediator of the stress–anxiety relationship, with bootstrapped 95% confidence intervals for the indirect effect. Statistical significance was set at $p < .05$.

Ethical Considerations

Informed consent was obtained in writing from all participants prior to data collection, with the study's goals and confidentiality protections explained in detail. Data files were password-protected to restrict access, and data were made available only to the researcher and supervisor for academic or verification purposes.

RESULTS

The sample comprised 300 undergraduate medical students (138 male, 162 female), with strong representation across all academic years and a majority of responses collected via paper-and-pencil administration (61.3%) versus online survey (38.7%).

Table 1 *Reliability and Descriptive Statistics for Study Measures (N = 300)*

Scale	Items	Cronbach's α	M	SD
Stress	7	.86	18.23	5.15
Anxiety	7	.84	14.18	4.79
Burnout	22	.89	58.84	11.77
Coping Mechanisms	28	.78	68.28	9.86

Note. All scales demonstrated acceptable-to-good internal consistency (α > .70).

Descriptive statistics indicated moderate levels of stress and anxiety, a moderate-to-high level of burnout, and moderate levels of coping mechanism use among the sample.

Table 2 *Pearson Correlations Among Study Variables (N = 300)*

Variable	1	2	3	4
1. Stress	—			
2. Anxiety	.49**	—		
3. Burnout	.48**	.45**	—	
4. Coping Mechanisms	.33**	-.18**	-.14*	—

*Note. *p < .05. **p < .01.*

Stress was significantly positively correlated with anxiety (r = .49, p < .001) and burnout (r = .48, p < .001), indicating that students reporting higher stress also reported higher anxiety and burnout. Stress was also significantly positively correlated with coping mechanisms (r = .33, p < .001), indicating that students experiencing greater stress reported using more coping strategies. Coping mechanisms were significantly negatively correlated with anxiety (r = –.18, p = .002), indicating that greater coping strategy use was associated with lower anxiety.

Table 3 *Regression Analyses Predicting Anxiety and Burnout From Stress*

Outcome	Predictor	B	SE	β	t	p	R^2
Anxiety	Stress	0.46	0.05	.49	9.72	< .001	.24
Burnout	Stress	1.10	0.12	.48	9.47	< .001	.23

Note. N = 300 for both models.

Stress significantly predicted anxiety, β = .49, t(298) = 9.72, p < .001, explaining 24% of the variance (R^2 = .24). Stress also significantly predicted burnout, β = .48, t(298) = 9.47, p < .001, explaining 23% of the variance (R^2 = .23), supporting H1 and H2.

Table 4 *Mediation Analysis of Coping Mechanisms in the Relationship Between Stress and Anxiety*

Path	B	SE	t	p	95% CI
Stress → Coping Mechanisms	0.62	0.10	5.93	< .001	[0.42, 0.83]
Coping Mechanisms → Anxiety	-0.18	0.02	-7.70	< .001	[-0.23, -0.14]
Stress → Anxiety (direct effect)	0.57	0.05	12.56	< .001	[0.48, 0.66]
Stress → Coping → Anxiety (indirect)	-0.11	—	—	—	[-0.17, -0.07]

Note. N = 300. The indirect effect is significant, as the 95% confidence interval excludes zero.

Mediation analysis using Hayes' PROCESS Model 4 showed that stress significantly predicted coping mechanisms (Path a), and coping mechanisms significantly predicted anxiety (Path b). Stress remained a significant direct predictor of anxiety after coping mechanisms were entered into the model, and the indirect effect of stress on anxiety through coping mechanisms was significant, as the bootstrap confidence interval excluded zero. This pattern indicates that coping mechanisms partially mediate the relationship between stress and anxiety, supporting H4 and H5. All hypotheses were supported (see Table 5).

Table 5 *Summary of Hypothesis Testing*

Hypothesis	Statement	Result	Decision
H1	Stress is positively associated with anxiety.	r = .49, p < .001	Supported
H2	Stress is positively associated with burnout.	r = .48, p < .001	Supported

H3	Stress is significantly related to coping mechanisms.	r = .33, p < .001	Supported
H4	Coping mechanisms are significantly associated with anxiety.	r = -.18, p = .002	Supported
H5	Coping mechanisms mediate the stress–anxiety relationship.	Indirect effect sig., 95% CI [-0.17, -0.07]	Supported (partial mediation)

DISCUSSION

This study examined the psychological impact of medical education by testing the interrelationships among stress, anxiety, burnout, and coping mechanisms in 300 undergraduate medical students, and testing coping mechanisms as a mediator of the stress–anxiety relationship. All five hypotheses were supported.

Consistent with H1, stress was significantly positively associated with anxiety (r = .49), replicating well-established findings that medical students experience elevated rates of psychological distress during training (Dyrbye et al., 2006; Quek et al., 2019). This pattern is also consistent with Dahlin et al.'s (2005) finding that stress in medical students is closely tied to depressive and anxiety-related symptoms, likely reflecting the combined burden of regular assessments, academic competition, clinical demands, and performance pressure characteristic of medical training.

Consistent with H2, stress was significantly positively associated with burnout (r = .48), aligning with prior findings that medical students report disproportionately high burnout relative to the general population (Dyrbye et al., 2014; Ishak et al., 2013). Burnout, as conceptualized by Maslach and Jackson (1981) in terms of emotional exhaustion, depersonalization, and diminished personal accomplishment, is understood to emerge when chronic academic and emotional stress outpaces students' available psychological resources—a pattern also documented by Fares et al. (2016) in relation to heavy workload, sleep disturbance, and clinical duties.

Consistent with H3, stress was significantly positively associated with coping mechanism use (r = .33), consistent with the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), which holds that coping responses are activated in reaction to perceived stress rather than occurring independently of it. This is consistent with Al-Dubai et al.'s (2011) finding that medical students facing academic stress commonly draw on active coping, religion, acceptance, and social support, and indicates that medical students are not passive recipients of stress but actively attempt to manage it, with the adaptiveness of the specific strategy used likely shaping its ultimate effectiveness.

Consistent with H4, coping mechanisms were significantly negatively associated with anxiety (r = –.18), consistent with the view that adaptive coping strategies such as planning, active coping, and positive reframing can help alleviate emotional distress (Folkman & Lazarus, 1980), and with Bassols et al.'s (2014) finding that more adaptive coping styles are associated with better psychological adjustment among medical students. Notably, this correlation was considerably weaker than the stress–anxiety association, suggesting that while coping mechanisms may reduce anxiety, they do not fully protect students against it; other unmeasured factors—academic performance, sleep quality, financial pressure, family expectations, personality traits, and social support—likely also shape anxiety levels.

The mediation analysis provides the clearest theoretical contribution of this study: coping mechanisms significantly, but only partially, mediated the relationship between stress and anxiety, with a substantial direct effect of stress on anxiety remaining even after accounting for coping. This pattern is consistent with the Transactional Model's premise that stress does not automatically translate into psychological distress but is shaped by how it is appraised and managed (Lazarus & Folkman, 1984), and echoes Carver's (1997) emphasis on coping responses as a key determinant of adaptation to stressful events. At the same time, the

persistence of a strong direct effect indicates that coping mechanisms alone are insufficient to fully protect medical students from anxiety, pointing to a need for institutional-level support alongside individual coping-skills development.

Implications

These findings carry direct implications for medical colleges and student-support services. Given the close relationship between stress and both anxiety and burnout, institutions should consider routine mental health screening to enable early identification and intervention. Structured coping-skills training—covering active coping, time management, relaxation, mindfulness, and social support-seeking—may help reduce anxiety, given its association with reduced anxiety and its partial mediating role in this study. Confidential counseling services are also important, as stigma and fear of judgment may otherwise deter students from seeking psychological help. Finally, faculty and administrators should remain attentive to the psychological demands of medical training, with supportive teaching practices, realistic academic workloads, mentoring, and student-friendly assessment systems all potentially contributing to reduced stress and burnout.

Limitations

Several limitations should be considered. The cross-sectional survey design precludes causal inference; although stress was significantly correlated with anxiety and burnout, this design cannot establish that stress directly causes these outcomes. Reliance on self-report questionnaires introduces potential response bias and social desirability effects. Purposive sampling, while practical, may limit the generalizability of findings to medical students outside Khyber Pakhtunkhwa or to postgraduate trainees. Additionally, coping was assessed as a single composite variable in the primary analyses, despite encompassing both adaptive and maladaptive strategies with likely divergent effects on well-being; future research should examine specific coping subtypes separately rather than as an aggregate score.

Future Directions

Future research should employ longitudinal designs to clarify the causal and temporal relationships among stress, anxiety, burnout, and coping, and should disaggregate coping mechanisms into adaptive and maladaptive subtypes to identify which specific strategies most effectively buffer psychological distress. Incorporating academic performance, sleep quality, financial pressure, and social support as additional predictors would help explain the substantial anxiety variance left unaccounted for by stress and coping alone. Comparative studies across academic years, clinical versus pre-clinical training stages, and different institutional contexts would further clarify when and for whom psychological risk is greatest.

CONCLUSION

This study demonstrates that medical education carries a considerable psychological burden, with stress significantly associated with anxiety and burnout among undergraduate medical students, and coping mechanisms significantly, if only partially, buffering the impact of stress on anxiety. These findings underscore the importance of early mental health screening, structured coping-skills training, confidential counseling services, and broader institutional support systems in medical colleges to protect students' psychological well-being throughout their training.

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