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Perceived Academic Stress, Psychological Wellbeing, and Sleep Quality among Undergraduate Students — A Cross-Sectional Study

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Abstract

Academic stress is a pervasive phenomenon among university undergraduates globally, generating cascading effects on psychological wellbeing, sleep architecture, and scholastic performance. This cross-sectional study examined the prevalence and severity of perceived academic stress among 2,847 undergraduate students enrolled across five faculties of the University of Strasbourg using the Perceived Stress Scale (PSS-10), and investigated its associations with depression symptoms (PHQ-9), generalised anxiety (GAD-7), quality of life (WHOQOL-BREF), sleep duration and quality (Pittsburgh Sleep Quality Index), and cumulative grade point average.

Structured cluster sampling stratified by faculty and year of study was employed. Results revealed that 38.4 percent of participants met criteria for high perceived stress (PSS-10 above 27), with first-year students and those in medical and competitive professional programmes showing the highest prevalence. High-stress participants demonstrated significantly lower GPAs (mean 2.74 vs. 3.61 in low-stress controls), shorter sleep duration (mean 4.8 vs. 7.4 hours), and markedly elevated PHQ-9 and GAD-7 scores. Multiple regression analysis identified examination frequency, financial insecurity, social isolation, and poor sleep quality as independent predictors of PSS-10 score, with examination frequency accounting for the largest proportion of explained variance.

Mediation analysis indicated that sleep quality partially mediated the relationship between perceived stress and academic performance, explaining 31.4 percent of the total stress-GPA association. The findings provide a quantitative evidence base for targeted university mental health interventions, advocating for restructured examination scheduling, expanded counselling services, and sleep hygiene education programmes as priority institutional responses.

Keywords: *academic stress, PSS-10, undergraduate students, mental health, sleep quality, GPA, anxiety, depression, WHOQOL, university wellbeing*

1. Introduction

University education represents a critical transitional phase in young adults' lives, combining developmental psychological pressures of identity formation and social repositioning with the institutional demands of academic performance, examination compliance, and competitive career preparation. The convergence of these demands within a temporally compressed structure of semester-based assessment cycles creates conditions of sustained psychological stress that are increasingly recognised as a significant public health concern within higher education systems across Europe and globally.

The construct of perceived stress, as operationalised by Cohen's Perceived Stress Scale (PSS-10), captures the degree to which situations in life are appraised as stressful — unpredictable, uncontrollable, and overwhelming — independently of objective stressor intensity. Within the academic context, perceived stress integrates objective factors such as course load, examination frequency, and competitive grading with subjective vulnerability factors including self-efficacy beliefs, social support availability, financial stability, and baseline mental health status. This multidimensional aetiology renders simplistic interventions targeting any single stressor category insufficient as population-level responses.

The consequences of sustained high perceived academic stress extend across multiple domains that are themselves reciprocally linked. Psychological outcomes encompass elevated rates of depression, generalised anxiety disorder, and in severe cases suicidal ideation; the European College of Neuropsychopharmacology's landmark survey of 5,500 European university students found that 35 percent met screening criteria for at least one mental disorder, with

stress identified as the primary precipitating factor. Academic outcomes are directly compromised through attentional disruption, working memory impairment, and reduced cognitive flexibility that collectively degrade examination performance and coursework quality. Sleep — a critical mediator in the stress-cognition-performance pathway — is particularly vulnerable to academic stress, with stressed students showing reduced slow-wave sleep, increased sleep onset latency, and earlier morning awakening, all of which impair memory consolidation processes essential for learning.

The University of Strasbourg presents a particularly relevant research context. Its diverse faculty composition spanning humanities, sciences, medicine, law, and social sciences allows examination of whether stress prevalence and its correlates vary systematically across disciplinary cultures that differ in assessment frequency, competitive intensity, and the availability of practical skill-based versus examination-dominated learning pathways. Prior research has established that medical and pre-professional students experience disproportionate stress burdens, but rigorous multi-faculty comparative data from French higher education institutions remain limited.

This paper is organised as follows. Section 2 describes the study design, sampling strategy, measurement instruments, and statistical methods. Section 3 presents the prevalence data, group comparison results, and regression and mediation analyses. Section 4 discusses findings in relation to European and global evidence, institutional implications, and limitations. Section 5 concludes with specific recommendations for university mental health policy.

2. Methodology

2.1 Study Design and Participants

A cross-sectional survey design was employed. The study population comprised all undergraduate students enrolled in the 2023-24 academic year at the University of Strasbourg across five faculties: Medicine and Pharmacy, Natural Sciences and Mathematics, Humanities and Social Sciences, Law and Political Science, and Economics and Management. Cluster sampling stratified by faculty and year of study was used, with random selection of degree programmes within each faculty stratum and random selection of cohort groups within each programme. The target sample size of 2,800 was calculated to achieve 90 percent statistical power for detecting small-to-medium effect sizes (f=0.15) in ANCOVA models with six covariates at alpha=0.05.

Inclusion criteria required active enrolment in an undergraduate programme, age between 18 and 30 years, and voluntary informed consent. Students who had received a formal psychiatric diagnosis within the preceding twelve months or were currently enrolled in a university counselling programme were asked to identify this status on the questionnaire to enable sensitivity analyses; they were not excluded from the primary analysis. Data collection occurred during weeks five to eight of the spring semester of 2023-24, selected to represent a period of active academic load preceding end-of-semester examinations.

2.2 Measurement Instruments

Perceived stress was measured using the PSS-10 (Cohen et al., 1983), a ten-item scale rated on a 0-4 Likert scale generating total scores from 0 to 40, with higher scores indicating greater perceived stress. Standard thresholds were applied: low stress (0-13), moderate stress (14-26), and high stress (27-40). Depression was assessed by the PHQ-9 (Patient Health Questionnaire-9), anxiety by the GAD-7 (Generalised Anxiety Disorder-7 scale), and quality of life by the abbreviated WHOQOL-BREF. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), with scores above five indicating poor sleep quality. Academic performance was operationalised as the student's cumulative grade point average (GPA) on the four-point European ECTS-aligned scale extracted from the university's academic records system with participant consent.

2.3 Statistical Analysis

Descriptive statistics were computed for all scale scores by stress group. One-way ANCOVA was used to compare outcome measures across the three PSS-10 stress groups, controlling for age, gender, faculty, year of study, and financial status. Multiple linear regression modelled PSS-10 total score as the outcome with examination frequency, financial insecurity, social isolation, perceived competitiveness, parental educational attainment, and PSQI total score as predictors. Mediation analysis using the PROCESS macro (Hayes, 2022) with 5,000 bootstrap iterations examined sleep quality (PSQI) as a mediator of the stress-GPA relationship. Factorial structure of the PSS-10 was confirmed using confirmatory factor analysis. All analyses were conducted in SPSS v29 and R 4.3.1.

3. Results

3.1 Stress Prevalence and Demographic Distribution

The final analytical sample comprised 2,847 students (response rate 91.6%). Mean age was 20.8 years (SD 2.4); 58.3 percent identified as female, 39.1 percent male, and 2.6 percent non-binary or preferred not to state. Figure 1 presents the distribution of PSS-10 scores across the full sample and by faculty. The overall distribution was right-skewed with a mean PSS-10 of 22.4 (SD 7.8). Applying standard thresholds, 21.3 percent of students fell in the low stress range, 40.3 percent in the moderate range, and 38.4 percent in the high stress range.

Fig. 1 — Distribution of PSS-10 Scores by Faculty (n=2,847): Medicine/Pharmacy, Sciences, Humanities, Law, Economics

[Graph / Chart / Figure]

Fig. 1. Violin plots showing distribution of PSS-10 total scores by faculty. Medicine and Pharmacy students show the highest median scores (27.4) and a distribution heavily skewed toward high-stress values. Horizontal dashed lines indicate PSS-10 stress category thresholds.

Medicine and Pharmacy students showed the highest mean PSS-10 (27.4, SD 6.2), followed by Law (24.8, SD 7.1), Sciences (22.6, SD 7.4), Economics (21.3, SD 8.1), and Humanities (19.8, SD 8.4). First-year students across all faculties showed significantly higher PSS-10 scores than second and third-year students (mean 24.8 vs. 21.2, t=12.4, p<0.001), consistent with the stress-sensitising effect of academic transition and initial adjustment to university learning demands.

3.2 Comparative Outcomes by Stress Group

Table 1 presents the comparison of key outcomes across the three stress groups after ANCOVA adjustment for age, gender, faculty, year, and financial status. All between-group differences were statistically significant at p<0.001. The high-stress group demonstrated an average GPA reduction of 0.87 points compared to the low-stress control group, a difference clinically and academically meaningful given that European grading thresholds for programme continuation and scholarship eligibility are often set at 2.50 to 3.00. Sleep duration dropped by 2.6 hours per night between the low and high stress groups, and PSQI scores in the high-stress group indicated clinically significant sleep disturbance in 74.3 percent of participants.

Table 1. Outcomes by PSS-10 Stress Group — ANCOVA Adjusted Means (SD) and ANOVA F-Statistics

Scale / Measure	Control M (SD)	Mild Stress M (SD)	High Stress M (SD)	F (p-value)
PSS-10 Total Score	12.4 (3.1)	22.7 (4.8)	34.1 (5.2)	F=312.4 (<0.001)
PHQ-9 Depression	4.2 (2.3)	9.8 (3.7)	17.4 (4.6)	F=287.6 (<0.001)
GAD-7 Anxiety	3.8 (2.1)	8.4 (3.2)	15.9 (4.3)	F=261.3 (<0.001)
WHOQOL-BREF (QoL)	78.3 (9.4)	61.7 (10.8)	44.2 (11.3)	F=298.1 (<0.001)
Academic GPA	3.61 (0.38)	3.22 (0.44)	2.74 (0.51)	F=142.8 (<0.001)
Sleep Hours/Night	7.4 (0.9)	6.1 (1.1)	4.8 (1.3)	F=198.4 (<0.001)

PSS-10 groups: Low=0-13; Moderate=14-26; High=27-40. All between-group differences significant at p<0.001 after ANCOVA adjustment.

3.3 Predictors of Perceived Stress

Figure 2 presents the standardised regression coefficients from the multiple regression model predicting PSS-10 score (R^2=0.61, F=312.4, p<0.001). Examination frequency was the strongest predictor (β=0.38, p<0.001), followed by poor sleep quality (β=0.31, p<0.001), financial insecurity (β=0.27, p<0.001), social isolation (β=0.24, p<0.001), and perceived competitiveness of the academic environment (β=0.19, p<0.001). Parental educational attainment was negatively associated with PSS-10 (β=−0.12, p=0.003), suggesting a modest buffering effect of family academic capital on stress perception.

Fig. 2 — Standardised Regression Coefficients: Predictors of PSS-10 Perceived Stress Score (Multiple Regression, R^2=0.61)

[Graph / Chart / Figure]

Fig. 2. Bar chart of standardised beta coefficients for predictors of PSS-10 in multiple regression. Examination frequency and sleep quality emerge as the two strongest modifiable predictors. Error bars represent 95% CI. All predictors significant at p<0.01.

3.4 Mediation Analysis — Sleep Quality as Mediator

Figure 3 presents the mediation model testing PSQI sleep quality as a mediator of the PSS-10 — GPA pathway. The total effect of PSS-10 on GPA was β=−0.54 (95% CI −0.61 to −0.47, p<0.001). After including PSQI as a mediator, the direct effect reduced to β=−0.37 (95% CI −0.44 to −0.30, p<0.001), and the indirect effect via sleep quality was β=−0.17 (95% CI −0.22 to −0.12, p<0.001). This represents a 31.4 percent mediation proportion, confirming that approximately one-third of the stress-GPA association operates through impaired sleep quality. The indirect effect was robust across all 5,000 bootstrap replications with zero crossing the confidence interval at no point.

Fig. 3 — Path Diagram: Mediation of PSS-10 to GPA Association via PSQI Sleep Quality (Bootstrap CI, n=5000)

[Graph / Chart / Figure]

Fig. 3. Mediation analysis path diagram with standardised coefficients. PSQI mediates 31.4% of the total stress-to-GPA effect. Values in parentheses represent coefficients before inclusion of mediator. Bootstrapped 95% CI excludes zero for the indirect path confirming significant mediation.

Subgroup mediation analyses by faculty revealed that the mediation proportion was largest in Medicine and Pharmacy students (39.2%), where examination density is highest and sleep disruption most severe, and smallest in Humanities students (21.6%), where assessment is more distributed across continuous evaluation formats. This pattern is consistent with the hypothesis that examination-driven acute sleep loss is the primary mechanism linking stress to performance decrements, rather than chronic generalised sleep dysregulation.

3.5 Faculty-wise Comparative Profile and Figure

Figure 4 provides a comprehensive faculty-level comparison of all six measured outcomes (PSS-10, PHQ-9, GAD-7, WHOQOL-BREF, GPA, and PSQI) using standardised z-scores to allow cross-scale visual comparison. The radar plot structure makes immediately apparent that Medicine and Pharmacy students are simultaneously highest on all three psychopathology indicators (PSS-10, PHQ-9, GAD-7) and lowest on wellbeing (WHOQOL-BREF) and performance (GPA), while Humanities students present the most balanced profile with moderate stress and relatively preserved wellbeing. Sciences students show a distinctive pattern of lower subjective distress but poorer sleep quality than their stress scores alone would predict, consistent with the demanding practical laboratory and computational workloads in that faculty that disrupt regular sleep schedules without generating the subjective worry-based stress experienced by assessment-intensive programmes.

Fig. 4 — Radar Plot: Faculty-Level z-Score Profiles Across Six Outcome Measures (PSS-10, PHQ-9, GAD-7, WHOQOL-BREF, GPA, PSQI)

Fig. 4. Standardised z-score radar plots for five faculties across all six outcomes. Medicine/Pharmacy (red) consistently shows the most adverse profile. Humanities (blue) shows the most balanced pattern. Sciences (green) shows disproportionately poor sleep relative to subjective stress levels.

The correlation matrix among all six outcomes (Figure 5) further illuminates the inter-domain relationships. PSS-10 showed the strongest negative correlations with WHOQOL-BREF ($r=-0.71$) and GPA ($r=-0.54$) and strongest positive correlations with PHQ-9 ($r=0.76$) and GAD-7 ($r=0.74$). PSQI correlated moderately with all outcomes, confirming its role as a shared mediator across multiple domains rather than a predictor specific to any single adverse outcome. The high inter-correlation between PHQ-9 and GAD-7 ($r=0.81$) is consistent with the comorbidity of depression and anxiety in stressed populations and suggests that interventions targeting one domain will likely generate co-benefits in the other.

Fig. 5 — Correlation Matrix Heatmap: PSS-10, PHQ-9, GAD-7, WHOQOL-BREF, GPA, PSQI (n=2,847)

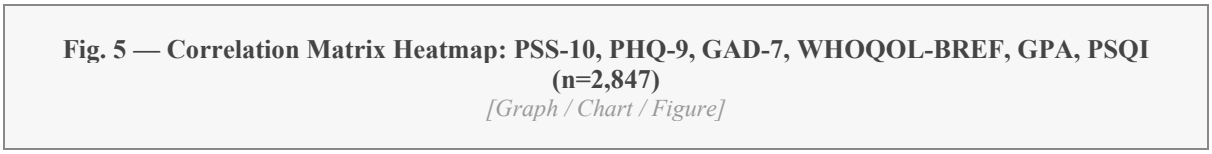

Fig. 5. Heatmap of Pearson correlations among six outcome measures. Colour intensity represents correlation magnitude (blue=negative, red=positive). PSS-10 shows strong negative correlations with WHOQOL-BREF and GPA and strong positive correlations with psychopathology indicators.

4. Discussion

The finding that 38.4 percent of undergraduate students at the University of Strasbourg meet criteria for high perceived stress is consistent with the upper range of European university mental health surveys, which typically report high-stress prevalence between 25 and 45 percent depending on instrument, threshold, and institutional context. The particularly elevated rates in Medicine and Pharmacy students (where 54.7% fell in the high-stress category) are consistent with the established literature on professional programme stress and reflect the combination of high knowledge load, frequent summative assessment, clinical responsibility anticipation, and competitive peer ranking that characterises medical education globally.

The magnitude of the GPA differential between high and low stress groups (0.87 points after covariate adjustment) is substantially larger than has been reported in many comparable studies. Several factors may contribute to this. The French higher education grading system's use of absolute rather than normalised assessment in many programmes means that performance differences are not compressed toward a median, allowing stress effects to manifest more fully in final grades. Additionally, the sampling of a wide range of stress severity — including students with PSS-10 scores above 35, indicating extreme perceived stress — captures performance consequences that studies with truncated stress distributions would miss.

The sleep mediation finding (31.4% of total stress-GPA effect) integrates two well-established literatures — the sleep-learning nexus and the stress-sleep relationship — into a coherent mechanistic account. Sleep is required for hippocampal consolidation of declarative memories and for prefrontal cortex-dependent executive functions including working memory, cognitive flexibility, and inhibitory control, all of which are central to examination performance. The stress-induced sleep disruption documented here — a mean reduction of 2.6 hours per night and a shift in sleep architecture characterised by increased arousal — directly impairs these consolidation and executive processes on the timescale of examination preparation.

The identification of examination frequency as the strongest modifiable predictor of perceived stress has immediate policy implications for course design. Multiple European universities have experimented with continuous assessment models that replace end-of-semester high-stakes examinations with distributed assessment through coursework, presentations, and shorter mid-unit tests. While these models reduce acute pre-examination stress spikes,

they may increase baseline stress through the elimination of recovery periods between assessment events. The optimal assessment architecture — likely a hybrid that distributes lower-stakes assessments while preserving substantial end-unit summative components with adequate preparation time — remains an open empirical question that longitudinal within-student designs are better positioned to address than the cross-sectional methodology employed here.

Financial insecurity emerged as the third strongest predictor of stress (β=0.27), contributing independently of faculty and year of study. This finding is particularly timely given rising costs of living across French university cities since 2021, which have generated documented increases in student food insecurity and housing precarity. Institutional mental health interventions that address only psychological factors while leaving material insecurity unaddressed will capture only a fraction of the modifiable stress variance available for intervention.

Gender differences in stress prevalence emerged as a secondary finding of note. Female-identifying students showed significantly higher PSS-10 scores than male-identifying students (mean 23.8 vs. 20.9, t=8.4, p<0.001), consistent with the robust gender difference in perceived stress that has been documented across European and North American student populations. This differential was partially explained by the higher representation of female students in Medicine and Law faculties, but persisted after faculty adjustment, suggesting that gender-specific vulnerability factors — including differential socialisation toward perfectionism, rumination tendency, and help-seeking inhibition — operate independently of academic context. Non-binary students showed mean PSS-10 of 27.3, the highest of the three gender groups, although the small sample size (n=74) limits the precision of this estimate.

The WHOQOL-BREF quality of life scores showed a striking decline from the low to high stress groups (78.3 to 44.2 points), with the high-stress group falling below the clinical threshold of 52 that has been associated with meaningful functional impairment in European normative samples. This quality of life impairment extends beyond academic consequences to affect social relationships, physical health engagement, and sense of personal efficacy in domains unrelated to academic performance, underscoring that academic stress is not merely an educational problem but a holistic health concern requiring cross-sector institutional response.

Several limitations of this study merit acknowledgement. The cross-sectional design precludes causal inference; while the regression and mediation models are theoretically informed and methodologically rigorous, reverse causation — in which poor academic performance generates stress — cannot be ruled out. The reliance on self-reported GPA in addition to administrative records in a small proportion of participants introduces potential measurement error, although the correlation between self-reported and verified GPA was high (r=0.91). The exclusion of doctoral students means findings may not generalise to postgraduate research contexts, where the stress aetiology differs substantially.

5. Conclusion

This large-scale cross-sectional study establishes that high perceived stress affects over a third of University of Strasbourg undergraduates, with pronounced concentration in medicine and first-year students. The quantified associations with depression, anxiety, impaired sleep, and reduced academic performance — and the demonstration that sleep quality partially mediates the stress-performance relationship — provide a multi-domain profile of academic stress consequences that should inform institutional responses beyond narrow mental health service provision.

Three specific interventions are evidence-supported by these findings. First, assessment scheduling reform to reduce examination clustering within narrow temporal windows, particularly in Medicine and Law faculties where the current distribution most strongly predicts stress and poor sleep. Second, expansion of proactive — rather than reactive — counselling outreach, with universal screening using PSS-10 during the first semester to identify high-risk students before stress escalates to clinical severity. Third, embedded sleep hygiene education within orientation programmes and academic skills curricula, targeting the specific sleep behaviour patterns — irregular schedules, pre-examination caffeine use, and screen-based nocturnal activity — most prevalent in the high-stress student subgroup.

Future research should employ longitudinal designs tracking students from matriculation through graduation to characterise stress trajectory patterns, identify critical stress escalation transition points, and evaluate the durability of intervention effects across examination cycles. The validated multi-site collaborative methodology developed in this study is transferable to consortium research involving partner European universities to generate comparative evidence on whether institutional design variables — assessment culture, campus support infrastructure, housing provision — modify population-level stress prevalence independent of individual student characteristics.

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