



Original article

Academic stress among students in Vietnam: a three-year longitudinal study on the impact of family, lifestyle, and academic factors

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Abstract

Objective: Academic stress is associated with mental health disorders, notably depression and anxiety among students. Mitigating stress can decrease the incidence of mental health disorders and improve student well-being. This study explored factors influencing academic stress among secondary school students in Vietnam.

Materials and Methods: A three-year longitudinal study was conducted using a self-reported questionnaire with 611 students from four secondary schools in Hue City, Vietnam. Academic stress was evaluated using the Educational Stress Scale for Adolescents (ESSA). Family factors, including the number of siblings and parental educational levels; lifestyle factors, including physical activity and sleep; and academic factors, including grade point average and attending extra classes were evaluated. Linear regression models were used to analyze the associations between the ESSA scores at follow-up and family, lifestyle, and academic factors at baseline.

Results: A total of 341 students completed both the baseline and follow-up surveys and answered the questions required for this analysis. The mean ESSA score of 341 students increased from 46.4 ± 7.6 (mean \pm SD) to 53.5 ± 10.8 , from 2018 to 2021. The multivariate model revealed that the number of siblings, higher father's educational attainment level, female gender, lower academic scores, and attending extra classes were associated with overall academic stress. In contrast, no associations were observed between the variables of lifestyle, parental concentration, and parental acceptance and overall academic stress.

Conclusion: The findings highlight the impact of family factors and study workload on academic stress, emphasizing the need for proper care from family and school to reduce or prevent student academic stress and provide them with a comfortable and healthy learning environment.

Key words: academic stress, Educational Stress Scale for Adolescents (ESSA), secondary school students

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Introduction

Recently, the substantial impact of academic burdens on learners has been increasingly acknowledged, leading to

heightened societal concern. A study revealed that across the Organization for Economic Co-operation and Development countries, 66% of students aged 15–16 years experienced stress regarding poor grades and 59% frequently worried about test-taking difficulties¹. Multiple studies have emphasized the correlation between academic stress and the emergence of mental health issues such as depression, anxiety, and suicidal tendencies. Excessive stress is recognized as a factor related to diminishing academic performance and increased student drop-out rates^{2–5}. The school environment is a major stressor for children and adolescents owing to social and academic pressures, particularly the intense competition for academic success⁶. This stress is compounded by several factors, including a demanding

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workload, an overwhelming volume of materials to cover, and the expectation of consistent peak performance. Academic pressure is further intensified by parental, school, and peer expectations; inadequate resources for academic achievement; and the influence of cultural factors⁷⁻⁹. Academic stress is characterized as the psychological state of a student arising from ongoing social and self-imposed pressures within a school environment that depletes students' psychological reserves¹⁰. Furthermore, academic stress is defined as anxiety and stress stemming from schooling and education¹¹.

Due to the potential consequences of academic stress, gaining insights into the factors that can decrease the likelihood of adolescents facing academic stress is important in both scholarly and clinical contexts. Academic performance refers to the extent of the comprehension, proficiency, and application of knowledge in a particular subject, which is typically evaluated by educators through test scores on annual examinations. A significant source of stress for many students stems from the intense pressure to excel in examinations, which creates a highly stressful learning environment. The fear of achieving outcomes below expectations is a prevalent concern, leading some individuals to associate their self-worth with academic accomplishments. Heightened stress levels can cause students to doubt their capabilities and future potential^{12, 13}.

Several studies have suggested that siblings shape various aspects of children's development¹⁴⁻¹⁶. In addition, the number of siblings influences children's academic stress. Numerous studies have highlighted the influence of sibling count on children's academic performance. A study conducted in China revealed that students without siblings experienced lower stress levels than those with siblings¹⁷. In contrast, a study in India indicated that adolescents with fewer siblings faced heightened academic stress than those with a greater number of siblings¹⁸.

Parental expectations were ranked among the crucial family factors linked to students' educational stress^{19, 20}. In India, approximately 66% of students reported that experiencing parental pressure enhanced academic performance²¹. Other studies have confirmed that exceedingly elevated parental expectations can amplify academic stress among students^{9, 22}. Such heightened expectations often lead to excessive parental involvement and control in their children's lives, causing students to allocate more time to their studies and confront more academic stress compared to their peers. The extent of parental expectations and pressure differ notably based on parents' educational backgrounds and mothers' occupations. The extant literature indicates that parents' educational levels influence the academic stress levels of children^{21, 23}.

Maintaining a regular and healthy exercise regimen has been shown to yield positive psychological effects, includ-

ing stress reduction²⁴. A study analyzing U.S. data revealed that individuals who did not engage in any physical activity throughout the week were more than twice as likely to experience anxiety and depression than those who participated in at least 60 min of daily exercise²⁵. Moreover, adhering to the regular physical activity guidelines suggested by the World Health Organization has been found to be effective in preventing and alleviating stress^{26, 27}. Data from the National Comorbidity Survey Adolescent Supplement indicate a significant correlation between inadequate sleep patterns and various adverse psychological outcomes such as anxiety, behavioral disorders, and diminished subjective mental well-being²⁸. Insufficient levels of physical activity and sleep among young individuals suggest that they may not fully experience the psychological advantages associated with health-related behaviors.

In Vietnam, societal attention to academic achievement has increased. While there are various expectations of student academic achievements, there is concern over some of the negative influences of pursuing academic achievements with respect to students' mental health. Findings from a study of 1,296 secondary school students in Hanoi reported that the rate of depression among students was 27%, with 9.5% and 4.9% of them having mild/moderate and extremely severe depression, respectively²⁹. Another study of 1,161 secondary school students in Vietnam reported that the estimates of the prevalence of anxiety and risk of depression were 22.8% and 41.1%, respectively³⁰. Among these students, 26.3% had seriously contemplated suicide, 12.9% had formulated a suicide plan, and 3.8% had attempted suicide³⁰. Some studies in Vietnam have investigated the relationship between mental health and the academic pressure that students endure³⁰⁻³². According to a 2019 study, Vietnamese students considered academic scores and examinations to be closely related to anxiety³³. The pressure to achieve better academic performance could be perceived not only by high school and university students but also by secondary school students. This is because the latter must prepare for their graduation examinations, the results of which are a prerequisite for admission to high school. The scores attained in this examination are used to gauge their academic proficiency and determine the level of high school the student can attend. Higher scores allow entrance into more prestigious high schools, fostering a competitive environment that exacerbates the stress and pressure students encounter throughout their educational journey. Although some studies have explored adolescent mental health in Vietnam, studies on educational stress and its associated risk factors for students, particularly secondary school students, are scarce. Therefore, this study aimed to investigate the factors affecting academic stress among secondary school students.

Materials and Methods

Survey participants and procedures

Data were collected from the Hue Healthy Adolescent Cohort Study, a three-year school-based cohort study (2018–2021) that included students attending secondary schools in urban areas of Vietnam. The cohort study was approved by the Institutional Review Board of the Medical Schools of Tokyo Medical and Dental University, Japan, and Hue University of Medicine and Pharmacy, Vietnam. The Department of Education and Training in Thua Thien Hue Province, Vietnam granted permission to recruit secondary school students.

The baseline and follow-up surveys were conducted in 2018 and 2021, respectively. Five junior high schools from among 23 public junior high schools in Hue City were selected using a multistage, stratified, cluster-random-sampling design. Depending on the size of each school, 4–5 classes of students in the 6th grade (11 years old) were randomly selected. All students in those classes who could communicate or read and were willing to participate in the study were recruited. Students who were absent on the survey day were excluded. During the study period, the novel coronavirus 2019 (COVID-19) epidemic prevailed in Hue City. Among the five schools selected, four schools completed baseline and follow-up surveys. The participants in the four schools were regarded as the study sample for this analysis. At the four schools, prior to conducting the baseline survey, 611 students were invited to participate in the survey. At the baseline and the follow-up surveys in 2018 and 2021, 517 and 479 students participated in the surveys, respectively. After excluding the data that did not record the key variables, the records of 341 students were used in the analysis. The reasons for exclusion were the unavailability of the father's or mother's educational levels, which were important variables for this analysis.

The research team collected the data through face-to-face interviews using structured questionnaires. The purpose of the study was explained to the students on the day of data collection. The students were told that the data being collected would remain anonymous and confidential and that they could stop the interview at any time. Students whose parents granted permission for them to participate in the study were interviewed in the survey room. The interviews took approximately 20–30 min to complete.

Measures

Academic stress

Academic stress was evaluated by using the Educational Stress Scale for Adolescents (ESSA) questionnaire, which was developed by Dunne *et al*³⁴. The final version of the ESSA is a 16-item questionnaire with five domains: “pressure from study”, “worry about grades”, “despondency”,

“self-expectations,” and “workload”. “Pressure from study” occurs from thinking about what will be needed for further education and jobs in the future and what parents and schools expect. “Worry about grades” reflects nervousness about how well one does on school tests. “Despondency” means not feeling confident, being unable to concentrate in class, or not being happy with how well one is doing in school overall. “Self-expectation” is the stress experienced when one's learning goals are not being met. “Workload” refers to stress from excessive study time, homework, and tests. ESSA responses are rated on a five-point Likert scale (1=strongly disagree; 5=strongly agree). The total ESSA score, calculated as the total score for the 16 questions, ranges from 16 to 80, with higher scores indicating greater stress³⁴. A previous study in Vietnam using ESSA indicated that the scale has good internal consistency (Cronbach's $\alpha=0.83$)³⁵.

Individual factors

Sociodemographic family factors

The sociodemographic data included gender (male or female), number of siblings, and parental (father's and mother's) educational levels. Parental educational levels were assessed by selecting from among the five response options. The responses were divided into two categories: low (less than primary school, secondary school, or high school) and high (college/university or postgraduate degree).

Study-related factors

The study-related variables included academic scores, attendance of extra classes, and private tutoring. Academic scores were assessed using the participants' grade point average. Attendance of extra classes and private tutoring was reported as “yes” or “no”.

Lifestyle factors

Physical activity and Hours of sleep were measured using variables in the Global School-based Student Health Survey. Regarding physical activity, students were asked how many days they had been physically active for at least 60 min per day in the last seven days. Eight response options were available, ranging from zero to seven days. Physical activity was categorized into less than three days and three days or more²⁶. Participants were asked how many hours of sleep they got on average. Seven response options were available, ranging from 4 h or less to 10 h or more, which was subsequently categorized into less than 8 h and 8 h or more³⁶.

Perceived parental attitude

Perceived parental attitude was measured using six questions related to parents or guardians for the Protective Factors Module in the Global School-based Student Health

Survey. This process was accomplished by conducting a principal component analysis (varimax rotation), which resulted in two dimensions. Concerning the core concept of parental attitude, “parental acceptance” and “parental concentration” were appropriate for characterizing the two dimensions of perceived parental attitude³⁷. Acceptance indicates that parents recognize their child as a significant family member, neither overly fixating on them nor neglecting them, and encourage the child to do their best. Concentration refers to parents being overly protective, limiting a child’s exploration and social interactions as well as expecting children to do more than they can and achieve ambitious goals^{38, 39}.

Data analyses

Representative statistics (% , means, and standard deviations) were calculated for the three groups: students who participated in the baseline survey, students who participated in both the baseline and follow-up surveys, and students who were used in the final analysis. The differences in the ESSA scores (total score, sub-total scores for the five domains, and scores for the 16 individual questions) between the baseline and follow-up surveys were tested using the paired sample t-test. Cronbach’s α was used to evaluate the internal consistency of ESSA. Univariate and multivariate linear regression analyses were performed. The associations between academic stress at follow-up (dependent variables) and sociodemographic, study-related, lifestyle, and perceived parental attitude variables at baseline (independent variables) were evaluated. The regression coefficient betas and 95% confidence intervals (CI) were calculated. In the multivariate model, all independent variables were simultaneously entered into the model to calculate the adjusted beta coefficients. Regarding the combinations of the father’s and mother’s educational attainment levels, there are four different combinations. The association between students’ academic stress at follow-up and combinations of parental educational attainment levels at baseline was calculated. In the multivariate models, gender, number of siblings, study-related, lifestyle, and perceived parental attitude variables were used for the adjustment. Data were analyzed using SPSS version 25.0, with the significance level at <0.05 .

Results

Table 1 shows the characteristics of those who participated in the baseline survey (Baseline group), those who participated in both the baseline and follow-up surveys (Follow-up group), and those who were used in the analysis (Final analysis group). The distributions of variables of family sociodemographic, study-related, and lifestyle characteristics and the means of number of siblings and academic scores were similar in the three groups. Regarding the fa-

ther’s and mother’s educational levels in the final analysis group, the distribution depicted 55.7% and 44.3% for low and high levels of the father’s education, respectively, and 54.5% and 45.5% for the corresponding levels of the mother’s education.

Table 2 shows the mean and SDs for the total score of ESSA, sub-total scores for the five domains, and scores for the 16 individual questions at baseline and follow-up among the 341 students who completed both the baseline and follow-up surveys. The total ESSA score at baseline ranged from 25 to 67, with a mean of 46.4 (SD=7.6), and was normally distributed (skewness=0.169, kurtosis=-0.026). The mean total ESSA score at follow-up was 53.5 (SD=10.8), which ranged from 16 to 80 and was normally distributed (skewness=-0.462, kurtosis=0.647). The scores of total ESSA and all domains, except “worry about grades”, were higher at follow-up than at baseline, and the differences were statistically significant according to the paired sample t-test ($P<0.05$). The increase in the mean ESSA scores at follow-up compared to those at baseline indicated the increase in students’ academic stress levels over the three-year period. Cronbach’s α for all items in ESSA was 0.88.

Tables 3 and 4 show the results of the unadjusted and adjusted linear regression analyses that examined the relationship between perceived academic stress at follow-up and related factors at baseline. The number of siblings, gender, father’s educational level, academic scores, and attendance of extra classes were statistically significantly associated with overall academic stress in the multivariate model ($P<0.05$). Specifically, having more siblings ($\beta=2.24$, 95% CI: 0.92, 3.57), having a father with higher educational attainment ($\beta=3.20$, 95% CI: 0.13, 6.27), and attending extra classes ($\beta=4.73$, 95% CI: 0.41, 9.06) increased overall academic stress. Conversely, male students compared with female students ($\beta=-2.85$, 95% CI: -5.15, -0.54) and students who had higher academic scores ($\beta=-1.79$, 95% CI: -3.02, -0.56) were less likely to perceive academic stress. Variables of lifestyles and perceived parental attitudes were not associated with overall academic stress in the multivariate model. In three of the five domains of academic stress, the number of siblings was significantly associated with stress. Students with more siblings were more likely to be stressed under “pressure from study” ($\beta=0.57$, 95% CI: 0.14, 1.00), “despondency” ($\beta=0.36$, 95% CI: 0.03, 0.69), and “workload” ($\beta=0.81$, 95% CI: 0.45, 1.16) compared with students with fewer siblings. Higher paternal education was significantly associated with higher levels of stress with respect to “despondency” ($\beta=0.95$, 95% CI: 0.18, 1.72), and “workload” ($\beta=0.88$, 95% CI: 0.05, 1.70). Students with lower academic scores and those who attended extra classes were more likely to be stressed by “pressure from study” and “despondency”. Moreover, regarding “despondency”, students with at least 8 h of sleep were less likely to be stressed

Table 1 Family sociodemographic, study-related, and lifestyle characteristics of participants

Characteristics	Baseline group n=517 n (%)	Follow-up group n=479 n (%)	Final analysis group n=341 n (%)
Gender			
Male	269 (52.0)	252 (52.6)	164 (48.1)
Female	248 (48.0)	227 (47.4)	177 (51.9)
Father's educational level			
Low	245 (47.4)	231 (48.2)	190 (55.7)
High	189 (36.5)	175 (36.5)	151 (44.3)
Missing	83 (16.1)	73 (15.2)	
Mother's educational level			
Low	237 (45.8)	225 (47.1)	186 (54.5)
High	199 (38.5)	183 (38.2)	155 (45.5)
Missing	81 (15.7)	71 (14.8)	
Attend extra classes			
Yes	471 (91.1)	438 (91.4)	314 (92.1)
No	46 (8.9)	41 (8.6)	27 (7.9)
Private tutoring			
Yes	99 (19.1)	91 (19.0)	64 (18.8)
No	418 (80.9)	388 (81.0)	277 (81.2)
Physical activity			
Less than 3 days	313 (60.6)	288 (60.2)	209 (61.3)
3 days or more	204 (39.4)	191 (39.8)	132 (38.7)
Hours of sleep			
Less than 8	64 (12.4)	60 (12.5)	40 (11.7)
8 or more	453 (87.6)	419 (87.5)	301 (88.3)
Number of siblings, mean \pm SD	1.51 \pm 0.95	1.49 \pm 0.92	1.43 \pm 0.89
Academic scores, mean \pm SD	7.40 \pm 1.06	7.43 \pm 1.04	7.61 \pm 0.95

Baseline group: those who participated in the baseline survey, Follow-up group: those who participated in both the baseline and follow-up surveys, Final analysis group: those who were used in the final analysis. SD: standard deviation.

($\beta=-1.05$, 95% CI: -1.95 , -0.16). In the adjusted model, parental concentration was statistically significantly associated with increased “worry about grades” ($\beta=0.29$, 95% CI: 0.01, 0.57). However, in the unadjusted model, parental concentration showed a significant association with overall academic stress, “pressure from study”, “worry about grades”, and “despondency”. No association was observed between “self-expectation” stress and the sociodemographic, study-related, lifestyle, and perceived parental attitude variables.

Table 5 shows the association between students' academic stress and different combinations of parental educational attainment levels. In the univariate linear regression analyses, among the four combinations, “Hi/Lo” was associated with the academic stress level perceived by students, indicating that those with a father and mother with high and low educational attainment, respectively, were more likely to be stressed. In the multivariate model, an association was not observed between academic stress and the four combinations of parental educational levels.

Discussion

This study explored the extent of academic stress among secondary school students using the ESSA questionnaire with a three-year follow-up as well as the factors influencing students' academic stress. The results of the multivariable linear regression analysis indicated that female gender, number of siblings, father's educational attainment levels, lower academic scores, and extra classes were significantly associated with overall academic stress and all of the domains, except “self-expectation”. Furthermore, lifestyle and parent-child relationship factors had weak or no associations with overall academic stress and its five domains.

Our results revealed a significant increase in students' academic stress levels in the three-year follow-up, which can be attributed to several factors. First, the baseline survey was conducted when the students were in the first grade of secondary school (the sixth grade). A follow-up survey was conducted three years later when the students were in the final grade of secondary school (the ninth grade). As students

Table 2 Means and standard deviations of the Educational Stress Scale for Adolescents (ESSA) scores: the total score, sub-total scores for five individual domains, and scores for the 16 individual questions (n=341)

	Baseline			Follow-up			P
	Mean	SD	95% CI	Mean	SD	95% CI	
Total ESSA	46.4	7.6	(45.6, 47.2)	53.5	10.8	(52.3, 54.6)	<0.001
Pressure from study	10.1	2.8	(9.7, 10.4)	12.7	3.4	(12.3, 13.0)	<0.001
4. Future education and employment bring me a lot of academic pressure	2.5	1.1	(2.4, 2.6)	3.6	1.1	(3.5, 3.7)	<0.001
5. My parents care about my academic grades too much, which brings me a lot of pressure	2.8	1.2	(2.7, 2.9)	3.0	1.2	(2.9, 3.1)	0.029
6. I feel a lot of pressure in my daily studying	2.5	1.0	(2.4, 2.6)	3.2	1.2	(3.1, 3.4)	<0.001
11. There is too much competition among classmates which brings me a lot of academic pressure	2.3	1.0	(2.2, 2.4)	2.8	1.1	(2.7, 2.9)	<0.001
Worry about grades	11.5	2.2	(11.3, 11.8)	11.1	2.6	(10.8, 11.4)	0.008
8. Academic grades are very important to my future and even can determine my whole life	4.2	1.0	(4.1, 4.3)	4.0	1.1	(3.9, 4.2)	0.060
9. I feel that I have disappointed my parents when my test/exam results are poor	3.8	1.1	(3.7, 3.9)	3.7	1.1	(3.6, 3.8)	0.078
10. I feel that I have disappointed my teacher when my test/exam results are not ideal	3.5	1.1	(3.4, 3.6)	3.4	1.1	(3.2, 3.5)	0.026
Despondency	8.0	2.4	(7.7, 8.2)	9.6	2.8	(9.3, 9.9)	<0.001
1. I am very dissatisfied with my academic grades	2.9	1.3	(2.8, 3.0)	3.2	1.2	(3.1, 3.3)	<0.001
12. I always lack confidence in my academic scores	2.8	1.1	(2.7, 2.9)	3.3	1.1	(3.2, 3.4)	<0.001
13. It is very difficult to concentrate during class	2.3	0.9	(2.2, 2.4)	3.2	1.2	(3.0, 3.3)	<0.001
Self-expectation	8.8	2.5	(8.6, 9.1)	10.3	2.9	(10.0, 10.6)	<0.001
14. I feel stressed when I do not live up to my own standards	3.1	1.1	(3.0, 3.2)	3.7	1.1	(3.6, 3.8)	<0.001
15. When I fail to live up my own expectations, I feel that I am not good enough	3.1	1.2	(3.0, 3.2)	3.5	1.2	(3.4, 3.6)	<0.001
16. I usually cannot sleep because of worry when I cannot meet the goals that I set for myself	2.6	1.2	(2.5, 2.8)	3.1	1.2	(3.0, 3.2)	<0.001
Workload	8.1	2.4	(7.8, 8.3)	9.8	2.9	(9.5, 10.1)	<0.001
2. I feel that there is too much schoolwork	2.8	1.1	(2.7, 2.9)	3.3	1.1	(3.2, 3.4)	<0.001
3. I feel there is too much homework	2.3	0.9	(2.2, 2.4)	3.2	1.1	(3.1, 3.3)	<0.001
7. I feel that there are too many tests/exams in school	3.0	1.2	(2.8, 3.1)	3.3	1.1	(3.1, 3.4)	<0.001

SD: standard deviation; p: p for paired-sample t-test, 95% CI: 95% confidence interval for mean.

advance to the final grade of secondary school, they encounter heightened pressure compounded by an overwhelming workload. Moreover, in the educational context in Vietnam, the stress associated with preparing for transfer examinations is particularly intense. Considering that this examination is important in shaping their future academic lives, students are seriously concerned about it and feel pressured. This situation may lead to anxiety, fear of inadequacy, and a lack of confidence, thereby amplifying students' concerns and pressures. In addition, preparing for important examinations prompts parents to enroll their children in supplementary classes, depriving them of their time for rest. Our findings revealed that attending extra classes was correlated with an increased level of student academic stress.

Another factor that requires attention is the timing of the follow-up survey, which was conducted in 2021 during the COVID-19 pandemic when restrictions on daily life were significant in Vietnam. Some studies have highlighted the psychological challenges that students faced in their academic activities during the pandemic^{40, 41}, with quarantine measures, lockdowns, and the shift to online learning posing new challenges for students that may have increased their stress levels⁴².

Male students exhibited lower levels of academic stress than female students, which aligns with similar observations in a study conducted in Greece among adolescents that reported that female students experienced higher academic stress than their male counterparts⁴³. Male students

Table 3 Univariate associations between perceived academic stress at follow-up and family sociodemographic, study-related, lifestyle, and perceived parental attitude variables at baseline, univariate linear regression analysis (n=341)

Baseline characteristics	Overall academic stress	Pressure from study	Worry about grades	Despondency	Self-expectation	Workload
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Sociodemographic						
Gender (male)	-2.43 (-4.73, -0.13)*	-0.20 (-0.93, 0.54)	-0.62 (-1.16, -0.08)*	-0.26 (-0.86, 0.34)	-0.59 (-1.20, 0.02)	-0.77 (-1.38, -0.15)*
Number of siblings	1.60 (0.30, 2.90)*	0.42 (0.01, 0.84)*	0.06 (-0.25, 0.37)	0.25 (-0.09, 0.59)	0.24 (-0.11, 0.59)	0.63 (0.29, 0.98)***
Father's educational level (high)	1.93 (-0.39, 4.25)	0.30 (-0.44, 1.03)	0.36 (-0.18, 0.91)	0.45 (-0.15, 1.05)	0.38 (-0.24, 1.00)	0.44 (-0.18, 1.06)
Mother's educational level (high)	0.47 (-1.85, 2.79)	0.28 (-0.46, 1.01)	-0.09 (-0.64, 0.45)	0.01 (-0.60, 0.61)	0.30 (-0.32, 0.91)	-0.01 (-0.63, 0.61)
Study-related						
Academic scores	-1.45 (-2.66, -0.24)*	-0.41 (-0.80, -0.03)*	-0.17 (-0.45, 0.12)	-0.88 (-1.18, -0.58)***	-0.10 (-0.42, 0.23)	0.11 (-0.21, 0.44)
Attend extra classes (yes)	3.09 (-1.18, 7.36)	1.20 (-0.15, 2.55)	0.49 (-0.52, 1.49)	0.58 (-0.53, 1.68)	0.20 (-0.94, 1.34)	0.63 (-0.51, 1.77)
Private tutoring (yes)	-0.02 (-2.98, 2.94)	0.28 (-0.66, 1.22)	-0.17 (-0.87, 0.53)	-0.14 (-0.90, 0.63)	-0.11 (-0.90, 0.68)	0.11 (-0.68, 0.90)
Lifestyle						
Physical activity (3 days or more)	-0.40 (-2.77, 1.98)	0.18 (-0.57, 0.93)	-0.25 (-0.81, 0.31)	-0.08 (-0.70, 0.53)	-0.16 (-0.79, 0.47)	-0.08 (-0.72, 0.55)
Hours of sleep (8 and more)	-3.44 (-7.01, 0.14)	-0.92 (-2.06, 0.21)	-0.40 (-1.24, 0.45)	-1.26 (-2.18, -0.34)**	-0.42 (-1.37, 0.54)	-0.45 (-1.41, 0.51)
Perceived parental attitude						
Parental acceptance	0.27 (-0.89, 1.43)	-0.11 (-0.48, 0.26)	0.10 (-0.18, 0.37)	0.07 (-0.23, 0.37)	0.01 (-0.30, 0.32)	0.21 (-0.10, 0.52)
Parental concentration	1.26 (0.11, 2.41)*	0.37 (0.00, 0.73)*	0.29 (0.02, 0.56)*	0.32 (0.02, 0.62)*	0.23 (-0.08, 0.53)	0.06 (-0.25, 0.37)

β : beta coefficient; CI: confidence interval; * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

also reported less stress related to “worry about grades” and “workload”. A study conducted in the United States showed similar results, with female students reporting higher stress levels than their male counterparts⁴⁴. This gender-based difference in perception of stress may be related to the observation that women often place greater importance on academic performance. Adolescent girls tend to be more concerned about various aspects of life and report experiencing more stressful events than boys⁴⁵.

In our study, students with more siblings showed greater overall academic stress and higher stress in the “pressure from study” and “workload” domains. This result may be explained by a tendency to compare one’s academic accomplishments with their siblings. Study-related pressure in students was partially associated with parent and school expectations. The perception that parents may favor children with better academic achievement could have created a competitive atmosphere among siblings to gain recognition from parents, potentially resulting in heightened stress in

their studies^{46, 47}. However, a previous study found that the number of siblings negatively predicted educational stress¹⁸. In contrast, another study reported that adolescents with more siblings display higher levels of self-confidence than those with fewer siblings, which may reduce stress⁴⁸.

Students who have fathers with higher educational attainment showed higher academic stress levels and higher stress levels in terms of “despondency” and “workload”. A study conducted in India indicated that adolescent girls with illiterate fathers exhibited elevated stress levels compared to those with literate fathers¹⁸. These findings align with the results observed in the United States, which showed that adolescents from families with lower parental educational levels exhibited higher stress than their counterparts of more educated families. Such a relationship potentially contributes to heightened stress levels in adolescents⁴⁹. Another study reported the opposite result; participants whose fathers were non-graduates were more likely to report academic stress²¹. In our study, no significant association was

Table 4 Multivariate associations between perceived academic stress at follow-up and family sociodemographic, study-related, lifestyle, and perceived parental attitude variables at baseline, multivariate linear regression analysis (n=341)

Baseline characteristics	Overall Academic stress	Pressure from study	Worry about grades	Despondency	Self-expectation	Workload
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Sociodemographic						
Gender (male)	-2.85 (-5.15, -0.54)*	-0.40 (-1.15, 0.35)	-0.64 (-1.20, -0.08)*	-0.42 (-1.00, 0.15)	-0.63 (-1.27, 0.01)	-0.76 (-1.38, -0.14)*
Number of siblings	2.24 (0.92, 3.57)**	0.57 (0.14, 1.00)*	0.16 (-0.16, 0.48)	0.36 (0.03, 0.69)*	0.35 (-0.02, 0.71)	0.81 (0.45, 1.16)***
Father's educational level (high)	3.20 (0.13, 6.27)*	0.28 (-0.71, 1.27)	0.74 (0.01, 1.48)*	0.95 (0.18, 1.72)*	0.35 (-0.49, 1.20)	0.88 (0.05, 1.70)*
Mother's educational level (high)	-1.11 (-4.10, 1.88)	0.16 (-0.81, 1.13)	-0.56 (-1.28, 0.16)	-0.42 (-1.17, 0.33)	0.15 (-0.68, 0.97)	-0.44 (-1.25, 0.36)
Study-related						
Academic scores	-1.79 (-3.02, -0.56)**	-0.45 (-0.84, -0.05)*	-0.24 (-0.54, 0.06)	-0.99 (-1.30, -0.69)***	-0.14 (-0.48, 0.20)	0.35 (-0.30, 0.37)
Attend extra classes (yes)	4.73 (0.41, 9.06)*	1.68 (0.28, 3.08)*	0.63 (-0.42, 1.67)	1.10 (0.02, 2.18)*	0.32 (-0.87, 1.52)	1.01 (-0.15, 2.17)
Private tutoring (yes)	-0.15 (-3.16, 2.85)	0.30 (-0.67, 1.27)	-0.15 (-0.87, 0.58)	-0.30 (-1.05, 0.46)	-0.20 (-1.03, 0.63)	0.19 (-0.62, 1.00)
Lifestyle						
Physical activity (3 days or more)	-0.45 (-2.81, 1.92)	0.13 (-0.64, 0.90)	-0.24 (-0.81, 0.33)	-0.28 (-0.87, 0.32)	-0.09 (-0.75, 0.56)	0.03 (-0.60, 0.67)
Hours of sleep (8 and more)	-2.49 (-6.05, 1.08)	-0.69 (-1.84, 0.46)	-0.15 (-1.01, 0.71)	-1.05 (-1.95, -0.16)*	-0.28 (-1.26, 0.71)	-0.31 (-1.27, 0.64)
Perceived parental attitude						
Parental acceptance	0.63 (-0.51, 1.76)	-0.02 (-0.39, 0.35)	0.13 (-1.15, 0.40)	0.18 (-0.10, 0.47)	0.05 (-0.26, 0.36)	0.29 (-0.13, 0.60)
Parental concentration	1.12 (-0.04, 2.28)	-0.02 (-0.07, 0.68)	0.29 (0.01, 0.57)*	0.18 (-0.11, 0.47)	0.23 (-0.09, 0.55)	1.23 (-0.19, 0.43)

β : beta coefficient; CI: confidence interval. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$. All sociodemographic variables, study-related variables, lifestyle variables, and perceived parental attitude variables were simultaneously entered into the model and β coefficients were calculated after the adjustment of all other variables.

observed between the mother's educational level and academic stress in children. One hypothesis is that nurturing and compassionate nature are generally associated with maternal caregiving. Mothers often prioritize their child's well-being and may not impose excessive expectations⁵⁰. A study in China reported that fathers traditionally serve as the primary breadwinners and place a greater emphasis on familial reputation, leading to higher expectations and pressure on their children⁵¹. This difference between fathers and mothers would explain why a father's educational attainment levels impact children's stress levels while that of mothers does not. A crude association observed between a combination of a father with high educational attainment and a mother with low education attainment and greater stress among children suggests interesting phenomena reflecting the roles of father and mother in the families in Vietnamese context. However, this association was weak and disappeared when adjusted

using other variables. Further studies should address the relationship between father's and mother's education and perceived stress among students.

Academic scores and attending extra classes were associated with the overall academic stress score. Our findings align with those in the literature, according to which students with low average scores experience higher levels of overall academic stress⁴³. Regarding attending extra classes, our research revealed that students who engaged in such classes exhibited higher levels of stress. This finding is in line with those reported in the literature^{43, 45}. Students who attended private, individual, or extracurricular classes after school, on weekends, and during holidays reported experiencing stress and pressure. Similarly, a study conducted in India indicated that extra classes contributed significantly to stress and tension among both students and teachers⁵². The demands of early morning and late evening attendance led to

Table 5 Linear regression model of the association between academic stress and parental educational attainment levels

Combination of educational attainment levels of father/mother	Overall Academic stress	
	Univariate model β (95% CI)	Multivariate model β (95% CI)
Hi/Hi	0.67 (-1.74, 3.07)	-4.87 (-10.91, 1.17)
Lo/Lo	-1.77 (-4.08, 0.54)	-4.87 (-10.91, 1.17)
Hi/Lo	4.43 (0.17, 8.69)*	4.87 (-1.17, 10.91)
Lo/Hi	-0.45 (-4.47, 3.57)	4.87 (-1.17, 10.91)

Hi/Hi: both parents' educational levels are high. Lo/Lo: both parents' educational levels are low. Hi/Lo: The father's educational level is high and the mother's educational level is low.

Lo/Hi: The father's educational level is low and the mother's educational level is high. The multivariate model was adjusted for each combination and gender, number of siblings, study-related, lifestyle, and perceived parental attitude variables; * $P < 0.05$.

various problems such as teacher resignations and students feeling overwhelmed by the increased workload⁵². Lower academic scores and attending extra classes were associated with greater stress levels from “pressure from study” and “despondency”, which is in line with the existing literature^{43,45}. This is understandable as students who achieve higher scores experience less anxiety regarding their academic performance, leading to increased confidence in their future education. In addition, high- (low-) scoring students tend to have greater (lower) self-confidence^{53,54}.

Our results showed no association between lifestyle factors, including hours of sleep and physical activity, and overall academic stress as well as most of the domains, except for the relationship between hours of sleep and “despondency”. Although there was no association between physical activity and academic stress, several studies have yielded contrasting findings, showing that students who participated in some form of physical exercise experienced less stress. Some studies have reported that physical activity plays a significant role in reducing the stress associated with school and various manifestations of youth development^{43,55}. “Despondency” encompasses issues of concentration during class. The impact of hours of sleep on “despondency” is interpreted by the fact that students who get sufficient sleep tend to be more alert, leading to greater concentration^{56,57}.

Parental concentration showed a significant association with “worry about grades”, whereas parental acceptance was not significantly associated with overall academic stress or its five domains. Although no association was found between parental concentration and overall academic stress in the multivariate model, parental concentration was significantly associated with academic stress in the univariate model, indicating that students' academic stress was partly influenced by their parents' expectations and overprotective attitudes. A previous study showed that the primary cause of academic stress, as indicated by 66% of

students, was pressure from parents to improve academic performance²¹. Another study in Hong Kong revealed that parental expectations contributed to an increase in students' depression levels²². Parents in Asia may exert this pressure out of concern for their children's well-being and awareness of the competitive nature of gaining admission to reputable institutions. Expectations and overprotection are perceived as expressions of love and support. However, parental focus on appearance or achievements may negatively impact children's stress levels⁵⁸. Consequently, students with overbearing parents often have limited time for relaxation, play, and casual interactions with neighbors and are sleep deprived. This leads to heightened anxiety, particularly when facing intense pressure from examinations.

To the best of our knowledge, this was the first longitudinal study on academic stress and its associated factors among Vietnamese subjects to focus on middle school students. The study design allowed us to analyze how the scores changed over time and make interpretations about causal relationships. Nevertheless, this study has several limitations. First, the timing of the follow-up survey was amid the COVID-19 pandemic, which made it difficult to complete follow-up surveys of the participants at the baseline survey. Second, information was collected using self-reported measurements. Self-reported measures could be biased as participants may have answered questions in a socially desirable manner. Third, the study excluded out-of-school adolescents and students enrolled in private schools. Therefore, the results are generalizable only for those attending public schools in Vietnam. Fourth, other potential factors that might influence academic stress were not evaluated. Future studies should consider the impacts of being raised by a single parent, the economic status of the households, and communications with friends, which are potential factors that relate to students' academic stress. Studies with larger sample sizes are also needed.

Conclusion

This cohort study contributes to understanding the status and association between academic stress and various factors among students. The results showed that academic stress among students increased over the three-year study period, implying that students faced stress-related academic issues in their final secondary school grades. Furthermore, our findings underscore the impact of family factors and workload on academic stress. Training and support programs in schools and urging parents to be attentive to their children are essential. Both teachers and parents could benefit from training to enhance their understanding of their children and develop effective time management for their children's education. This would help reduce or prevent academic stress among students.

Conflicts of interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Ethics approval and consent to participate: The Institutional Review Board of the Medical School of Tokyo Medical and Dental University, Japan, and the Hue University of Medicine and Pharmacy, Hue University, Vietnam approved this study. Secondary school students were recruited from the Department of Education and Training in Thua Thien Hue Province, Vietnam. All subjects enrolled in the study agreed to cooperate with the investigators after the purpose

of the research was explained, and written informed consent and assent were obtained from the parents/guardians and study participants.

Consent for publication: All authors have provided their consent for the publication of the paper in the Journal of Rural Medicine.

Data availability statement: The generated dataset is available upon request to the corresponding author at the contact address in this article.

Author's contributions: HTLN, KN, and KS designed the study, and HTLN, KS, VTT, and KN contributed to performing the surveys and compiling a database. TVT, XMTT, HTLN, KS, and KN conceptualized the analysis. TVT, XMTT, and YT performed statistical analysis and TVT, HTLN, XMTT, YT, KS, and KN interpreted the data. TVT and XMTT drafted the manuscript. TVT, HTLN, XMTT, YT, KS, TVV, and KN reviewed the draft and approved the final manuscript.

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