



# The Impact of Anxiety and Depression on Academic Performance: A Cross-Sectional Study among Medical Students in Syria

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## Abstract

**Background** The National Medical Unified Examination (NMUE) is a milestone in the life of medical students in Syria. The selection for residency programs depends mainly on the NMUE score, where competitive specialties require higher scores. Therefore, preparation for the NMUE might be a source of anxiety and depression. This study aims at evaluating the impact of anxiety and depression on the NMUE score. A secondary objective is to determine the effect of some factors (i.e., exercise, having breakfast, adequate sleep, and social media) on anxiety and depression.

**Methods** A cross-sectional study was conducted using an online questionnaire and included medical students who were preparing for the October 2019 NMUE exam. The Generalized Anxiety Disorder scale (GAD-7) and the Patient Health Questionnaire (PHQ-9) were used to screen for anxiety and depression, respectively. NMUE scores were obtained from the official score report. Demographics and other potential confounding factors, such as Cumulative Grade Point Average, were obtained through the questionnaire.

**Results** One hundred and thirty ( $n = 130$ ) students participated in the study, 83 of them were women (63.8%). The prevalence of anxiety and depression were 59.2 and 58%, respectively, with no difference between men and women. Both anxiety and depression were negatively correlated with the NMUE score. However, this relationship did not persist after controlling for other important predictors through multiple regression. Only exercising was statically significant in reducing PHQ-9 scores. None of the studied factors were significant in reducing GAD-7 scores.

**Conclusion** Although participants with higher anxiety/depression had lower NMUE scores, this association does not imply causation. The high prevalence of anxiety and depression (approximately two-thirds of the participants) is concerning and may pose a great threat to students' well-being and adversely affect the quality of care provided by them as future health care professionals.

## Keywords

- ▶ anxiety
- ▶ depression
- ▶ academic performance
- ▶ National Medical Unified Examination
- ▶ medical students
- ▶ university

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## Introduction

The National Medical Unified Examination (NMUE) is the standardized medical licensing examination in Syria. The NMUE score plays a significant role in the residency selection process. Therefore, students need to get a high NMUE score to secure a position in their desired specialty. Given that it can decide students' future and careers, the NMUE can be a primary source of anxiety.

Previous studies have shown a negative relationship between anxiety and academic performance.<sup>1,2</sup> In a meta-analysis that included papers from 1988 to 2018, high anxiety students scored lower on standardized exams with a mean effect size of  $r = -0.26$ .<sup>1</sup> Students may suffer from underachievement, not because of lack of ability but because of their anxiety.<sup>3</sup> However, the impact of anxiety on academic performance is merely an association, and association does not necessarily imply causation.<sup>1,3</sup> The cause-effect relationship is yet to be proven.<sup>1,3</sup> Little is known about the effect of depression on academic performance among medical students. One study that examined this effect found that depression negatively impacts academic performance.<sup>4</sup>

Several lifestyle habits have been linked to psychological distress. Regular exercising,<sup>5,6</sup> breakfast,<sup>7</sup> and adequate sleep<sup>8</sup> were associated with lower levels of anxiety and depression. Social media was found to be a source of unhealthy comparisons between peers, leading to decreased life satisfaction and poor mental health.<sup>9</sup>

This study aims to explore the impact of anxiety and depression on academic performance while controlling for students' ability. A secondary objective is to examine how some factors (i.e., exercise, breakfast, sleep, and social media) affect anxiety and depression.

## Methods

### Study Design and Participants

A cross-sectional study was conducted among medical students in Syria to evaluate the impact of anxiety and depression on the NMUE score. We included medical students who were preparing to take the NMUE exam in October 2019 from both private and public universities in Syria. Participants were excluded if they (1) were not eligible for taking the NMUE in October 2019, (2) did not provide their full name, or (3) were not listed on the official NMUE score report. Collecting full names was necessary, as it allowed us to pair participants with their corresponding NMUE scores.

### Procedures

We developed an online questionnaire using Google Forms and distributed it to online NMUE study groups on Facebook and Telegram that included most of the students who were applying to the NMUE exam in October 2019. The data collection phase took place between September 18, 2019, and October 2, 2019, a month before the NMUE. All the questions were in Arabic, as it is the official language in Syria.

The questionnaire was developed based on a literature review. It included the Generalized Anxiety Disorder scale

(GAD-7) and the Patient Health Questionnaire (PHQ-9). It also included questions about full name, gender, university, year of study, self-reported Cumulative Grade Point Average (CGPA), whether they had a part-time job during the NMUE preparation period, whether it was their first time to take the NMUE, degree of presence in online NMUE study groups, the materials they used to prepare for the NMUE, the date they started preparing for the NMUE, hours of study per day, hours of sleep per day, whether they exercise regularly, whether they have breakfast regularly, and whether they have used any anxiolytics or antidepressants. A translated version of the questionnaire can be found in the [Appendix](#) (available in the online version).

All questions were mandatory, except for the PHQ-9, which was made optional to increase the response rate. The study material question had four choices (synopsis, official materials, official materials plus external sources, or other). Choosing "other" gave the participant the ability to type their answer in a small paragraph. After completing the data collection phase, all the open-ended responses to this question were categorized into one of the existing three categories as appropriate. We used participants' names and universities to obtain their NMUE scores from the official NMUE score report published by "the Center for Measurement and Evaluation in Higher Education," which was available for the public. As such, the NMUE score was not self-reported, which ensured eligibility for the inclusion and exclusion criteria because only students who took the NMUE at the specified date were included in the study.

### Ethics Approval and Consent to Participate

All participants were informed before filling the questionnaire that their data will be used for research purposes. Participation was voluntary, and confidentiality was assured. A contact email address was provided in case any of the participants wished to withdraw from the study. The institutional review board in Al-Baath University approved the research protocol.

### Terms and Measures

Upon graduating from high school, students may apply for their desired majors in Syrian Universities. The acceptance decision is based on high school score (i.e., applicants with the highest high school score will be accepted in their desired majors).<sup>10</sup> Medical education in Syrian Universities consists of a 6-year program.<sup>11</sup> All medical students from public and private universities who completed their sixth year in medical school must pass the clinical examination in their faculties to be eligible for the NMUE.<sup>12</sup> Students must obtain 60/100 marks or more in the NMUE to graduate and be able to apply for the residency program in Syria.<sup>12</sup>

The NMUE is a 2-day written exam that consists of 240 multiple-choice questions.<sup>12</sup> Questions cover internal medicine (72 questions); pediatrics (36 questions); dermatology (12 questions); ear, nose, and throat (12 questions); ophthalmology (12 questions); surgery (48 questions); and gynecology and obstetrics (48 questions).<sup>12</sup> The NMUE is designed and supervised by "the Center for Measurement and Evaluation in Higher Education" (CME).<sup>12</sup> The exam is

conducted twice a year at the date and time specified by the CME.<sup>12</sup>

The grade point average (GPA) is a 100-point scale with higher scores indicating better performance.<sup>13</sup> The GPA for each college year is the mean of all final grades in that year.<sup>13</sup> CGPA in our study was calculated by averaging the GPA of the first 5 years.<sup>13</sup>

The GAD-7 is a 7-item self-administrated instrument that can be used to screen for any anxiety disorder.<sup>14</sup> A participant is considered to have an anxiety disorder if they have a GAD-7 score of 8 or greater, which yields a sensitivity of 77% and specificity of 82%.<sup>14</sup> The PHQ-9 is the 9-item self-administrated depression module from the full PHQ that can be used to screen for depression and assess its severity.<sup>15</sup> A participant is considered to have a major depressive disorder if they have a PHQ-9 score of 10 or greater, which yields a sensitivity of 88% and specificity of 88%.<sup>15</sup> The Arabic version of GAD-7<sup>16</sup> and PHQ-9<sup>17</sup> were used. GAD-7 and PHQ-9 were chosen as they are brief, self-administered measures with acceptable sensitivity and specificity.

We categorized participants according to their self-reported sleep hours into three groups: long sleepers ( $\geq 9$  hours), normal sleepers (6 to 8 hours), and short sleepers ( $< 6$  hours). These cutoffs were adopted with modification from Jungquist et al (2016).<sup>18</sup> The cut-off for long sleepers was 9 hours instead of the suggested 8.1 hours because sleeping hours were reported as a whole number in our study.

Questions about the use of anxiolytics or antidepressants, taking the NMUE for the first time, exercising regularly, having breakfast regularly, and having a part-time job were yes or no questions. The degree of presence in online NMUE study groups question had four choices (none, some groups, most groups, or all groups). The study material question had four choices (synopsis, official materials, official materials plus external resources, or other).

### Statistical Analysis

Categorical data (gender, university, taking the NMUE for the first time, use of anxiolytics or antidepressants, exercise, having breakfast, part-time job, study materials, and presence in online NMUE study groups) were reported as frequencies and rates. Continuous variables (NMUE score, CGPA, total days of studying, hours of study per day, hours of sleep per day, GAD-7 score, and PHQ-9 score) were reported as mean (standard deviation) (M[SD]) and median (Mdn).

Simple Pearson's correlations between all continuous variables were reported as a correlation matrix. Hierarchical regression was performed to examine the impact of anxiety (GAD-7) on academic performance and the relationship type (linear vs. nonlinear). Control variables were entered first, followed by GAD-7 scores, and lastly, squared GAD-7 scores. We added the nonlinear component to the regression model to study if anxiety followed a nonlinear relationship (inverted U-shape) with academic performance as some studies noted (i.e., high and low anxiety was associated with low performance while optimal levels of anxiety caused

an increase in performance.)<sup>19,20</sup> We also performed another hierarchical regression by adding PHQ-9 scores to the control variables to examine the effect of depression on academic performance. Control variables included CGPA, total study days, hours of study per day, use of antidepressants or anxiolytics, having a part-time job, and study materials.

Multicollinearity was checked through the correlation matrix and variance inflation factor. Outliers that were dropped out of the regression analysis were defined as having two or more of the following: high Mahalanobis distance, high leverage, and high Cook's distance.

Subgroup comparisons were conducted to explore the effect of gender, exercise, having breakfast, hours of sleep per day, and the degree of presence in online NMUE study groups on GAD-7 and PHQ-9 scores. Independent *t*-test and one-way analysis of variance (ANOVA) were used for subgroup comparisons as appropriate. Alternatively, Mann-Whitney U and Kruskal-Wallis tests were used when the assumption for normal distribution was not met.

The Shapiro-Wilk test was used to test for normality of the variables' distribution. Little's MCAR test was done to determine if the data were missing completely at random. The maximum likelihood technique using the expectation-maximization (EM) algorithm was performed to impute the missing data. All statistical tests used a two-sided *p*-value with the significance level set at 0.05. Dealing with missing values was done using IBM SPSS 26.0.0.0. The rest of the data analysis was done using Jamovi and R 4.0.3.<sup>21,22</sup>

## Results

### Missing Data and Outliers

A total of 143 medical students completed the questionnaire. Thirteen participants were excluded because they did not provide their full names ( $n = 3$ ), they were not eligible for taking the NMUE at the time of the study ( $n = 5$ ), or they were not listed on the official NMUE score report ( $n = 5$ ). Nine participants (6.9%) did not complete the PHQ-9 questions as these questions were optional. We used EM technique to estimate the missing values. Little's MCAR test showed that the data missing pattern was random  $X^2(9, n = 121) = 6.203, p = 0.719$ . Three observations were considered outliers. As a result, only 127 observations were included in the correlation and multiple regression analysis.

### General Characteristics

► **Table 1** shows the numbers of individuals who completed the questionnaire and participation rates per university. Out of the 130 students included in the study, 36.2% were men and 63.8% were women (► **Table 2**). Using a cut-off of 8 or greater for GAD-7 score and a cut-off of 10 or greater for PHQ-9 score, we found that 59.2 and 58% of participants had anxiety and depression, respectively. Only 11.5% used antidepressants/anxiolytics.

### Anxiety and Depression Impact on the NMUE Score

Students with higher NMUE scores had higher CGPA, studied more hours per day, and had lower GAD-7 and PHQ-9 scores

**Table 1** Number of participants per university

University	Number of students who took the NMUE <sup>a</sup>	Number of survey participants	Participation rate per university (%)
Damascus	953	32	3.4
Tishreen	539	27	5.0
Al-Baath	270	26	9.6
Aleppo	600	26	4.3
Tartous	126	11	8.7
Hamah	132	4	3.0
Al-Furat	17	0	0.0
Private Universities	196	4	2.0
Non-Syrian Applicants	72	0	0.0
Total	2,905	130	4.5

Abbreviation: NMUE, National Medical Unified Examination.

<sup>a</sup>Figures were taken from the official NMUE score report published online by “the Center for Measurement and Evaluation in Higher Education.”<sup>33</sup>

([Table 3](#)). We found no correlation between total study days and the NMUE score.

We performed two hierarchical multiple regression analyses to examine the impact of anxiety and depression on the NMUE score while controlling for other factors, such as CGPA. First, the basic model—which included the control variables—predicted 56.8% of the variability in the NMUE score; CGPA was the only significant predictor in this model ([Table 4](#)). According to the basic model, each additional point in CGPA increased the NMUE score by 1.31 points. Next, we added the GAD-7 score and PHQ-9 score separately to the basic model. We considered linear and nonlinear models for the relationship between the GAD-7 score and the NMUE score, but neither was significant. After accounting for control variables, the PHQ-9 score was insignificant in predicting the NMUE score. The hierarchical multiple regression suggests that—after controlling for CGPA—anxiety and depression did not affect the NMUE score.

### The Effect of Exercise, Breakfast, Sleep, and Online Study Groups on Anxiety and Depression

GAD-7 and PHQ-9 scores were checked for normality using the Shapiro–Wilk test. PHQ-9 scores were normally distributed and were analyzed using an independent *t*-test and one-way ANOVA. GAD-7 scores were not normally distributed and were analyzed through the Mann–Whitney U test and Kruskal–Wallis H test.

Exercise lowered PHQ-9 scores but had no effect on GAD-7 scores ([Table 5](#)). Neither gender nor breakfast had an effect on GAD-7 or PHQ-9 scores. There was no difference between sleep groups in GAD-7 scores ( $H = 4.72, p = 0.094$ ) or PHQ-9 scores ( $F[2, 72.7] = 2.22, p = 0.113$ ). Presence in online NMUE study groups also did not affect GAD-7 scores ( $H = 1.59, p = 0.662$ ) or PHQ-9 scores ( $F[3, 68.6] = 0.679, p = 0.566$ ).

## Discussion

The results show a strikingly high prevalence of anxiety (59.2%) and depression (58%). No gender difference was observed. A previous study at Damascus University in Syria found similar levels of depression (60.6%), whereas only 35.1% of medical students suffered from anxiety.<sup>23</sup> World-wide prevalence was estimated to be 33.8% for anxiety<sup>24</sup> and 28% for depression<sup>25</sup> among medical students. These figures confirm our concern about the poor mental health among NMUE takers. The increased prevalence of anxiety and depression in our study might be explained by (1) the timing of administration (a month before the NMUE exam) and (2) the use of different screening tools. It is worth mentioning that despite the high prevalence of anxiety and depression in our sample, only a minority of participants received treatment (11.5%). This can be explained by the stigma attached to psychological disorders and the lack of access to mental health services.

The main purpose of our study was to determine the impact of anxiety and depression on the NMUE score. A simple correlation showed that both anxiety and depression correlated negatively with the NMUE score. However, this relationship did not persist after controlling for other important predictors through multiple regression. As expected, the CGPA accounted for most of the variance in the NMUE score.

One explanation is that the observed negative correlation between anxiety/depression and the NMUE score is illusory. This relationship can be attributed to the correlation between CGPA and anxiety/depression, on the one hand, and between CGPA and NMUE score, on the other. In other words, CGPA may serve as a confounder ([Fig. 1A](#)).

Several studies supported this explanation. In a longitudinal study conducted at the University of Hong Kong, two measurements of depression and anxiety were performed:

**Table 2** General characteristics of participants (n = 130)

Characteristic	n (%)
<b>Gender</b>	
Male	47 (36.2)
Female	83 (63.8)
<b>University</b>	
Damascus	32 (24.6)
Tishreen	27 (20.8)
Al-Baath	26 (20)
Aleppo	26 (20)
Tartous	11 (8.5)
Hamah	4 (3.1)
Kalamoon	2 (1.5)
SPU	2 (1.5)
<b>Having breakfast</b>	
Yes	90 (69.2)
No	40 (30.8)
<b>Exercise</b>	
Yes	27 (20.8)
No	103 (79.2)
<b>Sleep Group</b>	
Short sleepers (<6 hours)	19 (14.6)
Normal sleepers (6–8 hours)	83 (63.8)
Long sleepers (≥9 hours)	28 (21.5)
<b>Part-time job</b>	
Yes	26 (20)
No	104 (80)
<b>Use of anxiolytics or antidepressants</b>	
Yes	15 (11.5)
No	115 (88.5)
<b>Taking NMUE for the first time</b>	
Yes	128 (98.5)
No	2 (1.5)
<b>Study material</b>	
Official Materials and external resources	47 (36.2)
Official Materials	41 (31.5)
Synopsis	42 (32.3)
<b>Presence on online NMUE study groups</b>	
All online groups	42 (32.3)
Most online groups	59 (45.4)
Some online groups	27 (20.8)
No involvement	2 (1.5)
<b>Anxiety (GAD ≥8)</b>	
Yes	77 (59.2)
No	53 (40.8)

(Continued)

**Table 2** (Continued)

Characteristic	n (%)
<b>Depression (PHQ ≥10)</b>	
Yes	76 (58)
No	54 (42)

Abbreviations: GAD-7, Generalized Anxiety Disorder 7-item scale; NMUE, National Medical Unified Examination; PHQ-9, patient health questionnaire 9-item scale; SPU, Syrian Private University.

one at the start of the first year of medical school and another 8 months later. Consistent with our result, the authors found an association between the second measure of depression and a subsequent exam score, but it was gone after controlling for previous academic performance. They also found that higher anxiety and depression levels were associated with previous poor performance. This relationship persisted even after controlling for the first measure of anxiety and depression. The findings of this study suggested that academic performance caused anxiety and depression, not the opposite.<sup>26</sup> Clark et al found that students with a higher undergraduate GPA (before starting medical school) were less likely to experience depression during medical school, suggesting that poor academic performance preceded depression.<sup>27</sup>

An alternative explanation is that controlling for ability masks the effect of anxiety. A student's ability (measured as CGPA in our study) is an important factor that should be accounted for when analyzing the relationship between anxiety and academic performance.<sup>3</sup> However, we should keep in mind that ability cannot be measured in isolation from anxiety, as anxiety might have a negative impact on the tests intended to measure ability.<sup>3</sup> As a result, ability measures might be a measure of anxiety and ability combined.<sup>3</sup>

This alternative explanation is less probable for depression. Most individuals with major depressive disorder episodes recover within 3 months to 1 year of onset<sup>28</sup> while the CGPA in our study was the average of 5 years of medical school. Therefore, it is unlikely that depression could have had an impact on ability measure (i.e., CGPA) to the same degree anxiety did.

It is more probable that poor academic performance preceded depression and contributed to its development or possibly an external variable caused both. On the contrary, the relationship between anxiety and academic performance is more complex. Students who performed poorly on prior examinations may be more likely to perceive future tests as anxiety provoking. Anxiety could also cause poor performance. Thus, anxiety may be caused by previous poor performance, anxiety may cause poor performance, the relationship may be bidirectional, or anxiety and test performance may be both caused by an external variable.<sup>3</sup> This relationship is illustrated in **Fig. 1B**.

There is some evidence supporting that anxiety and depression do impair academic performance. In one meta-analysis, Hembree reported that the poor academic performance among anxious students was improved by treating

**Table 3** Means, standard deviation, and Pearson's correlations of the continuous variables

Variable	M (SD)	Mdn	1	2	3	4	5	6
1. NMUE score	75.18 (11.09)	78						
2. CGPA	79.1 (5.37)	79.32	0.74 <sup>b</sup>					
3. Total study days	218.92 (101)	198	0.15	0.09				
4. Hours of study per day	7.48 (2.69)	8	0.19 <sup>a</sup>	0.27 <sup>b</sup>	0.10			
5. Hours of sleep per day	7.63 (1.15)	8	0.13	0.01	0.03	-0.23 <sup>b</sup>		
6. PHQ-9 score	11.8 (5.77)	9.5	-0.22 <sup>a</sup>	-0.19 <sup>a</sup>	0.01	-0.09	0.06	
7. GAD-7 score	9.96 (5.73)	11	-0.24 <sup>b</sup>	-0.21 <sup>a</sup>	-0.05	-0.03	-0.08	0.75 <sup>b</sup>

Abbreviations: CGPA, Cumulative Grade Point Average; GAD-7, Generalized Anxiety Disorder scale; M, mean; Mdn, median; NMUE, National Medical Unified Examination; PHQ-9, patient health questionnaire 9-item scale; SD, Standard deviation.

<sup>a</sup>Indicates  $p < 0.05$ .

<sup>b</sup>Indicates  $p < 0.01$ .

their anxiety. The improvement in grades in the treated compared with the nontreated students was similar to the earlier observed difference between anxious and nonanxious students. Based on these findings, Hembree concluded that anxiety caused poor performance.<sup>2</sup> Another study compared the GPA of 121 students who were diagnosed with depression and found that the duration of depression symptoms during a college term was associated with a lower GPA in that term.<sup>4</sup> In addition, they found that treating depression canceled out its negative effect on GPA.<sup>4</sup>

We also examined the nonlinear effect of anxiety on academic performance. According to the Yerkes-Dodson law (1908), an optimal level of arousal causes an optimal performance. This creates an inverted U-shaped relationship between arousal and performance, which means that both too much and too little arousal leads to poor performance.<sup>29</sup> Some authors regarded anxiety as a form of arousal and hypothesized that it follows the same inverted U-shaped relationship.<sup>19,20</sup> However, we failed to prove the nonlinear nature of this relationship as most of the published research.<sup>30</sup>

On a final note, our study, because of its cross-sectional design, cannot establish causality or determine the direction of this relationship. The two proposed explanations are plausible, and more studies are required to reach a satisfactory conclusion.

### The Effect of Exercise, Breakfast, Sleep, and Online Study Groups on Anxiety and Depression

A secondary objective was to examine the effect of exercise, breakfast, sleep, and using online study groups on anxiety and depression. Contrary to expectations, none of the factors had a significant impact on anxiety or depression except for exercising, which was significant in reducing depression.

Exercise might be a promising alternative to antidepressants and psychological therapy, as it is more widely available and is not accompanied by the stigma of traditional treatments. Our results confirm this idea, which can also be found in previous research.<sup>5,6</sup> It is worth noting that simply asking whether the participant exercises or not leaves out important details such as exercise duration, intensity, fre-

quency, and type (e.g., aerobic or strength). Nonetheless, it still constitutes an important finding that should be further investigated.

Many studies have shown that breakfast<sup>7,31</sup> and adequate sleep<sup>8</sup> can reduce anxiety and depression. The reason our results were not consistent with previous studies might lie in our questionnaire. We did not collect in-depth information about these factors for the sake of brevity, which in turn affected the data quality. For example, not only having a regular breakfast is important but also the timing and the contents of the breakfast (i.e., the amount of carbohydrates, protein, and fat). Sleep hours relied on subjective estimation rather than an objective measure. Lastly, we assumed that students who compare their productivity with their peers will have higher levels of anxiety and depression.<sup>9,32</sup> We failed to find a link between social media use and psychological distress, probably because the number of online study groups someone is involved in does not necessarily indicate how much participants compare themselves with others. For this reason, the results regarding these factors are inconclusive.

### Limitations

The most important limitation of our study was the voluntary sampling method, which introduced a selection bias and did not allow us to calculate the response rate as we posted it on social media groups. In addition, a longitudinal design with multiple measurements of anxiety and depression (i.e., during the sixth year and after completing the NMUE) would have given a better understanding of the relationship between psychological distress and the NMUE. Although confidentiality was assured to the participants, collecting their full names may have affected the completion rate and contributed to the selection bias. Self-reported GPA was affected by the recall bias. GAD-7 and PHQ-9 were used to determine the existence of anxiety and depression. However, a full diagnostic interview by a qualified mental health professional is required to establish the diagnosis of anxiety and depression. The prevalence of anxiety and depression may have been overestimated due to selection bias and the

**Table 4** Hierarchical regression analysis for predictors of National Medical Unified Examination (NMUE) Score

Predictor	Basic model		Basic model + GAD-7		Basic model + GAD-7 + GAD-7 <sup>2</sup> (nonlinear Model)		Basic model + PHQ-9	
	b	95% CI	b	95% CI	b	95% CI	b	95% CI
(Intercept)	-28.56 <sup>b</sup>	[-46.06, -11.06]	-25.12 <sup>b</sup>	[-43.51, -6.72]	-24.19 <sup>a</sup>	[-43.05, -5.33]	-24.38 <sup>b</sup>	[-42.70, -6.05]
CGPA	1.31 <sup>b</sup>	[1.08, 1.53]	1.28 <sup>b</sup>	[1.05, 1.51]	1.28 <sup>b</sup>	[1.04, 1.51]	1.28 <sup>b</sup>	[1.05, 1.51]
Total study days	0.01	[-0.00, 0.02]	0.01	[-0.01, 0.02]	0.01	[-0.00, 0.02]	0.01	[-0.00, 0.02]
Hours of study per day	-0.18	[-0.67, 0.32]	-0.18	[-0.67, 0.32]	-0.18	[-0.68, 0.32]	-0.21	[-0.70, 0.29]
Antidepressants or anxiolytics usage	-0.99	[-4.66, 2.68]	-0.78	[-4.46, 2.90]	-0.83	[-4.53, 2.87]	-0.46	[-4.18, 3.27]
Having a part-time job	-2.00	[-4.99, 1.00]	-1.77	[-4.79, 1.24]	-1.75	[-4.77, 1.28]	-1.95	[-4.93, 1.04]
Use of the official material	1.87	[-1.09, 4.82]	1.85	[-1.10, 4.80]	1.76	[-1.22, 4.75]	1.88	[-1.06, 4.82]
Use of the official material and external resources	1.99	[-0.98, 4.96]	2.15	[-0.83, 5.13]	2.21	[-0.79, 5.21]	2.26	[-0.72, 5.24]
GAD-7			-0.13	[-0.34, 0.09]	-0.32	[-1.16, 0.52]		
(GAD-7) <sup>2</sup>					0.01	[-0.03, 0.05]		
PHQ-9							-0.16	[-0.37, 0.06]
Model R <sup>2</sup>	0.568 <sup>b</sup>		0.573 <sup>b</sup>		0.574 <sup>b</sup>		0.575 <sup>b</sup>	
ΔR <sup>2</sup>			0.005		0.001		0.008	

Abbreviations: CGPA, Cumulative Grade Point Average; CI, confidence interval; GAD-7, Generalized Anxiety Disorder scale; NMUE, National Medical Unified Examination; PHQ-9, patient health questionnaire 9-item scale.

Note: A significant *b*-weight indicates the semipartial correlation is also significant. *b* represents unstandardized regression weights.

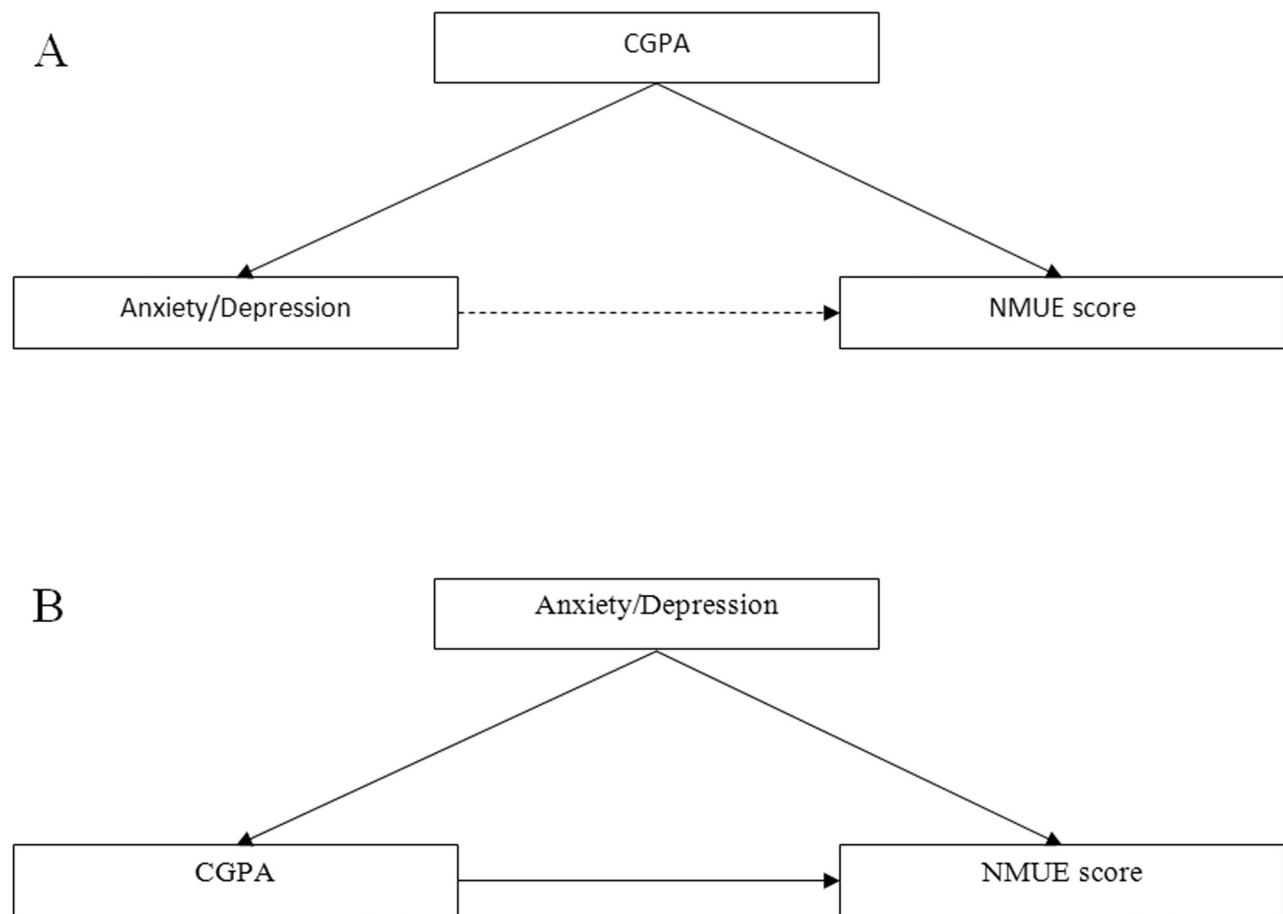
<sup>a</sup>Indicates *p* < 0.05.

<sup>b</sup>Indicates *p* < 0.01.

**Table 5** Factors affecting GAD-7 and PHQ-9 scores

Variable	GAD-7			PHQ-9		
	<i>n</i>	<i>Mdn</i>	Mann-Whitney U test	<i>n</i>	<i>M (SD)</i>	Independent <i>t</i> -test
Gender						
Male	47	8	$U = 1,642$	47	10.41 (6.48)	$t = 1.29$
Female	83	10	$p = 0.134$	83	11.77 (5.31)	$p = 0.198$
Exercise						
Yes	27	7	$U = 1,265$	27	9.22 (5.35)	$t = 2.13$
No	103	10	$p = 0.471$	103	11.8 (5.79)	$p = 0.035$
Having breakfast						
Yes	90	8	$U = 1,422$	90	10.07 (5.97)	$t = 1.93$
No	40	12	$p = 0.056$	40	12.8 (5.12)	$p = 0.056$

Abbreviations: GAD-7, Generalized Anxiety Disorder scale; *M*, mean; *Mdn*, median; *SD*, standard deviation; PHQ-9, patient health Questionnaire 9-item scale.



**Fig. 1** The two possible relationships between anxiety/depression and NMUE score. (A) Lower CGPA is associated with higher anxiety/depression as well as lower NMUE score (i.e., CGPA is a confounder). The dashed line indicates that the relationship is nonexistent. (B) Anxiety/depression is associated with lower NMUE score as well as lower CGPA. Lower CGPA is also associated with lower NMUE score. CGPA, Cumulative Grade Point Average; NMUE, National Medical Unified Examination.

use of self-administrated instruments. Moreover, data regarding the socioeconomic status of participants were not collected to use as controls in regression modeling. Some of the data collected were subjective and relied on participants'

estimation (i.e., exercise, presence in online NMUE study groups, study material, hours of study per day, total study days, and hours of sleep per day). Bonferroni adjustment was not done to adjust for type 1 error. Given the relatively small



sample size (4.5% of all students who took the exam), caution must be made when generalizing the results of this study.

## Conclusion

Mental health plays a vital role in our well-being, yet it is often overlooked by students and educators alike. Our study showed that approximately two-thirds of NMUE takers in our sample suffered from anxiety or depression, which can have a long-term impact on students' life and career. The impact of anxiety and depression on academic performance is uncertain; both anxiety and depression were associated with lower academic performance, but this relationship did not persist after taking students' abilities into account. Exercise might provide an effective method to fight depression.

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### Conflict of Interest

None declared.

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