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Article

# Mood Disorders and Sleep Quality among Undergraduate Students during COVID-19

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**Abstract:** Studies have established the crucial role of sleep among the students which plays a significant role in their mood. This study aimed to examine the mood disorders and sleep quality among undergraduate students at the University of Georgia (UG) and comparison between students' nationality. This cross-sectional study was a self-reported questionnaire comprised of demographics including age, gender, year of study, current location, lifestyle data (Exercise and smoking), the Depression, Anxiety, and Stress Scale (DAS21) and the Pittsburgh Sleep Quality Index (PSQI). We performed a descriptive analysis, and the Chi-square was statistically significant at  $p < 0.05$ . The prevalence was at a 95% confidence interval (95% CI) as multivariate analysis examined the multicollinearity. The female students were most of the respondents, below the age of 20 years. The student's mean age was 20.20 ( $SD \pm 3.0$ ). DAS report presented 72.7% of students with depressive symptoms, 77.8% with anxiety symptoms, and 62.2% had stress. Georgian students were more at risk of having depressive complaints (95% CI[1.567-3.788]), anxiety (95% CI[1.612-4.285]), and stress symptoms (95% CI[1.743-3.831]). There was a strong relationship between the students who experienced poor sleeping patterns and depressive complaints (aOR 0.10). The students who were smokers (aOR 0.39) were more likely to report anxiety symptoms than the students that do not exercise (aOR 1.68). It was observed that students with depressive symptoms, anxiety, and complaints of stress had a significantly high risk of poor sleep quality. Further studies are recommended to curb psychological symptoms of mood changes in association with sleep disorders among students.

**Keywords:** depression; anxiety; stress; sleep quality; students; COVID-19

## 1. Introduction

Students encounter different activities which could affect their health effectiveness to function subsequently. Considering the challenges from the sudden skyrocket of Covid19 pandemic in the educational system, students tend to cope with the stress which could be challenging [1,2]. Psychological distress could affect the sleep quality of the students [3,4]. There are different life stressors which students usually encounter such as the level of social support [5], diet [6], internet and smartphone addiction [7,8] which can have an impact in the required sleep quality and cause mood changes.

Sleep is crucial for the body biological process which helps to promote health [9,10]. Undergraduate students have been identified to be prone to sleep disturbances [11] which could be because of the high demand of time in achieving academic task. Students are subjected to high academic stress as the prevalence which could cause anxiety and depression surges [12]. This study

aimed to examine the psychiatry mood disorders and sleep quality among undergraduate students at the University of Georgia (UG) and comparison between students' nationality.

## 2. Methodology

### 2.1. Study Design and Sampling

This cross-sectional study which was web based self-reported questionnaire comprised of demographic including age, gender, year of study, current location, lifestyle data (Exercise and smoking), the Depression, Anxiety and Stress Scale (DASS21) and the Pittsburgh Sleep Quality Index (PSQI). 535 students responded to the anonymous questionnaires shared among the UG students through the University intranet after its ethical approval. There was no reward to the participants as the study was voluntary. The data were collected between September and October 2022.

### 2.2. Assessment

**Demographic variables:** included gender, age group (<20, 21-25 >26), year of study, current location, nationality, and lifestyle data (Exercise and smoking).

**Psychological Problems:** We used the Depression, Anxiety and Stress Scale (DASS21) as designed to assess the students' depression, anxiety, and stress symptoms. Each comprised of seven self-assessed questions as respondents were required to rate their psychological symptoms for the past one week on a Likert scale from 0- 3 (0: did not apply at all over the last week, 1: applied to some degree, or some of the time; 2: applied a considerable degree, or a good part of time; 3: applied very much or most of the time). The DASS21 cut off were as follows,  $\geq 10$  in depression,  $\geq 8$  in anxiety, and  $\geq 15$  in stress according to the DASS21 manual [14]

**PSQI:** Sleep quality was assessed using the Pittsburgh Sleep Quality Index scale (PSQI) which contained 19 self-rated questions. It comprised of seven subscales including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep alterations, sleep pills, daytime sleep dysfunction. The seven subscales were comprised to get global score which ranged from 0 – 21 points.

**PSQI grading:** subjective sleep quality- Poor (Very poor and poor), Good (Very good and pretty good), sleep latency- High (31–60 minutes and > 60 minutes), Low (<15 minutes and 16–30 minutes), sleep pills- <1 time/week (Not during the last month and less than once a week) and > 1 time/week (once or twice a week and three or more times a week). The cut-off point of the global score was > 5 which can show more than 80% of both poor sleep quality sensitivity and specificity [13].

### 2.3. Statistical Analysis

Statistical Package for the Social Sciences (SPSS) version 23.0 software (SPSS Inc., Chicago, IL, USA) was used to assess all data analysis. The descriptive analysis and Chi-square were performed to determine the risk of psychological problems on sleep quality, statistically significant at  $p < 0.05$ . Though the DASS21 were categorized into dichotomous responses (yes/no) before performing the multivariate analysis. Multivariate analysis examined the multicollinearity, homogeneity of variance and Variance Inflation Factors (VIF <4). The prevalence was at 95% confidence interval (95% CI).

## 3. Results

### 3.1. Demographic Characteristics of the Students

The female students (65.4%) were most of the respondents, majority were below the age of 20years (67.5%), and the mean age was 20.20 (SD $\pm$  3.0). 53.1% of the students were in First year, currently in Georgia (96.3%), 50.8% reported self-perceived poor mental health, 39.4% do not exercise and 37.6% smokes cigarette (Table 1). In DASS report (Table 2) 72.7% of students reported depressive symptoms, 77.8% had anxiety symptoms and 62.2% had stress as 89.2% reported had poor sleep quality.

**Table 1.** Demographic Characteristics of UG Undergraduate students.

<b>Variables</b>	<b>N</b>	<b>%</b>
<b>Gender</b>		
Female	35065.4	
Male	18534.6	
<b>Age</b>		
< 20	36167.5	
21-25	15629.2	
>26	18	3.4
<b>Year of Study</b>		
First year	28453.1	
Second year	11020.6	
Third year	68	12.7
Fourth year	48	9
Fifth year	22	4.1
Sixth year	3	0.6
<b>Students in Tbilisi</b>		
Yes	51596.3	
No	20	3.7
<b>Nationality</b>		
Georgian students	19035.5	
International students	34564.5	
<b>Nationality</b>		
Good	26349.2	
Poor	27250.8	
<b>Exercise</b>		
Yes	32460.6	
No	21139.4	
<b>Smoking Status</b>		
Yes	20137.6	
No	33462.4	

**Table 2.** Distribution of the Students Responses to DASS and PSQI questionnaires.

<b>DASS 21 Report</b>		
<b>Depression</b>	<b>N</b>	<b>%</b>
Yes	389	72.7
No	146	27.3
<b>Anxiety</b>		
Yes	416	77.8
No	119	22.2
<b>Stress</b>		
Yes	333	62.2
No	202	37.8
<b>PSQI Report</b>		
<b>Subjective Sleep</b>	<b>N</b>	<b>%</b>
Poor	283	52.9
Good	252	47.1
<b>Sleep Latency</b>		
High	534	99.8
Low	1	0.2

Sleep Duration		
> 7hours	113	21.1
< 7hours	422	78.9
Sleep Efficiency		
< 75%	178	33.3
> 75%	357	66.7
Sleep alterations		
High	230	43
Low	305	57
Sleep pills		
< 1 time/week	457	85.4
> 1 time/Week	78	14.6
Day time Sleep Dysfunction		
High	448	83.7
Low	86	16.1
Global Score		
Poor	477	89.2
Good	58	10.8

### 3.2. Students Nationality and Gender Differences

Table 3 showed that Georgian students were more at risk of having depressive complaints (83.2%, OR 2.437;  $\chi^2$  (16.208a),  $p=0.000$ , 95% CI[1.567-3.788]), anxiety (87.4%, OR 2.628;  $\chi^2$  (15.737a),  $p=0.000$ , 95% CI[1.612-4.285]), and stress symptoms (75.8%, OR 2.584;  $\chi^2$  (23.007a),  $p=0.000$ , 95% CI[1.743-3.831]). However, in Table 4 female students had increased risk for depression (76.6%, OR 0.578;  $\chi^2$  (7.605a),  $p=0.006$ , 95% CI[0.391-0.855]), anxiety (83.7%, OR 0.386;  $\chi^2$  (20.769a),  $p=0.000$ , 95% CI[0.254-0.585]), and stress (68.3%, OR 0.480;  $\chi^2$  (15.726a),  $p=0.000$ , 95% CI[0.333-0.692]).

**Table 3.** Comparison of Nationality among Psychological Symptoms, and Sleep Quality.

	Nationality			Chi-square	P-value	OR	95% Confidence Interval	
	Georgian students	International students	Total				Lower	Upper
<b>Depression</b>								
Yes	158 (83.20%)	231 (67.00%)	389	<b>16.208a</b>	<b>0.000</b>	<b>2.437</b>	<b>1.567</b>	<b>3.788</b>
No	32 (16.80%)	114 (33.00%)	146					
<b>Anxiety</b>								
Yes	166 (87.40%)	250 (72.50%)	<b>416</b>	<b>15.737a</b>	<b>0.000</b>	<b>2.628</b>	<b>1.612</b>	<b>4.285</b>
No	24 (12.60%)	95 (27.50%)	119					
<b>Stress</b>								
Yes	144 (75.80%)	189 (54.80%)	333	<b>23.007a</b>	<b>0.000</b>	<b>2.584</b>	<b>1.743</b>	<b>3.831</b>
No	46 (24.20%)	156 (45.20%)	202					
<b>Sleep quality</b>								
Poor	175 (92.10%)	302 (87.50%)	477	2.646a	0.104	1.661	0.897	3.077
Good	15 (7.90%)	43 (12.50%)	58					

**Table 4.** Comparison between gender differences, psychological symptoms, and sleep quality.

	<b>Gender</b>			Chi-square	P-value	OR	95% Confidence Interval	
	Male students	Female students	Total				Lower	Upper
<b>Depression</b>								
Yes	121 (65.40%)	268 (76.60%)	389	<b>7.605a</b>	<b>0.006</b>	<b>0.578</b>	<b>0.391</b>	<b>0.855</b>
No	64 (34.60%)	82 (23.40%)	146					
<b>Anxiety</b>								
Yes	123 (66.50%)	293 (83.70%)	416	<b>20.769a</b>	<b>0.000</b>	<b>0.386</b>	<b>0.254</b>	<b>0.585</b>
No	62 (33.50%)	57 (16.30%)	119					
<b>Stress</b>								
Yes	94 (50.80%)	239 (68.30%)	333	<b>15.726a</b>	<b>0.000</b>	<b>0.480</b>	<b>0.333</b>	<b>0.692</b>
No	91 (49.20%)	111 (31.70%)	202					
<b>Sleep quality</b>								
Poor	160 (86.50%)	317 (90.60%)	477	2.089a	0.148	0.666	0.383	1.159
Good	25 (13.50%)	33 (9.40%)	58					

### 3.3. Comparison of Psychological Symptoms and Sleep Quality

In Table 5, 62.70% of students that had poor subjective sleep had an increased risk for depressive symptoms (OR 4.62;  $\chi^2$  (55.256),  $p < 0.05$ , 95% CI[3.033-7.029]). 81.20% of students that slept less than 7hours were at increased risk of depression (OR 0.61;  $\chi^2$  (4.747),  $p < 0.05$ , 95% CI[0.393-0.954]) including students that had high sleep alterations (53.7%; OR 6.91;  $\chi^2$  (67.048),  $p < 0.05$ , 95% CI[4.178-11.433]), daytime dysfunction (94.3%; OR 12.984;  $\chi^2$  (114.365),  $p < 0.05$ , 95% CI[7.564-22.289]), and the students that used sleep pills (18.8%; OR 0.15;  $\chi^2$  (20.062),  $p < 0.05$ , 95% CI[0.061-0.388]).

Table 6 presented that the students who reported poor subjective sleep quality (61.1%; OR 4.87;  $\chi^2$  (49.987),  $p < 0.05$ , 95% CI[3.064-7.728]), less than 7hours sleep (81.3%; OR 0.55;  $\chi^2$  (6.313),  $p < 0.05$ , 95% CI[0.348-0.882]), sleep alterations (51.2%; OR 6.30;  $\chi^2$  (51.452),  $p < 0.05$ , 95% CI[3.639-10.893]) and daytime sleep dysfunction (92.8%; OR 11.41;  $\chi^2$  (108.587),  $p < 0.05$ , 95% CI[6.8-19.136]) were at increased risk of anxiety.

Table 7 showed that students that complained of poor subjective sleep quality (65.5%; OR 3.995;  $\chi^2$  (55.914),  $p < 0.05$ , 95% CI[2.755-5.794]), high sleep alterations (58.6%; OR 6.74;  $\chi^2$  (87.214),  $p < 0.05$ , 95% CI[4.41-10.309]), used sleep pills (19.5%; OR 0.28;  $\chi^2$  (17.283),  $p < 0.05$ , 95% CI[0.152-0.529]) and high daytime sleep dysfunction (95.2%; OR 10.473;  $\chi^2$  (82.734),  $p < 0.05$ , 95% CI[5.865-18.703]) had increased risk of stress symptoms.

**Table 5.** Comparison between depressive symptom and PSQI subcomponent.

	<b>Depression Symptoms</b>		Total	$\chi^2$	p-value	OR	95% Confidence Interval (CI)	
	Yes	No					Lower	Upper
<b>Subjective Sleep</b>								
Poor	244 (62.7%)	39 (26.7%)	283	<b>55.256a</b>	<b>0.000</b>	<b>4.617</b>	<b>3.033</b>	<b>7.029</b>
Good	145 (37.3%)	107 (73.3%)	252					
<b>Sleep Latency</b>								
High	388 (99.7%)	146 (100%)	534	.376a	0.540	0.727	0.69	0.765
Low	1 (0.3%)	0	1					
<b>Sleep Duration</b>								
> 7hours	73 (18.8%)	40 (27.4%)	113	<b>4.747a</b>	<b>0.029</b>	<b>0.612</b>	<b>0.393</b>	<b>0.954</b>
< 7hours	316 (81.2%)	106 (72.6%)	422					

Sleep Efficiency								
< 75%	130 (33.4%)	48 (32.9%)	178	.014a	0.906	1.025	0.684	1.536
> 75%	259 (66.6%)	98 (67.1%)	357					
Sleep alterations								
High	209 (53.7%)	21 (14.4%)	230	<b>67.048a</b>	<b>0.000</b>	<b>6.911</b>	<b>4.178</b>	<b>11.433</b>
Low	180 (46.3%)	125 (85.6%)	305					
Sleep pills								
< 1 time/week	316 (81.2%)	141 (96.6%)	457	<b>20.062a</b>	<b>0.000</b>	<b>0.154</b>	<b>0.061</b>	<b>0.388</b>
> 1 time/week	73 (18.8%)	5 (3.4%)	78					
Day time Sleep Dysfunction								
High	366 (94.3%)	82 (56.2%)	448	<b>114.365a</b>	<b>0.000</b>	<b>12.984</b>	<b>7.564</b>	<b>22.289</b>
Low	22 (5.7%)	64 (43.8%)	86					

Table 6. Comparison between anxiety symptoms and PSQI subcomponent.

	Anxiety Symptoms		Total	Chi-Square Tests	p-value	OR	95% Confidence Interval	
	Yes	No					Lower	Upper
Subjective Sleep								
Poor	254 (61.1%)	29 (24.4%)	283	<b>49.987a</b>	<b>0.000</b>	<b>4.866</b>	<b>3.064</b>	<b>7.728</b>
Good	162 (38.9%)	90 (75.6%)	252					
Sleep Latency								
High	415 (99.8%)	119 (100%)	534	.287a	0.592	0.777	0.743	0.813
Low	1 (0.2%)	0	1					
Sleep Duration								
> 7hours	78 (18.8%)	35 (29.4%)	113	<b>6.313a</b>	<b>0.012</b>	<b>0.554</b>	<b>0.348</b>	<b>0.882</b>
< 7hours	338 (81.3%)	84 (70.6%)	535					
Sleep Efficiency								
< 75%	144 (34.6%)	34 (28.6%)	178	1.522a	0.217	1.324	0.847	2.068
> 75%	272 (65.4%)	85 (71.4%)	357					
Sleep alterations								
High	213 (51.2%)	17 (14.3%)	230	<b>51.452a</b>	<b>0.000</b>	<b>6.296</b>	<b>3.639</b>	<b>10.893</b>
Low	203 (48.8%)	102 (85.7%)	305					
Sleep pills								
< 1 time/week	344 (82.7%)	113 (95.0%)	457	<b>11.178a</b>	<b>0.001</b>	<b>0.254</b>	<b>0.107</b>	<b>0.599</b>
> 1 time/Week	72 (17.3%)	6 (5.0%)	78					
Day time Sleep Dysfunction								
High	385 (92.8%)	63 (52.9%)	448	<b>108.587a</b>	<b>0.000</b>	<b>11.407</b>	<b>6.8</b>	<b>19.136</b>
Low	30 (7.2%)	56 (47.1%)	86					

Table 7. Comparison between stress complaints and PSQI subcomponent.

	Stress Symptoms		Total	Chi-Square Tests	p-value	OR	95% Confidence Interval	
	Yes	No					Lower	Upper

	Yes	No			Lower	Upper
<b>Subjective Sleep</b>						
Poor	218 (65.5%)	65 (32.2%)	283	<b>55.914a</b>	<b>0.000</b>	<b>3.995 2.755 5.794</b>
Good	115 (34.5%)	137 (67.8%)	252			
<b>Sleep Latency</b>						
High	332 (97.7%)	202 (100%)	534	.608a	0.436	0.622 0.582 0.664
Low	1 (0.3%)	0	1			
<b>Sleep Duration</b>						
> 7hours	62 (18.6%)	51 (25.2%)	113	3.316a	0.069	0.677 0.445 1.032
< 7hours	271 (81.4%)	151 (74.8%)	422			
<b>Sleep Efficiency</b>						
< 75%	112 (33.6%)	66 (32.7%)	178	.052a	0.819	1.044 0.72 1.514
> 75%	221 (66.4%)	136 (67.3%)	357			
<b>Sleep alterations</b>						
High	195 (58.6%)	35 (17.3%)	230	<b>87.214a</b>	<b>0.000</b>	<b>6.742 4.41 10.309</b>
Low	138 (41.4%)	167 (82.7%)	305			
<b>Sleep pills</b>						
< 1 time/week	268 (80.5%)	189 (93.6%)	457	<b>17.283a</b>	<b>0.000</b>	<b>0.284 0.152 0.529</b>
> 1 time/Week	65 (19.5%)	13 (6.4%)	78			
<b>Day time Sleep Dysfunction</b>						
High	316 (95.2%)	132 (65.3%)	448	<b>82.734a</b>	<b>0.000</b>	<b>10.47 5.865 18.703</b>
Low	16 (4.8%)	70 (34.7%)	86			

**Table 8.** Multiple logistic regression model predicting depression, anxiety, and stress symptoms among UG students.

Variable	B	Wald	Sig.	aOR	95% Confidence Interval	
					Lower Bound	Upper Bound
<b>Depression</b>						
	Constant	-0.261	0.135	0.713		
Gender	Female	-0.356	2.264	0.132	0.7	0.44 1.114
	Male <sup>+</sup>	-	-	-	-	-
Age	<20	1.002	3.134	0.077	2.723	0.898 8.257
	21-25	0.727	1.548	0.213	2.069	0.658 6.503
	>26 <sup>+</sup>	-	-	-	-	-
Exercise	Yes	-0.421	2.93	0.087	0.656	0.405 1.063
	No <sup>+</sup>	-	-	-	-	-
Smoking status	<b>Yes</b>	<b>0.819</b>	<b>9.834</b>	<b>0.002</b>	<b>2.268</b>	<b>1.359 3.783</b>
	No <sup>+</sup>	-	-	-	-	-
Sleep quality	<b>Poor</b>	<b>1.79</b>	<b>26.586</b>	<b>0.000</b>	<b>5.988</b>	<b>3.033 11.824</b>
	Good <sup>+</sup>	-	-	-	-	-
<b>Anxiety</b>						
Yes	Constant	1.211	2.63	0.105		
Gender	<b>Female</b>	<b>-0.872</b>	<b>12.659</b>	<b>0.000</b>	<b>0.418</b>	<b>0.258 0.676</b>

	Male <sup>+</sup>	-	-	-	-	-	-
Age	<20	0.498	0.699	0.4031.646	0.512	5.297	
	21-25	-0.15	0.061	0.806 0.86	0.26	2.85	
	>26 <sup>+</sup>	-	-	-	-	-	-
Exercise	Yes	-0.492	3.467	0.0630.612	0.364	1.026	
	No <sup>+</sup>	-	-	-	-	-	-
Smoking status	<b>Yes</b>	<b>0.896</b>	<b>10.288</b>	<b>0.0012.451</b>	<b>1.417</b>	<b>4.238</b>	
	No <sup>+</sup>	-	-	-	-	-	-
Sleep quality	<b>Poor</b>	<b>1.38</b>	<b>17.578</b>	<b>0.0003.973</b>	<b>2.085</b>	<b>7.573</b>	
	Good <sup>+</sup>	-	-	-	-	-	-
Stress							
Yes	Constant	0.901	1.65	0.199			
Gender	<b>Female</b>	<b>-0.595</b>	<b>7.518</b>	<b>0.0060.551</b>	<b>0.36</b>	<b>0.844</b>	
	Male <sup>+</sup>	-	-	-	-	-	-
Age	<20	-0.006	0	0.9910.994	0.33	2.99	
	21-25	-0.418	0.521	0.47 0.658	0.212	2.048	
	>26 <sup>+</sup>	-	-	-	-	-	-
Exercise	<b>Yes</b>	<b>-0.58</b>	<b>6.934</b>	<b>0.008 0.56</b>	<b>0.363</b>	<b>0.862</b>	
	No <sup>+</sup>	-	-	-	-	-	-
Smoking status	<b>Yes</b>	<b>0.657</b>	<b>8.358</b>	<b>0.0041.929</b>	<b>1.236</b>	<b>3.01</b>	
	No <sup>+</sup>	-	-	-	-	-	-
Sleep quality	<b>Poor</b>	<b>1.152</b>	<b>10.612</b>	<b>0.0013.163</b>	<b>1.582</b>	<b>6.324</b>	
	Good <sup>+</sup>	-	-	-	-	-	-

aOR= adjusted odd ratio; Reference category is +; Bolded values are the significant predictors.

### 3.4. Multivariate Analysis

The multicollinearity like the variance inflation factor (VIF) in depression, anxiety and stress were assessed. The VIF suggested that all the independent variables were not strongly correlated with the dependent factors. In the final model, three variables which are exercise, smoking status, and sleep quality were significant correlate of depressive symptoms (Table 8). Among these variables, the students that do not exercise had adjusted odds ratio (aOR) of 1.61 than students that smoked cigarette (aOR 0.41). There was a strong relationship between the students who experienced poor sleeping patterns and depressive complaints (aOR 0.10).

For anxiety, (Table 8) the female students, students who do not exercise, smokers, and poor sleep quality were the significant predictors. The students who had poor sleep quality (aOR 0.15) had the strongest correlate as the female students were at risk of anxiety (aOR 2.43). Students who are smokers (aOR 0.39) more likely to report anxiety symptoms than the students that do not exercise (aOR 1.68).

In Table 8 for stress, the female students, exercise, smoking status, and sleep quality, significantly correlated. The students that experienced poor sleep habits had the strongest correlate (aOR 0.17), followed by cigarette smokers (aOR 0.50). As the students who do not exercise (aOR 1.79) were more at risk than the female students (1.80).

## 4. Discussion

We found that Georgian students were more at risk of having depressive symptoms than the international students as this was consistent with our previous study [15] though Covid-19 restrictions from social events was suggested as a major factor. International students have been compelled to have high sleep and psychological disturbances considering the struggles to adapt to a new environment, food, culture, friends, and society [16,17]. As studies have shown that most international students requested for counseling because of depressive complaints, anxiety symptoms and stress in which they sought for a comprehensive means in managing such symptoms as it becomes intolerable [18,19]. Considering the large extent in which foreign students can be prone to

mental health complaints [20], which can manifest in feeling of loneliness and sadness, Georgian students were more prone to psychological complaints considering the recovery from Covid-19 crisis and socio-economic issues.

Meanwhile the female students involved in our study were more at risk of experiencing depression, anxiety, and stress. As most of the participants were female students from first year of study and less than the age of 20 years. Gender differences as related to psychological problems have an effect among the male and female students [21]. Studies have shown that the young females, go to bed earlier than male but were more likely to be disturbed by nightmares or awakened by little noise [22,23] which could result to manifestation of psychological symptoms over a prolonged period. These differences can be influenced by certain life factors such as age differences as observed in a wide cohort study [24], seasonal changes [25], family and next day activities [26].

Our study evaluated the prevalence of poor sleep habits in association with psychological problems such as depression, anxiety, and stress symptoms. Overall, was consistent, with the results from the previous studies regarding the sleep patterns among undergraduate students from University of Georgia (UG) [15]. In this study, it was observed that students with depressive symptoms had significant high risk of poor sleep quality. As it has been reported that undergraduate students are more vulnerable to experiencing both psychological symptoms and poor sleep habits [3] considering the required course load [27,28].

Students with anxiety symptoms had poor subjective sleep quality, slept less than 7 hours, had sleep alterations and daytime sleep dysfunction. The students with depressive and stress symptoms had poor subjective sleep quality, high sleep alterations, used sleep pills and had high daytime sleep dysfunction. Though poor sleep quality, sleep alterations, sleeping pills and disturbances have remained prevalent among students because of different academic challenges and non-academic activities [29].

Despite the required sleep duration (7-9 hours) for proper body function [30], our study reported less than 7 hours of sleep as reported in Gaultney studies, 2010 [31]. Moreover, the level of sleep duration and night sleep alterations can affect student's daytime dysfunction [32]. Studies performed among undergraduate students from northeastern United States reported the use of sleep medication which could increase the symptoms of insomnia [33] as we recorded a slight increase in use sleep pills among the students which was consistent with the previous studies [15].

Students tend to adopt different coping mechanism such as smoking and drinking lifestyle to adapt to the stress [34] which could cause deteriorating sleep quality [35]. The students from this study who are smokers had poor sleep quality. Previous studies conducted among UG students have presented the prevalence of stress and sleep deprivation because of poor academic performance [36] which corresponds with the level of psychological problems observed in this study.

## 5. Conclusions

Our study presented the associations of self-reported students sleep quality with depression, stress, and anxiety symptoms. Poor sleep quality associated with the high prevalence of the psychological symptoms as female students and Georgian students were prone to more complaints. Students should always put their health in consideration as negligence of these can lead to deteriorating events.

**Supplementary Materials:** Table S1- Sociodemographic characteristics between Georgian students and international students. Table S2- Distribution on Psychological Report of Georgian students and international students. Table S3- Distribution on Sleep Report of Georgian students and international students.

**Recommendations:** Initiating a counseling department for the students would help in managing the prevalence of psychological symptoms as it is not popular in Georgia. This has been proven helpful by Yahushko et al. (2008) [37] in which the awareness spread from friends to friends. Most times, during these psychological events, the student might not have the mood to appear for lectures or stick around with friends but can book an appointment for counseling regarding the issues. Students mostly feel that sleeping medication (which is used without

physician's prescriptions) could help them whenever such moody or depressive feeling overwhelms. There should be educational programs and events in the university environment which can be organized by the students' club to help promote healthy sleep habits. Considering the increased rate of sleep disturbances, students should be encouraged to create a conducive environment, discourage cigarette smoking, and encourage exercise which would promote good sleep quality.

**Data Availability:** This article contained all collected and analyzed data. Additional inquiries can be directed to any of the corresponding author.

**Conflict of Interest:** The authors declare no conflict of interest.

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**Ethical Approval:** This research study is approved by the Institutional Review Board (IRB) of the School of Health Sciences, the University of Georgia (Approval number- UGREC-01-22) in accordance with the Declaration of Helsinki.

**Informed Consent Statement:** There was no consent required because of the IRB institutional approval.

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## Reference

- Xiong, J., Lipsitz, O., Nasri, F., Lui, L. M. W., Gill, H., Phan, L., Chen-Li, D., Iacobucci, M., Ho, R., Majeed, A., & McIntyre, R. S. (2020). Impact of covid-19 pandemic on Mental Health in the general population: A systematic review. *Journal of Affective Disorders*, 277, 55–64. <https://doi.org/10.1016/j.jad.2020.08.001>
- Sanchez-Ramirez, D. C., Normand, K., Zhaoyun, Y., & Torres-Castro, R. (2021). Long-term impact of COVID-19: A systematic review of the literature and meta-analysis. *Biomedicines*, 9(8), 900. <https://doi.org/10.3390/biomedicines9080900>
- Seun-Fadipe, C. T., & Mosaku, K. S. (2017). Sleep quality and psychological distress among undergraduate students of a Nigerian University. *Sleep Health*, 3(3), 190–194. <https://doi.org/10.1016/j.sleh.2017.02.004>
- Zhang, Y., Peters, A., & Chen, G. (2018). Perceived stress mediates the associations between sleep quality and symptoms of anxiety and depression among college nursing students. *International Journal of Nursing Education Scholarship*, 15(1). <https://doi.org/10.1515/ijnes-2017-0020>
- Guo, K., Zhang, X., Bai, S., Minhat, H. S., Nazan, A. I. N. M., Feng, J., Li, X., Luo, G., Zhang, X., Feng, J., Li, Y., Si, M., Qiao, Y., Ouyang, J., & Saliluddin, S. (2021). *Assessing social support impact on depression, anxiety, and stress among undergraduate students in Shaanxi Province during the covid-19 pandemic of China*. PLOS ONE. Retrieved December 16, 2022, from <https://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0253891>
- Flaudias, V., Iceta, S., Zerhouni, O., Rodgers, R., Billieux, J., Llorca, P., Boudesseul, J., Chazeron, I. de Romo, L., Maurage, P., Samalin, L., Bègue, L., Naassila, M., Brousse, G., & Guillaume, S. (2020, September 24). [PDF] *covid-19 pandemic lockdown and problematic eating behaviors in a student population: Semantic scholar*. Journal of Behavioral Addictions. Retrieved December 16, 2022, from <https://www.semanticscholar.org/paper/COVID-19-pandemic-lockdown-and-problematic-eating-a-Flaudias-Iceta/43d5433ae3af06c403b6198328060ab10b50cd3c>
- Matar Boumosleh, J., & Jaalouk, D. (2017). Depression, anxiety, and smartphone addiction in University Students- A Cross Sectional Study. *PLOS ONE*, 12(8). <https://doi.org/10.1371/journal.pone.0182239>
- Awasthi, A. A., Taneja, N., Maheshwari, S., Gupta, T., & Bhavika. (2020). Prevalence of internet addiction, poor sleep quality, and depressive symptoms among medical students: A cross-sectional study. *Osong Public Health and Research Perspectives*, 11(5), 303–308. <https://doi.org/10.24171/j.phrp.2020.11.5.06>
- Irwin, M. R. (2015). Why sleep is important for Health: A Psychoneuroimmunology Perspective. *Annual Review of Psychology*, 66(1), 143–172. <https://doi.org/10.1146/annurev-psych-010213-115205>
- Lueke, N. A., & Assar, A. (2022). Poor sleep quality and reduced immune function among college students: Perceived stress and depression as mediators. *Journal of American College Health*, 1–8. <https://doi.org/10.1080/07448481.2022.2068350>
- Kloss, J. D., Nash, C. O., Horsey, S. E., & Taylor, D. J. (2011). The delivery of Behavioral Sleep Medicine to college students. *Journal of Adolescent Health*, 48(6), 553–561. <https://doi.org/10.1016/j.jadohealth.2010.09.023>
- Simegn, W., Dagnew, B., Yeshaw, Y., Yitayih, S., Woldegerima, B., & Dagne, H. (2021). Depression, anxiety, stress and their associated factors among Ethiopian University students during an early stage of covid-19

- pandemic: An online-based cross-sectional survey. *PLOS ONE*, 16(5). <https://doi.org/10.1371/journal.pone.0251670>
13. Buysse, D. J., Reynolds, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality index: A new instrument for psychiatric practice and Research. *Psychiatry Research*, 28(2), 193–213. [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4)
  14. Lovibond, S. H., & Lovibond, P. F. (1996). *Manual for the depression anxiety stress scales*. Psychology Foundation of Australia.
  15. Mgbedo, N. E., Alighanbari, F., Radmehr, S., George, A. M., & Gogichadze, M. (2022). Covid-19 pandemic's impact on the student's sleep patterns at the University of Georgia. *Sleep Medicine*, 100. <https://doi.org/10.1016/j.sleep.2022.05.206>
  16. Poyrazli, S. (2015). Psychological symptoms and concerns experienced by international students: Outreach implications for counseling centers. *Journal of International Students*, 5(3), 306–312. <https://doi.org/10.32674/jis.v5i3.424>
  17. Tung, W.-C. (2011). Acculturative stress and help-seeking behaviors among international students. *Home Health Care Management & Practice*, 23(5), 383–385. <https://doi.org/10.1177/1084822311405454>
  18. Mitchell, S. L., Greenwood, A. K., & Guglielmi, M. C. (2007). Utilization of counseling services: Comparing International and U.S. college students. *Journal of College Counseling*, 10(2), 117–129. <https://doi.org/10.1002/j.2161-1882.2007.tb00012.x>
  19. Yi, J. K., Lin, J. G., & Kishimoto, Y. (2003). Utilization of counseling services by international students. *Journal of Instructional Psychology*, 30, 333–342.
  20. Hyun, J., Quinn, B., Madon, T., & Lustig, S. (2007). Mental health need, awareness, and use of counseling services among international graduate students. *Journal of American College Health*, 56, 109–118.
  21. Bayram, N., & Bilgel, N. (2008). The prevalence and socio-demographic correlations of depression, anxiety and stress among a group of university students. *Social Psychiatry and Psychiatric Epidemiology*, 43(8), 667–672. <https://doi.org/10.1007/s00127-008-0345-x>
  22. Reyner, L. A., Horne, J. A., & Reyner, A. (1995). Gender- and age-related differences in sleep determined by home-recorded sleep logs and actimetry from 400 adults. *Sleep*, 18(2), 127–134.
  23. Park, Y. M., Matsumoto, K., Shinkoda, H., Nagashima, H., Kang, M. J., & Seo, Y. J. (2001). Age and gender difference in habitual sleep-wake rhythm. *Psychiatry and clinical neurosciences*, 55(3), 201–202. <https://doi.org/10.1046/j.1440-1819.2001.00825.x>
  24. Dregan, A., & Armstrong, D. (2010). Adolescence sleep disturbances as predictors of adulthood sleep disturbances--a cohort study. *The Journal of adolescent health : official publication of the Society for Adolescent Medicine*, 46(5), 482–487. <https://doi.org/10.1016/j.jadohealth.2009.11.197>
  25. Husby, R., & Lingjaerde, O. (1990). Prevalence of reported sleeplessness in northern Norway in relation to sex, age and season. *Acta psychiatrica Scandinavica*, 81(6), 542–547. <https://doi.org/10.1111/j.1600-0447.1990.tb05009.x>
  26. Tsai, L.-L., & Li, S.-P. (2004). Sleep patterns in college students. *Journal of Psychosomatic Research*, 56(2), 231–237. [https://doi.org/10.1016/s0022-3999\(03\)00507-5](https://doi.org/10.1016/s0022-3999(03)00507-5)
  27. Hsieh, Y. H., Hsu, C. Y., Liu, C. Y., & Huang, T. L. (2011). The levels of stress and depression among interns and clerks in three medical centers in Taiwan--a cross-sectional study. *Chang Gung medical journal*, 34(3), 278–285.
  28. Shaikh, B. T., Kahloon, A., Kazmi, M., Khalid, H., Nawaz, K., Khan, N., & Khan, S. (2004). Students, stress and coping strategies: a case of Pakistani medical school. *Education for health (Abingdon, England)*, 17(3), 346–353. <https://doi.org/10.1080/13576280400002585>
  29. Clegg-Kraynok, M. M., McBean, A. L., & Montgomery-Downs, H. E. (2011). Sleep quality and characteristics of college students who use prescription psychostimulants nonmedically. *Sleep Medicine*, 12(6), 598–602. <https://doi.org/10.1016/j.sleep.2011.01.012>
  30. Carskadon, M. A. (2001). Factors influencing sleep patterns of adolescents. *Adolescent Sleep Patterns*, 4–26. <https://doi.org/10.1017/cbo9780511499999.005>
  31. Gaultney, J. F. (2010). The prevalence of sleep disorders in college students: Impact on academic performance. *Journal of American College Health*, 59(2), 91–97. <https://doi.org/10.1080/07448481.2010.483708>
  32. Bokhari, N. M., & Zafar, M. (2020). Daytime sleepiness and sleep quality among undergraduate medical students in Sialkot, Pakistan. *Dr. Sulaiman Al Habib Medical Journal*, 2(2), 51. <https://doi.org/10.2991/dsahmj.k.200514.002>
  33. Goodhines, P. A., Gellis, L. A., Ansell, E. B., & Park, A. (2019). Cannabis and alcohol use for sleep aid: A daily diary investigation. *Health Psychology*, 38(11), 1036–1047. <https://doi.org/10.1037/hea0000765>
  34. Huang, Y., Su, X., Si, M., Xiao, W., Wang, H., Wang, W., Gu, X., Ma, L., Li, J., Zhang, S., Ren, Z., & Qiao, Y. (2021, October 27). *The impacts of coping style and perceived social support on the mental health of undergraduate students during the early phases of the COVID-19 pandemic in China: A multicenter survey*. BMC psychiatry. Retrieved December 16, 2022, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8549419/>

35. Mahfouz, M. S., Ali, S. A., Bahari, A. Y., Ajeebi, R. E., Sabei, H. J., Somaily, S. Y., Madkhali, Y. A., Hrooby, R. H., & Shook, R. N. (2020). association between sleep quality and physical activity in Saudi Arabian University students. *Nature and Science of Sleep, Volume 12*, 775–782. <https://doi.org/10.2147/nss.s267996>
36. Shonia, T., Lobjanidze, M., Antia, K., & Lobjanidze, T. (2020). Stress and sleeping disorders among international students of the University of Georgia. *European Journal of Public Health, 30*(Supplement\_5). <https://doi.org/10.1093/eurpub/ckaa166.779>
37. Yakushko, O., Davidson, M. M., & Sanford-Martens, T. C. (2008). Seeking help in a foreign land: International students' use patterns for a U.S. university counseling center. *Journal of College Counseling, 11*, 6-18.

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