

## RELATIONSHIPS BETWEEN QUALITY OF SLEEP AND INSOMNIA WITH DEPRESSION AND ANXIETY SYMPTOMS IN MEDICAL UNIVERSITY STUDENTS IN SERBIA

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Since sleep problems are very common among university students, this study explored the interplay between symptoms of depression, anxiety, quality of sleep, and insomnia.

The cross-sectional study was carried out at the University of Niš, Faculty of Medicine (Serbia) in 2016 and included 600 students of both genders. Students completed the questionnaire, which was compiled and developed from the Depression Anxiety Stress Scale, the Pittsburgh Sleep Quality Index, and the Insomnia Severity Index.

Sleep problems are very frequent among university students: 432 (72%) and 258 (43%) students reported poor sleep quality or sub-threshold insomnia problems, respectively. Even 66 students (11%) reported moderate or severe insomnia. Above-threshold depression symptoms were reported by 168 students (28%) and anxiety symptoms by 180 of them (30%). Depression was strongly associated with poor sleep quality ( $\chi^2 = 20.35$ ;  $df = 1$ ;  $p < 0.001$ ), and insomnia severity ( $\chi^2 = 13.05$ ;  $df = 1$ ;  $p < 0.001$ ). Above-threshold anxiety was associated only with insomnia severity ( $\chi^2 = 16.42$ ;  $df = 1$ ;  $p < 0.001$ ).

It has been found that an anxiety pathway was strongly associated with insomnia severity, while a depression was more relevant for worsening the quality of sleep.

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**Key words:** quality of sleep, insomnia, depression, anxiety

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### Introduction

Sleep problems are very common among university students. They are particularly pronounced in students of medical sciences, and among them, primarily in students at the state universities. In the private faculties, which have become more and more frequent in recent times in Serbia as well as in other ex Yu territories, the students generally do not have problems that the students of the Faculties of Medicine of the Universities of Niš, Belgrade, Novi

Sad are facing. The regime of study in these Universities is quite rigorous, and students often resort to various strategies that can influence their further psychosocial development in order to achieve and demonstrate their maximum in exams.

Unfortunately, this reflects on their psychosocial status, in a negative sense (1, 2).

In addition to exhaustion and comorbid physical or psychological problems, various psychoactive substances are often used by medical students for these reasons.

Students who suffer from insomnia often have severe depressive symptoms and/or some anxiety disorders (3, 4).

Persistent insomnia can be a risk factor or an early symptom of bipolar, depressive, and anxiety disorders (1, 3). Accordingly, depression and anxiety can be risk factors for insomnia (2, 5, 6).

Insomnia often occurs at about the same time or immediately after the onset of anxiety distress (3-5). However, the nature of the link between depression and developing insomnia is controversial. Loneliness is a disease of modern society! Since sleep problems are very common among university students, this study explored the interplay between the symptoms of depression and anxiety, quality of sleep, and insomnia.

## Materials and methods

### *Participants and Ethics*

The participants were 600 undergraduate students of the Faculty of Medicine of the University of Niš. Their mean age was 22.18 years (SD = 2.52). The survey was performed in the classrooms by trained assistants (interviewers) and was intended to last a maximum of 20 min, including the time needed for instructions. We have got verbal consent from all participants before data collection. The study procedures were carried out in accordance with the Declaration of Helsinki, and the approval of the Ethical Committee of the Faculty of Medicine of the University of Niš (14-5785-3).

### *Measures*

The DASS device is a set of three self-reporting scales designed to measure the negative emotional states of depression, anxiety, and stress. Each of the three scales contains 14 items, divided into the subscales of 2–5 items with similar content. DASS is designed to be used for further defining, understanding, and measuring all present and clinically significant emotional states in the examinees (7, 8).

The students were asked to mark from 0 (none) to 3 (mostly or almost always) the extent to which they have experienced each of the listed conditions during the previous week. The score results of depression, anxiety, and stress were calculated by adding the points for each relevant scale. The result was then calculated for every student and for each of the subscales, according to the score matrix, and then evaluated as per the severity-rating index.

The reliability scores of the scales in terms of Cronbach's alpha scores rate the depression scale at 0.91, the anxiety scale at 0.84, and the stress scale at 0.90 in the normative sample. The means for each scale are 6.34 (SD 6.97) for depression, 4.7 (SD 4.91) for anxiety, and 10.11 (SD 7.91) for stress.

Pittsburgh Sleep Quality Index measures retrospective sleep quality and disturbances over one month (9). It comprises nineteen questions that yield seven clinically derived component scores: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunctions. All component scores range from 0 to 3, and the Global Score ( $\alpha = .78$  in the present study) ranges from 0 to 21. A conventional cutoff score of  $> 5$  is used to separate poor sleepers from good sleepers.

The Pittsburgh Sleep Quality Index (PSQI) is an effective instrument used to measure the quality and patterns of sleep in adults. It differentiates "poor" from "good" sleep quality by measuring seven areas (components): subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the last month.

Insomnia Severity Index consists of seven items reflecting DSM-V criteria for an insomnia disorder (10). These are sleep onset, sleep maintenance, early morning awakening problems, sleep dissatisfaction, the extent to which sleep problems interfere with daytime functioning, whether one's sleep problems are noticeable to others, and the distress caused by sleep difficulties. Respondents rate symptom severity during the past two weeks using a five-point scale (0 = affected me very little to 4 = affected me a lot). The ISI yields a total score ranging from 0 to 28 ( $\alpha = .82$  in this study). The guidelines for interpretation are as follows: 0–7 = no clinically significant insomnia; 8–14 = subthreshold insomnia; 15–21 = clinical insomnia of moderate severity; 21–28 = severe clinical insomnia.

### **Data analysis**

All of the data were entered into Excel spreadsheets (Microsoft Office 2003, Microsoft, Redmond, DC, USA) by several teams each consisting of two people, whereby cross-checking was done for every given survey. The statistical analysis was performed using the SPSS 17.0 program (SPSS Inc., Chicago, IL, USA) in Windows 7 Ultimate. The research results were presented in tables.

The statistical analysis of the data included the application of descriptive tests and analytical parametric tests, as well as binary logistic regression tests and correlation tests. The descriptive statistics were performed to report the analysis of the data that were presented as mean and standard deviations. The categorical variables were shown as frequency and percentages. The independent t-test was used to compare the parametric variables between the genders. Pearson and Spearman correlations were used to determine the strength of the relationships between the examined variables. Binary logistic regression was used to estimate the odds ratios (ORs) and 95% confidence intervals (CIs) of the independent and interactive relationships of several prediction variables with depression, anxiety, and stress. The statistical significance was set at  $p < 0.05$ .

## **Results**

### *Descriptive analyses and correlations*

More than two thirds of the surveyed students ( $n = 432$ , 72%) and 258 (43%) of the students reported poor sleep quality or sub-threshold insomnia problems, respectively. Even 66 students (11%) reported moderate or severe insomnia (Table 1).

Above-threshold depression symptoms were reported by 168 students (28%) and anxiety symptoms by 180 of them (30%) (Table 2).

Depression was strongly associated with poor sleep quality ( $\chi^2 = 20.35$ ;  $df = 1$ ;  $p < 0.001$ ), and insomnia severity ( $\chi^2 = 13.05$ ;  $df = 1$ ;  $p < 0.001$ ).

Above-threshold anxiety was associated only with insomnia severity ( $\chi^2 = 16.42$ ;  $df = 1$ ;  $p < 0.001$ ) (Table 2).

**Table 1.** The distribution of the Pittsburgh Sleep Quality Index (PSQI) scores

Components of the PSQI	PSQI sub-component	Percentage
PSQI component of sleep duration	≥ 7 h	30.3
	6 – 7 h	17.2
	5 – 6 h	9.3
	< 5 h	43.2
PSQI component of sleep disturbances	0	15.1
	1	83.9
	2	1.0
	3	0
PSQI component of sleep latency	0	11.9
	1	36.1
	2	38.2
	3	13.8
PSQI component of daytime dysfunction	0	92.4
	1	4.3
	2	2.1
	3	1.2
PSQI component of sleep efficiency	> 85%	34.4
	75 – 84%	8.7
	65 – 74%	7.6
	< 65%	49.3
PSQI component of sleep quality	Very good	32.8
	Fairly good	39.5
	Fairly bad	18.4
	Very bad	9.3
PSQI component of sleep medication	Not during the past month	82.0
	Less than once a week	8.0
	Once or twice a week	4.5
	Three or more times a week	1.5

**Table 2.** The distribution of Insomnia Severity Index (ISI) - each item response

Item ISI	0	1	2	3	4
1. falling asleep	19.6	24.5	22.8	21.8	11.3
2. staying asleep	0.5	4.4	18.5	53.8	22.8
3. early awakening	8.5	8.2	28.3	39.8	15.2
4. satisfaction	0.3	0.5	7.2	43.7	48.3
5. interference	1.6	8.5	42.0	36.1	11.8
6. noticeable	6.2	28.3	46.2	17.5	1.8
7. worry	0.8	2.7	39.2	41.1	16.2

Moderate, severe, or extremely severe levels of depression symptoms were reported by 137 students (22.8%) and "above mild" anxiety symptoms were reported by 217 (36.16%) students (Table 3).

Binary logistic regression was conducted in order to estimate the effects of gender, age, pocket money, physical activity, quality of sleep, and insomnia severity on the probability that the surveyed students would respond positively to questions about depression and anxiety.

The whole model, along with all the predictors, was statistically significant: for depression:  $\chi^2(8, N = 600) = 179.181, p < 0.001$ ; for anxiety:  $\chi^2(8, N = 600) = 226.532, p < 0.001$ . This indicates that the model distinguishes those students who are from those who are not sorted, so that they have some of the symptoms. The assumptions of collinearity and singularity were satisfied, and non-typical points were also checked.

**Table 3.** The scores of depression, anxiety, and stress with respect to students' gender

Symptom Levels	Depression			Anxiety		
	Total	Male	Female	Total	Male	Female
		n %	n %		n %	n %
Normal	n = 384 64.0%	136 64.2	248 63.9	n = 331 55.2%	121 57.1	210 54.1
Mild	n = 79 13.2%	22 10.4	57 14.7	n = 52 8.7%	21 9.9	31 8.0
Moderate	n = 84 14.0%	30 14.2	54 13.9	n = 106 17.7%	25 11.8	81 20.9
Severe	n = 33 5.5%	15 7.1	18 4.6	n = 34 5.7%	17 8.0	17 4.4
Extremely severe	n = 20 3.3%	9 4.2	11 2.8	n = 77 12.8%	28 13.2	49 12.6

**Table 4.** Prediction of the levels of depression and anxiety in the surveyed students

Independent Variables	B	df	p	OR	95% CI for OR	
					Lower	Upper
Depression	Hosmer-Lemeshow test of goodness-of-fit ( $p = 0.101$ , for $\chi^2 = 13.34$ , $df = 8$ )					
Gender (1)	0.358	1	0.098	1.431	0.936	2.187
Age	-0.036	1	0.466	0.964	0.875	1.063
Pocket money	0.000	1	0.103	1.000	1.000	1.000
Physical activity	-0.258	1	0.016	0.773	0.627	0.953
Quality of sleep (1)	0.299	1	0.011	2.748	1.192	2.038
Insomnia severity (1)	-0.708	1	0.026	0.493	0.264	0.918
Constant	-0.284	1	0.784	0.753	Correctly classified 77.3%	
Anxiety	Hosmer-Lemeshow test of goodness-of-fit ( $p = 0.102$ , for $\chi^2 = 13.30$ , $df = 8$ )					
Gender (1)	-0.018	1	0.925	0.982	0.673	1.433
Age	-0.079	1	0.074	0.924	0.847	1.008
Pocket money	0.000	1	0.125	1.000	1.000	1.000
Physical activity	-0.312	1	0.001	0.732	0.610	0.878
Quality of sleep (1)	0.126	1	0.039	1.334	1.287	1.635
Insomnia severity (1)	-0.083	1	0.021	0.821	1.564	2.502
Constant	1.535	1	0.096	4.643	Correctly classified 64.2%	

As Table 4 shows, four independent variables (gender, age, pocket money, physical activity, quality of sleep, and insomnia severity) provided a unique statistically significant contribution to some of two presented models.

The strongest predictor of whether a surveyed student has high levels of depression symptoms was quality of sleep, where the odds ratio was  $OR = 2.75$ . This shows that respondents with higher scores of quality of sleep have symptoms of depression 2.75 times more often, with all other factors in the model being equal. Also, it has been observed that depression symptoms are more com-

mon in those students with higher insomnia severity indices.

Anxiety symptoms are the most present in those with higher insomnia severity indices. (Table 4).

### Discussion

This sleep research has shown that anxiety and depression can uniquely predict poor sleep quality and insomnia symptoms in surveyed students.

Our findings are consistent with the view that exaggerated concerns about the real or presumed consequences of anxiety might affect the sleep variables through the magnification of contingent anxiety and depression states (3, 11-13).

Specifically, it looks like that the mental component is more strongly related to depression than the physical and social components which affect anxiety symptoms.

Poor sleep quality is a typical characteristic of depression, with a likely bidirectional relationship (11, 14, 15).

Poor sleepers often complain about intrusive and uncontrollable ruminative thinking during the pre-sleep period and report using ineffective mental control strategies to try to suppress unpleasant thoughts (16-22).

Despite methodological strengths, our study is not exempt from limitations. First, our findings are entirely based on cross-sectional data.

For instance, insomnia severity and poor sleep quality might precede the onset insurgence of depression or anxiety symptoms; it is still entirely possible that impaired sleep reinforces dysfunctional cognitive dispositions associated with psychological symptoms.

Causal inferences cannot properly be made without active control over the variables concerned.

Second, our study was based on a convenience sample. University students are not representative of the Serbian population, at least in

terms of age, gender, education, and personality characteristics.

For instance, the prevalent female gender in our sample might have heightened the average anxiety and depression ratings.

Moreover, since university students have irregular sleep patterns, about 1/3 of the students were poor sleepers, and 40% reported sub-threshold insomnia.

So, despite we admit that there might be a potential selection bias in our study, the sample characteristics increased the salience of our findings for a population at risk for sleep disturbances.

Anyway, it has been found that an anxiety pathway was strongly associated with insomnia severity, while a depression was more relevant for worsening the quality of sleep.

Non-depressed people with insomnia have a twofold higher risk of developing depression than people with no sleep difficulties.

### **Conclusion**

It has been found that an anxiety pathway is strongly associated with insomnia severity, while the depression is more relevant for worsening the quality of sleep.

The further researches will provide more answers to public health professionals in which direction to take measures to lifestyle balance according to these issues.

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Originalni rad

UDC: 613.79:616.89-008  
doi:10.5633/amm.2020.0106**POVEZANOST KVALITETA SNA I NESANICE SA SIMPTOMIMA  
DEPRESIJE I ANKSIOZNOSTI KOD STUDENATA MEDICINE U SRBIJI***Aleksandar Višnjic<sup>1,2</sup>, Snežana Miljković<sup>3</sup>, Dragan Nikolić<sup>2</sup>, Tamara Jovanović<sup>1,2</sup>,  
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Budući da su problemi sa spavanjem vrlo česti među studentima medicine, ova studija je istraživala povezanost depresije i anksioznosti sa kvalitetom sna i nesanicom.

Studija preseka izvedena je na Medicinskom fakultetu Univerziteta u Nišu 2016. godine i obuhvatila je 600 studenata oba pola. Studenti su ispunili upitnik, koji je sastavljen i razvijen iz skala „Depression Anxiety Stress Scale“, „Pittsburgh Sleep Quality Index“ i „Insomnia Severity Index“.

Pokazalo se da su problemi sa spavanjem zaista česti među studentima: 432 (72%) studenta prijavilo je loš kvalitet sna, dok 258 (43%) njih ima probleme sa nesanicom. Čak 66 studenata (11%) prijavilo je vrlo ozbiljnu ili ozbiljnu nesanicu. Simptome depresije iznad praga prijavilo je 168 studenata (28%), a simptome anksioznosti njih 180 (30%). Depresija je bila snažno povezana sa lošim kvalitetom sna ( $\chi^2 = 20,35$ ;  $df = 1$ ;  $p < 0,001$ ) i stepenom nesanice ( $\chi^2 = 13,05$ ;  $df = 1$ ;  $p < 0,001$ ). Anksioznost iznad praga bila je povezana samo sa ozbiljnošću nesanice ( $\chi^2 = 16,42$ ;  $df = 1$ ;  $p < 0,001$ ).

Nađeno je da je anksioznost bila snažno povezana sa nesanicom, dok je depresija bila povezanija sa pogoršanjem kvaliteta sna.

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**Ključne reči:** *kvalitet sna, nesanica, depresija, anksioznost*