SLEEP QUALITY IN RELATION TO SLEEP HYGIENE KNOWLEDGE AND PRACTICE, CHRONOTYPE AND LIFESTYLE BEHAVIOUR AMONG HEALTHCARE STUDENTS

POVEzanost kvaliteta spavanja studenata zdravstvenih nauka sa znanjem i praktom higijene spavanja, hronotipom i životnim stilom i navikama

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Summary

Introduction. The purpose of this study was to evaluate sleep quality among healthcare science students and to assess its association with sleep hygiene knowledge and practices, circadian typology and lifestyle factors. Material and Methods. The research was conducted as a cross-sectional questionnaire-based internet study on a sample of 268 students. The Pittsburgh Sleep Quality Index and The Self-Morningness-Eveningness Questionnaire were applied as research instruments to assess sleep quality and circadian types respectively, while evaluation of the other variables was conducted using the Sleep Hygiene Knowledge Questionnaire, socio-demographic questionnaire and the questionnaire of lifestyle factors. Results. The average of the Pittsburgh Sleep Quality Index global score for all students was 6.9 ± 3.2. The poor sleep quality (The Pittsburgh Sleep Quality Index > 5) was reported in 62.7% of students. Sleep efficiency less than 85% was found in 43.0% of students, and 78% of students reported daytime dysfunctionality. Sleep quality was significantly worse among female students; coffee, alcohol and energy drink consumers and long-term cell phone users. Only 11.9% of students were classified as the morning chronotype and they had the best quality of sleep and the best sleep hygiene knowledge and practices, whereas the evening chronotype had the worst quality of sleep. A significant negative correlation was identified between sleep hygiene knowledge (r = -0.133) and practice (r = 0.501) and sleep quality whereby the lower the Sleep Hygiene Knowledge Questionnaire and Sleep Hygiene Practice Scale scores follow a higher the Pittsburgh Sleep Quality Index score. Conclusion. Majority of students had a suboptimal level of overall sleep quality, satisfactory knowledge of sleep hygiene, but they did not have the sleep hygiene practices which suggests that knowledge is not a factor of deterring from unhealthy behaviors.

Key words: Sleep Hygiene; Circadian Rhythm; Health Knowledge, Attitudes, Practice; Life Style; Students, Nursing; Surveys and Questionnaires; Chronobiology Disorders

Sažetak

Uvod. Cilj ove studije bio je da se proceni kvalitet spavanja studenata zdravstvenih nauka i ispita njegova veza sa znanjem i praksom higijene spavanja, cirkadijalnom tipologijom i faktorima životnog stila. Materijal i metode. Istraživanje je sprovedeno kao studija preseka onlajn anketiranjem 268 studenata. Kao instrumenti istraživanja koristili su se Pittsburški indeks kvaliteta spavanja za procenu kvaliteta spavanja, Upitnik o samoproceni „jutarnjosti/večernjosti” za procenu diurnalne sklonosti, a za evaluaciju ostalih varijabli korišćen je Upitnik znanja o higijeni spavanja i Skala prakse higijene spavanja, sociodemografski upitnik i upitnik o životnom stilu i navikama. Rezultati. Prosečan ukupni skor Pittsburškog indeksa kvaliteta spavanja svih studenata iznosio je 6,9 ± 3,2. Loš kvalitet spavanja (Pittsburški indeks kvaliteta spavanja >5) imalo je 62,7% studenata. Efikasnost spavanja manju od 85% imalo je 43% studenata, a 78% je prijavilo dnevnu disfunkcionalnost. Studenti ženskog pola, konzumenti kafe, alkohola i energetskih napitaka, kao i oni koji duže koriste mobilne telefone, imali su značajno lošiji kvalitet spavanja. Samo 11,9% studenata je pripadalo jutarnjem hronotipu i imali su najbolji kvalitet spavanja i najbolja znanja i praksu iz higijene spavanja, a večernji najlošiji. Utvrđeno je značajna negativna povezanost znanja (r = -0.133; p < 0.05) i praks praksi higijene spavanja (r = 0,51; p < 0.001) sa kvalitetom spavanja pri čemu niži Upitnik znanja o higijeni spavanja i skor skale prakse higijene spavanja prati viši skor na Pittsburški indeks kvaliteta spavanja. Zaključak. Većina studenata je imala suboptimalni ukupni kvalitet spavanja, zadovoljavajuće znanje o higijeni spavanja, ali ne i praksu higijene spavanja, što ukazuje da znanje nije faktor odvraćanja od nezdravog ponašanja.

Ključne reči: higijena spavanja; cirkadijalni ritam; znanje o zdravlju, stavovi, praksa; stil života; studenti zdravstvene nege; istraživanja i upitnici; hronobiološki poremećaji
important to know those behaviors that affect its quality and which may possibly cause sleep disorders [3].

Sleep hygiene is defined as a set of behaviors and environmental rules that aim to ensure a restorative and good quality sleep in order to avoid certain sleep disorders [4]. Previous studies indicate that sleep hygiene practice is associated with sleep quality, and the results of the interaction between sleep hygiene knowledge and sleep quality were found to be inconsistent [4–7]. Having thoroughly studied literature, we have found that sleep hygiene knowledge does not affect sleep quality [4, 5], or that people with better sleep hygiene report better sleep quality [5, 6], or that there is a weak, negative correlation between sleep hygiene knowledge and sleep quality [7]. However, sleep hygiene knowledge, defined by some authors as “sleeping beliefs” [8], does not have to be related to sleep quality, but the adherence to the implementation of sleep hygiene recommendations serves as a mediator between “sleeping beliefs” and sleep quality [9].

Some of the individual differences that may affect the effectiveness of sleep hygiene knowledge and practices are circadian typology differences (referred as chronotype) [5]. Although these differences are somewhat innate, the individual inclination to a certain sleeping pattern, vigilance and better cognitive and physical activity enable the classification of individuals by their chronotype as morning, evening, and intermediate chronotypes [10]. Data on the association between circadian typology and sleep hygiene knowledge are inconsistent. Although some authors find that people with morning chronotype have more accurate knowledge of sleep hygiene than intermediate and evening types [8] the others find no correlation [6].

Student population is particularly vulnerable to sleep disorders caused by external factors such as change of the surroundings, responsibility for lifestyle self-management, changing of daily schedule, stress caused by a greater scope of academic and social commitments. These factors are associated with reduced sleep duration, resulting in poor sleep quality and excessive daytime sleepiness [4, 5]. In particular, the circadian rhythm can be disrupted during the exam period, night-time learning and prolonged exposure to light associated with the excessive use of computer, which contribute to irregular sleep patterns and poor sleep quality [5]. The latest reports show that the recommendation of The National Sleep Foundation requiring 7 to 9 hours of sleep per night is respected by less than 50% of students [9], and only about 40% of students reported a good sleep quality [11].

Taking into account the significance of sleep quality in student population primarily, this study has been aimed at evaluating sleep quality among health science students and assessing its association with sleep hygiene knowledge and practices, circadian typology and lifestyle factors.

Material and Methods

Study Design and Participants

The research was conducted as a cross-sectional questionnaire-based internet study among students of Faculty of Medicine in Novi Sad during the winter semester of the academic 2016-17 year. The study link was shared across social networks within closed groups of Faculty students. The study sample consisted of 268 students divided into two groups: n = 174 students of basic studies (nursing, medical rehabilitation and special rehabilitation and education) and n = 94 students of integrated studies (medicine, dentistry and pharmacy).

Instruments

In order to achieve study goals, a questionnaire was designed to cover socio-demographic issues related to gender, age, place of residence and study (the area of study, average grade), as well as a questionnaire of lifestyle factors affecting sleep (including consumption of alcohol, tobacco, coffee, and caffeinated energy drinks, implementation of physical activity and mobile phone use).

The Pittsburg Sleep Quality Index (PSQI) was used to measure sleep quality. PSQI is a 19-item standardized instrument for evaluating sleep quality over the previous month through 7 components: sleep latency, sleep duration, habitual sleep efficiency and sleep disturbances, subjective sleep quality, use of sleeping pills, and daytime dysfunction. The components are evaluated on a scale of 0–3, and then totaled to yield a global PSQI score, ranging from 0 to 21. A global score > 5 indicates a poor sleep quality. PSQI showed good psychometric characteristics and differentiation between good and bad sleepers [12]. In our study, the Cronbach’s alpha coefficient was 0.64.

Sleep hygiene knowledge and practices were assessed by the questionnaires designed for the purpose of this research, and on the basis of literature data on the activities that can affect sleep patterns positively or negatively [2, 4, 6, 13]. The 17-item Sleep Hygiene Knowledge Questionnaire (SHKQ) was used to assess knowledge of activities that help or interfere with sleep patterns, where 1 point was given for each correct response, 0 for incorrect, whereas the global score ranged from 0 to 17. Higher score reflected better sleep hygiene knowledge. In this research, the questionnaire was found to be reliable (Cronbach’s alpha: 0.80).

Sleep Hygiene Practice Scale (SHPS) comprised 22 items to evaluate how many nights per week a respondent was engaged in certain activities known to promote or disrupt sleep. Responses ranged from 0 (“never”) to 7 (“7 times a week”). Items that indicated a poor sleep hygiene practice were reversed scored. The global score ranged from 0 to 154, with higher scores indicating better implementation of sleep hygiene practices. In this study, the questionnaire showed a satisfactory level of reliability. The Cronbach’s Alpha coefficient was 0.70.
The Self-Morningness/Eveningness (Self-ME) was used to estimate diurnal preferences/chronotypes. Self-ME was based on the 19th question which was singled out of the Morningness-Eveningness Questionnaire (MEQ) [14], according to which the respondents were self-classified into a definitely morning, definitely evening or intermediate chronotype.

Statistical Data Analysis
IBM SPSS statistics software, Version 23 was used for data analysis. Data processing included descriptive and inferential statistics. A comparison of differences between means from two groups was performed by t-test, whereas one-factor analysis of variance (ANOVA) was used to compare the means of multiple groups with LSD post-hoc test. Effect sizes (d and η²) were also calculated for quantifying the difference between mean scores. Pearson correlation coefficient was used to determine the relationship between variables. The cut off level for statistical significance was p < 0.05.

Table 1. The global PSQI score: differences in relation to socio-demographic characteristics and lifestyle factors among students

| Characteristic                          | n (%)     | Mean ± SD | t / F    | 95%CI       | p        | d / η² |
|-----------------------------------------|-----------|-----------|----------|-------------|----------|-------|
| Gender/Pol                              |           |           |          |             |          |       |
| Female/Žensko                           | 222 (82.8)| 7.1 ± 3.2 | -2.065   | -2.076 – -0.050 | 0.040   | 0.36* |
| Male/Muško                             | 46 (17.2) | 6.0 ± 2.9 |          |             |          |       |
| Study group/Studijska grupa             |           |           |          |             |          |       |
| Basic study/Osnovne studije            | 174 (64.9)| 5.9 ± 3.8 | 2.647    | 0.325 – 2.213 | 0.009   | 0.35* |
| Integrated study/Integrisane studije    | 94 (35.1) | 4.6 ± 3.6 |          |             |          |       |
| Average grade/Prosečna ocena (n = 191) |           |           |          |             |          |       |
| 7.00 – 7.99                             | 53 (27.7) | 6.6 ± 3.0 |          | 5.77 – 7.43 |          |       |
| 8.00 – 8.99                             | 92 (48.2) | 7.1 ± 3.1 | 3.265    | 6.48 – 7.75 | 0.040   | 0.03  |
| 9.00 – 10                               | 46 (24.1) | 5.7 ± 3.2 |          | 4.74 – 6.65 |          |       |
| Use of mobile phone/Upotreba mobilnog telefona |       |           |          |             |          |       |
| Up to an hour/Do sat vremena            | 31 (11.6) | 6.5 ± 3.4 |          | 5.26 – 7.77 |          |       |
| 2 to 3 hours per day                    | 76 (28.4) | 6.1 ± 3.2 |          | 5.38 – 6.83 |          |       |
| 3 do 5 hours per day                    | 72 (26.9) | 7.0 ± 2.9 | 3.047    | 6.32 – 7.73 | 0.029   | 0.03  |
| Over 6 hours/Preko 6 sat                | 89 (33.2) | 7.6 ± 3.2 |          | 6.8 – 8.22  |          |       |
| Doze off during the lecture/Dremanje tokom predavanja |         |           |          |             |          |       |
| Yes/Da                                  | 114 (42.5)| 8.2 ± 3.3 |          | 1.237 – 2.720 | 0.000   | 0.70** |
| No/Ne                                   | 154 (57.5)| 6.0 ± 2.9 |          |             |          |       |
| Tobacco consumption/Konuzumiranje duvana|           |           |          |             |          |       |
| Yes/Da                                  | 61 (22.8)| 8.3 ± 3.1 |          | 1.005 – 2.785| 0.000   | 0.58**|
| No/Ne                                   | 207 (77.2)| 6.5 ± 3.1 |          |             |          |       |
| Coffee consumption/Konuziranje kafe      |           |           |          |             |          |       |
| Yes/Da                                  | 190 (70.9)| 7.2 ± 3.3 |          | 2.624 – 1.953| 0.009   | 0.36* |
| No/Ne                                   | 78 (29.1) | 6.1 ± 2.8 |          |             |          |       |
| Alcoholic beverage consumption/Konuzumiranje alkoholnih napitaka|      |           |          |             |          |       |
| Yes/Da                                  | 160 (59.7)| 7.3 ± 3.3 |          | 2.724 – 1.846| 0.007   | 0.32* |
| No/Ne                                   | 108 (40.3)| 6.2 ± 2.9 |          |             |          |       |
| Caffeinated energy drinks consumption/Konuzumiranje energetskih napitaka sa kofeinom |          |           |          |             |          |       |
| Yes/Da                                  | 131 (48.9)| 7.3 ± 2.9 |          | 2.181 – 1.610| 0.030   | 0.25* |
| No/Ne                                   | 137 (51.1)| 6.5 ± 3.4 |          |             |          |       |
| Regular physical activity/Redovna fizička aktivnost |         |           |          |             |          |       |
| Yes/Da                                  | 125 (46.6)| 6.5 ± 2.9 |          | -1.694 – -1.429 | ns     | ns    |
| No/Ne                                   | 143 (53.4)| 7.2 ± 3.4 |          |             |          |       |

Effect size: Cohen’s d* = small; d** = medium; Eta-squared η²… = small

Veličina uticaja: Cohen’s d* = mala; d** = srednja; Eta-squared η²… = mala
Results

Socio-Demographic Characteristics and Lifestyle Behavior in Students

Of the total sample of 268 students, 17.2% were male and 82.8% were female. The average age of students was 21.6 ± 3.0, ranging from 18 to 46 years. More than half of them, i.e. 156 (58.2%) lived without parents in a rented apartment, 60 (22.4%) students had a steady or occasional job while studying. As for the field of medical sciences, the majority were students of nursing 143 (53.4%), medicine 65 (24.3%), and the fewest were students of medical rehabilitation 4 (1.5%). Among the students who gave the answer regarding the average grade during the studies (n = 191), almost half had an average grade between 8.00 and 8.99.

Sleep quality was affected by the following lifestyle factors as reported by the respondents: regular consumption of coffee in 70.9% of students, consumption of caffeinated energy drinks in 48.9% of students, and consumption of alcoholic beverages in 53.4% of students. One hundred and seventy-eight students (66.5%) slept less than 7 hours, whereas 114 (42.5%) said that it had happened to them to doze off during the lectures. Almost a third of students (33.2%) used the mobile phone for more than six hours during the day and sent 134 messages by mobile phones on average through social networks.

Sleep Quality

The average PSQI global score for all students was 6.9 ± 3.2 ranging from 0 to 16. The poor sleep quality (PSQI > 5) was reported by 168 (62.7%) students, whereas a hundred students said they were good sleepers (37.3%). On average, students slept 6.4 ± 1.3 hours with a sleep latency of 20.0 ± 16.1 minutes. One hundred and fifteen students (43.0%) reported having poor sleep efficiency (less than 85%), and 45 (16.8%) used sleeping pills. Two hundred and nine students (78.0%) reported daytime dysfunctionality. Of the nine factors that could cause sleep difficulties, the respondents most often reported: the inability to fall asleep within 30 minutes (n = 84; 31.3%), waking up during the night or very early in the morning (n = 74; 27.6%) and experiencing bad dreams (n = 47; 17.5%). The average values of the global PSQI score differed significantly in relation to gender, type of study, average grade, and lifestyle factors among students (Table 1).

| Items                                                                 | Correct Pravilno | Wrong Pogrešno |
|-----------------------------------------------------------------------|------------------|----------------|
| Take a nap during the day/Dremanje tokom dana                         | 136              | 132            |
| Smoke a cigarette within 4 hours of bedtime/Konzumiranje cigareta 4 sata pre odlaska na spavanje | 104              | 164            |
| Use sleep medication/Uzimanje tableta za spavanje                     | 102              | 166            |
| Take beer (or other drinks with alcohol) within 4 hours of bedtime/Konzumiranje piva (ili drugog napitka sa alkoholom) 4 sata pre odlaska na spavanje | 77               | 191            |
| Eat heavy night snack before bedtime/Konzumiranje jakog večernjeg obroka pre spavanja | 235              | 33             |
| Drink caffeinated beverages after 2 p.m./Konzumiranje pića koja sadrže kofein posle 14 h | 127              | 141            |
| Drink a glass of milk before bedtime*/Popiti čašu mleka pre odlaska pred spavanjem* | 130              | 138            |
| Perform active exercises within 2 hours of bedtime/Baviti se aktivnim telesnim vežbanjem 2 sata pre odlaska na spavanje | 111              | 157            |
| Go to bed hungry/Otići na spavanje gladan                             | 252              | 16             |
| Go to bed thirsty/Otići na spavanje šedan                              | 259              | 9              |
| Studying intensively before bedtime/Intenzivno učiti pre odlaska na spavanje | 155              | 113            |
| Use of bed for things other than sleep (watching TV, reading, learning, eating, etc.) – except for sexual activities/koristiti krevet za stvari koje nisu spavanje (gledanje TV, čitanje, učenje, uzimanje obroka i sl.) – izuzev seksualnih aktivnosti | 204              | 64             |
| Sleep in the optimal room temperature*/Spavati u sobi optimalne temperature* | 209              | 59             |
| Perform relaxing exercises before bedtime/Primeniti relaxirajuće vežbe ili aktivnosti pre spavanja* | 198              | 70             |
| Sleep for approximately the same time each day*/Spavati otpriлиke jednako dugo svake noći* | 195              | 73             |
| Go to bed at the same time each day*/Odlaziti na spavanje svako veče u isto vreme* | 192              | 76             |
| Wake up at similar time each day*/Ustati svako jutro u isto vreme*     | 179              | 89             |

Total score/Ukupni skor 10.7 ± 2.6 (SD)

* Correct sleep hygiene knowledge; Pravilno poznavanje higijene spavanja
Sleep Hygiene Knowledge and Practices

The average SHKQ score for the whole sample was 10.7 ± 2.6 (ranging from 3 to 17). The percentage of correct or incorrect answers to SHKQ questions indicates that there are misconceptions about sleep hygiene (Table 2).

The average SHKQ score differed in relation to groups of students (t = -3.069; df = 266; p = 0.002), whereby the students of integrated studies had a significantly higher score (11.3 ± 2.3) compared to the students of basic health studies (10.3 ± 2.7), but this difference was small (Cohen’s d = 0.4).

The average SHPS score for the whole sample was 100.5 ± 15.0 or 4.6 per item (Table 3).

The average SHPS score differed in relation to the groups of students (t = 2.020; df = 266; p = 0.000), Table 4.

Table 3. Distribution of students’ responses to SHPS questions

| Items | Stavke | Mean | Stand. dev. |
|-------|--------|------|-------------|
| Take a nap during the day/Odremate tokokom dana | 4.9 | 1.8 |
| Smoke a cigarette within 4 hours of bedtime/Konzumirate cigarete 4 sata pre odlaska na spavanje | 5.9 | 2.2 |
| Use sleep medication/Koristite tablete za spavanje | 6.9 | 0.4 |
| Take beer (or other drinks with alcohol) within 4 hours of bedtime/Konzumirate alkoholna pića 4 sata pre odlaska na spavanje | 6.3 | 0.9 |
| Eat heavy night snack before bedtime/Pojedete jak večernji obrok pre spavanje | 5.6 | 1.5 |
| Drink caffeinated beverages after 2pm/Konzumirate pića koja sadrže kofein posle 14 časova | 4.6 | 2.5 |
| Drink a glass of milk before bedtime/Popijete čašu mleka pre odlaska na spavanje | 0.9 | 1.3 |

Table 4. The total SHKQ, SHPS and PSQI score: differences in relation to circadian typology

| Variable | Varijabla | Mean ± SD/Prosek ± SD | F | 95% CI | p | η² |
|----------|-----------|-----------------------|---|--------|---|-----|
| SHKQ     | Jutarnji hronotip | 12.0±2.3 | 10.6±2.6 | 5.369 | 10.38–11.00 | 0.005 | 0.03 |
|          | Večernji hronotip | 10.2±2.5 | 8.2±2.6 | | | | |
|          | Intermedijarni hronotip | 6.3±2.6 | 6.8±3.3 | 9.950 | 6.50–7.27 | 0.000 | 0.70 |

Effect size: Eta-squared η² = small, η²† = medium/Veličina uticaja: Eta-squared η² = mala, η²† = srednja

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**Circadian Typology**

As for the chronotype, the students were classified as the intermediate chronotype (67.2%), evening chronotype (20.9%) and morning chronotype (11.9%). A significant difference between sleep hygiene knowledge and practices and sleep quality in relation to circadian typology was determined (Table 4).

**Correlation Between Sleep Hygiene Knowledge and Practices and Sleep Quality**

We found a significant negative correlation between sleep hygiene knowledge and practices and sleep quality, whereby the lower SHKQ and SHPS scores followed a higher PSQI score (Table 5).

**Discussion**

Previous studies suggest that students generally sleep less than the general population because of the exposure to academic stressors and numerous academic demands. They are therefore at risk of having poor sleep quality, daytime dysfunction and cognitive impairment. Although a large number of them strive to adapt their daily activities to academic, social and other obligations, only a small number of students manage to align their obligations with the circadian regulated sleep-wake rhythm [11,15]. Accordingly, students in our study slept for about 6.4 hours on average, with sleep latency within 20 minutes, and almost half of them had sleep efficiency less than 85%, whereas two-thirds reported daytime dysfunction. The global PSQI score of all students was 6.9 ± 3.2, whereby the “poor sleepers” accounted for the majority (62.7%). Similar results were obtained in studies on the students from Iran [16], Hong Kong [13], and USA [11], while the students from China [17], Ethiopia [18] and Lebanon [10] could be classified as “better sleepers”. However, differences in the results of the abovementioned studies can be culturally conditioned.

In this study, as in the previous ones, sleep quality was worse among the female students compared to the male students [17, 18]. A traditional role of females in the family and society, cognitive differences between genders, and the fact that women for physiological reasons need more sleep than men can explain this difference [2, 4].

Comparing two groups of health science students, we found that the students of basic studies had poorer sleep quality compared to the students of integrated studies. This result could be explained by the fact that the students of basic studies are overloaded with a large number of hours of practical skill training [19], and that a certain number of them work and study [15, 20], or perhaps by the fact that those who study integrated studies use better strategies for solving their academic obligations [2]. Also, the students with an average grade between 8.00 and 8.99 had poor sleep quality. Probably the need of this group of students to get an average grade that would enable them to enroll at a higher level of study has led them to compensate their academic performance by means of unhealthy sleep patterns [21].

The consequence of poor sleep quality in the student population is a feeling of daytime sleepiness that results in a decline in cognitive abilities (attention, concentration and decision-making) [15, 22], which has been confirmed by the results of this study. Namely, the students who said that it had happened to them to doze off during lectures had significantly lower sleep quality than those who did not. This finding is of high public health significance because poor sleep quality and unintended sleep episodes of dozing off in future health professionals increase the risk of mistakes in the patients’ care [23].

In our sample, the students who reported to consume coffee, alcohol and energy drinks had a poorer sleep quality, which was in agreement with literature data, but we did not find a significant correlation between regular physical activities and sleep quality [18]. Namely, Lemma et al. [18] found a weak negative correlation between physical activities and sleep quality. However, their study does not explain which physical activities are in question and at what time of the day they are being practiced. Besides, the longer use of mobile phones and computers associated with poor sleep quality was confirmed in several studies [3, 21, 24]. In the same way, this study has shown that the sleep quality deteriorates significantly with the increasing level of excessive mobile phone use.

The average score of SHKQ in our sample was 10.7 ± 2.6 and the correct answers were given by 62.9% of students, which is very similar to the results of the research carried out in Croatia [5], and slightly worse than the results of Hong Kong students [13]. Most of our students had the misconceptions about sleeping during the day, sleeping pills, alcohol, caffeinated drinks, and that doing 2 hours of exercise before bedtime did not interfere with the quality of

| Variable | PSQI | SHKQ | SHPS |
|----------|------|------|------|
| PSQI     | 1    | -0.133* | -0.501** |
| SHKQ     | -0.133* | 1    | 0.190** |
| SHPS     | -0.501** | 0.190** | 1    |

*p < 0.05, **p<0.001
sleep, or that the consumption of a glass of milk positively affected the sleep quality. The average SHPS score for the entire sample in our study was 100.5 ± 15.0 (4.6 per item), which indicates that students performed all activities regarding sleep hygiene on average 4.6 times a week, which is similar to the results of the Hong Kong study [13]. The students of Integrated Healthcare Studies had better knowledge and practice of sleep hygiene compared to the students of basic studies and therefore better sleep quality. This is probably the result of a difference in the study curriculum, due to the fact that the students of integrated studies have more knowledge about the sleep physiology and the impact of sleeping on the quality of life in individuals. In our research, a significant negative correlation between sleep hygiene knowledge and practices and sleep quality was determined, whereby lower SHKQ and SHPS scores were followed by a higher PSQI score, indicating that there was also a higher probability for students who had poor sleep hygiene knowledge and practices to have poor sleep quality. Unlike data from this study, the results of a number of studies indicate that sleep hygiene practice is associated with sleep quality unlike the level of knowledge [4, 6, 13]. The differences in methodological research procedures can explain this inconsistency. Furthermore, in our research, a weak positive correlation between sleep hygiene knowledge and practices was established, which was supported by the findings of the Croatian study [5], while Felix et al. [9] claimed the opposite. By analyzing diurnal sleep preferences among our students, sleep quality was to be the highest in the morning chronotype, whereas in the evening chronotype it was the worst. The same applies to sleep hygiene knowledge and practices. Our findings are in accordance with literature data indicating a poorer sleep quality in those with the evening chronotype [3, 5, 7, 25], more accurate knowledge on sleep hygiene in the morning chronotype compared to the evening chronotype [8], and less adherence to good sleep hygiene practices in the evening chronotypes in relation to the morning chronotype [26]. Diaz-Morales et al. [8] believe that less adherence to good sleep hygiene practices correlates the evening chronotype with lower sleep quality.

Limitations of the study
This study has some limitations which have to be pointed out. The research was conducted on-line, and it is possible that the reasons for students’ involvement were pre-existing poor sleep quality or higher levels of sleep hygiene knowledge. We could not collect data from students who did not have access to the Internet, therefore, caution should be taken in generalizing the results.

Conclusion
An average sleep quality score indicates that a large proportion of Novi Sad University students experience a suboptimal level of overall sleep quality according to the PSQI criterion. Although satisfactory sleep hygiene knowledge was found in a high percentage of students, many of them reported unhealthy practices indicating that knowledge was not a factor of deterring from unhealthy behaviors. Interventions on sleep hygiene practices must focus on changing and applying behavioral factors, and not just learning about sleep hygiene.

References
1. Stanojević Ć, Simić S, Milutinović D. Health effects of sleep deprivation on nursing working shifts. Med Pregl. 2016;69(5-6):183-8.
2. Yazdi Z, Loukzadeh Z, Moghaddam P, Jalilolghadr S. Sleep hygiene practices and their relation to sleep quality in medical students of Qazvin University of Medical Sciences. J Caring Sci. 2016;5(2):153-60.
3. Fossum IN, Nordnes LT, Storemark SS, Bjorvatn B, Pallesen S. The association between use of electronic media in bed before going to sleep and insomnia symptoms, daytime sleepiness, morningness, and chronotype. Behav Sleep Med. 2014;12(5):343-57.
4. Al-Kandari S, Alsalem A, Al-Mutaeri S, Al-Lumai D, Dawoud A, Moussa M. Association between sleep hygiene awareness and practice with sleep quality among Kuwait University students. Sleep Health. 2017;3(5):342-7.
5. Škvorc Lj, Košćec Bjelajac A. Sleep beliefs and circadian typology of helping professions students. International Online Journal of Educational Sciences. 2016;8(5):69-78.
6. Voinescu BI, Coogan AN, Orăsăna R. Sleep beliefs subjective sleep quality and diurnal preference-findings from depressed patients. J Cogn Behav Psychother. 2010;10(1):1-12.
7. Voinescu BI, Szentagotai-Tatar A. Sleep hygiene awareness: its relation to sleep quality and diurnal preference. J Mol Psychiatry. 2015;3(1):1.
8. Diaz-Morales JF, Prieto PD, Barreno CE, Mateo JC, Randler C. Sleep beliefs and chronotype among adolescents: the effect of a sleep education program. Biol Rhythm Res. 2012;43(4):397-412.
9. Felix VA, Campsen NA, White A, Buboltz WC. College students’ prevalence of sleep hygiene awareness and practices. Advances in Social Sciences Research Journal. 2017;4(4):91-105.
10. Kabrita CS, Hajjar-Muça TA, Duffy JF. Predictors of poor sleep quality among Lebanese University students: association between evening typology, lifestyle behaviors, and sleep habits. Nat Sci Sleep. 2014;6:11-8.
11. Lund HG, Reider BD, Whiting AB, Prichard JR. Sleep patterns and predictor of disturbed sleep in a large population of college students. J Adolesc Health. 2010;46(2):124-32.
12. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2):193–213.
13. Suen LK, Tam WW, Hon KL. Association of sleep hygiene-related factors and sleep quality among university students in Hong Kong. Hong Kong Med J. 2010;16(3):180-5.
14. Horne JA, Ostberg OA. Self-assessment questionnaire to determine morningness-eveningness in human circadian rhythms. Int J Chronobiol. 1976;4(2):97–110.
15. Milutinović D, Stanojević Č, Stanojević V, Simić S. Sleep quality, level of daytime sleepiness and fatigue among working nursing students. Timočki medicinski glasnik. 2016;41(4):257-65.
16. Bakhshandeh Bavarsad M, Azimi N, Moradbeigi K, Latifi M. Associations between morningness-eveningness and sleep quality among female dormitory residents. Thrita. 2015;4(1):e59661.
17. Cheng SH, Shih CC, Lee IH, Hou YW, Chen KC, Chen KT, et al. A study on the sleep quality of incoming university students. Psychiatry Res. 2012;197(3):270-4.
18. Lemma S, Patel SV, Tarekegn YA, Tadesse MG, Berhane Y, Gelaye B., et al. The epidemiology of sleep quality, sleep patterns, consumption of caffeinated beverages, and khat use among Ethiopian college students. Sleep Disord. 2012;2012:583510.
19. Sajadi A, Farsi Z, Rajai N. The relationship between sleep quality with fatigue severity and academic performance of nursing students. Nursing Practice Today. 2014;1(4):213–20.
20. De Mattos Moraes dos Santos TC, De Martino MMF, Sonati JG, De Faria AL, De De Almeida Nascimento EF. Sleep quality and chronotype of nursing students. Acta Paulista de Enfermagem. 2016;29(6):658-63.
21. Al Ghamdi AA. Sleep deprivation and academic performance of students in the collage of nursing at King Saud University. World Applied Sciences Journal. 2013;27(2):155-67.
22. Huang CF, Yang LY, Wu LM, Liu Y, Chen HM. Determinants of daytime sleepiness in first year nursing students: a questionnaire survey. Nurse Educ Today. 2014;34(6):1048–53.
23. Caruso CC, Hitchcock EM. Strategies for nurses to prevent sleep-related injuries and errors. Rehabil Nurs. 2010;35(5):192-7.
24. Brunborg GS, Mentzoni RA, Molde H, Myrseth H, Skouveroe KJM, Bjorvatn B, et al. The relationship between media use in the bedroom, sleep habits and symptoms of insomnia. J Sleep Res. 2012;20(4):569–75.
25. Ninama NJ, Kagathara J. Sleep wake pattern analysis: study of 131 medical students. NHL Journal of Medical Sciences. 2012;1(1):33–6.
26. Vollmer C, Hammer J, Keller C, Maxand AK, Diaz-Morales JF, Randler C. Development and evaluation of a sleep education program in middle school pupils based on self-determination theory. International Journal of Biology Education. 2014;3(1):12–22.