

# Sleep disorders and night-shift work in nursing students: a cross-sectional study

MICHAEL BELINGHERI, MICHELA LUCIANI, DAVIDE AUSILI, MARIA EMILIA PALADINO, STEFANIA DI MAURO, GIOVANNI DE VITO, MICHELE A. RIVA

School of Medicine and Surgery, University of Milano-Bicocca, Monza, Italy

**KEY WORDS:** Sleep disturbances; insomnia; healthcare students; nursing students; night work; internship

## ABSTRACT

**Background:** University students are known to have higher sleep disorders prevalence than the general population. Among them, nursing students are even more susceptible to sleep disorders. This study evaluates sleep disorders' risk factors among nursing students and their potential association with symptoms and assesses whether night shifts affect sleep quality by increasing the prevalence of sleep disorders. **Methods:** A total of 202 nursing students were included; a self-administered questionnaire was used to collect data on sociodemographic and academic characteristics (i.e., gender, age, height, weight, and year of nursing program) and risk factors for sleep disorders (e.g., smoking, lack of physical activity, and coffee intake late in the evening). The survey included the General Health Questionnaire to assess perceived stress, the Sleep and Daytime Habits Questionnaire, and the Epworth Sleepiness Scale to assess sleep disorders symptoms. **Results:** A high level of perceived stress is associated with sleep disorders symptoms and with poor sleep quality. Daytime symptoms are also associated with smoking. Students who drink coffee late in the evening report fewer nighttime symptoms. Night shifts and their increasing number are not associated with sleep disorders symptoms. The perception of an unsatisfying academic performance is associated with daytime symptoms and poor sleep quality. **Conclusions:** Although night shifts seem to not affect sleep quality among nursing students, sleep disorders represent a critical issue in this population since sleep disorders symptoms may result in errors, accidents, or low academic performance.

## INTRODUCTION

University students are known to have higher sleep disorders prevalence than the general population, with an insomnia prevalence of 18.5% [1]. Sleep disorders can decrease students' academic performance [2] and are responsible for the onset of mental problems, such as anxiety, depression, and burnout symptoms [1]. Furthermore, poor sleep in young adults might have medium and long-term

consequences on health, such as weight gain, fatigue, and car accidents [3].

Nursing students are even more susceptible than university students to sleep disorders, with 30% of them having bad sleep habits [2] and one in four reporting insomnia [4]. Sleep disorders have been associated with several risk factors, such as smoking, being overweight, lack of physical activity, coffee intake, and stress [5–7]. Several studies report a high prevalence of some of those risk factors among

university students, including nursing students [8]. In nurses, sleep disorders have also been associated with night-shift work [9]. A link exists between shift work and sleep disorders [9], especially due to sleep loss in night and early-morning shifts [10]. Furthermore, shift work acts on cardiometabolic stress similarly to insufficient sleep; hence, the combination of the two seems to increase cardiometabolic stress and cognitive impairments [10]. Finally, early-career burnout in nurses seems to be linked to sleep disorders [11].

Nursing students often have some periods of night shift due to hospital internships [12]. Currently, there is a debate as to whether night shifts during placement are an effective learning time although they might disturb sleep in undergraduate nursing students [12, 13]. Cursory information suggests that the first night shifts in young nursing students are well tolerated [14], but, despite the relevance of this problem, studies investigating whether night shifts during hospital internship in undergraduate education cause sleep disorders in nursing students are lacking. Having this information could help develop preventive interventions on sleep and design internships around students' well-being. Hence, this study evaluates the prevalence of risk factors for sleep disorders among nursing students and their potential association with symptoms, and it assesses whether night shifts affect the quality of nursing students' sleep by increasing the prevalence of sleep disorders among them.

## METHODS

This cross-sectional study recruited nursing students at a university in Northern Italy. Participation was voluntary, free of compensation, and completely anonymous since no personal data were collected during the survey. The Independent Ethics Committee of the University of Milano-Bicocca approved the study, and each participant provided written consent. All students were invited to complete an anonymous self-administered questionnaire in close temporal proximity to a hospital internship period.

The questionnaire was composed of different parts and collected sociodemographic and academic characteristics of participants, such as gender,

age, height, weight, and year of nursing program. A portion of the survey assessed the risk factors for sleep disorders: smoking, lack of physical activity, and coffee intake late in the night. The perceived stress, another well-known risk factor, was assessed using the validated General Health Questionnaire (GHQ-12); the scoring system used in the current study was the method (0-0-1-1); hence, each participant could score from 0 to 12 [15].

Risk factors for sleep disorders were defined as follows: age  $\geq 25$  years, smoking (i.e., consumption of 10 or more cigarettes per day), BMI  $\geq 25$  kg/m<sup>2</sup>, inadequate physical activity (i.e., two or fewer days per week), and coffee intake late in the evening. Considering the small sample size of the study population, risk factors have been considered as dichotomous variables. In details, we considered as risk factor smoking 10 or more cigarettes per day, since several students reported to smoke only very few cigarettes but a little numbers of cigarettes might be not enough to affect sleep quality. Similarly, inadequate physical activity was defined as no physical activity or physical activity no more than twice a week. Distress was defined as a GHQ score of 5 or higher.

Since another well-known risk factor is night-shift work, a portion of the questionnaire was dedicated to internship activities to evaluate its impact on sleep quality. Data were collected for the last internship attended and included the type of work schedule (i.e., rotating shifts with nights or fixed daily routine shifts) and night shift frequency per internship (none, 1–3 nights, 4–5 nights, >5 nights). The internship activities lasted one or two months.

We assessed the prevalence of daytime and nighttime insomnia symptom, as well as sleep quality, with the Sleep and Daytime Habits Questionnaire (S&DHQ) [4, 16], which includes 24 questions on sleep duration and quality and daytime habits, such as the average time needed for falling asleep, early awakening, and perceived sleep quality. The questionnaire also includes questions on academic progress.

As we expected a higher frequency of daytime symptoms than nighttime, the questionnaire included the Epworth Sleepiness Scale (ESS) [17]—a validated scale scoring the tendency to fall asleep during typical daily activities—to characterize daytime sleep-related symptoms better. Scores > 10

were considered as a pathological tendency to fall asleep during the day.

Nighttime symptoms included nocturnal symptoms of insomnia, such as long time needed for falling asleep, difficulty in getting to sleep at night, and early awakening and difficulty in getting to sleep again. Sleep quality was assessed using the same questionnaire (S&DHQ), which contains a specific question on self-reported sleep quality.

Data were analyzed using SAS (SAS Institute, NC, USA) statistical software;  $p$ -values  $< 0.05$  were considered significant. Differences between categorical values were tested with Fisher's Exact test or  $\chi^2$  test. A logistic regression model was also used. The Armitage test was used to assess whether the prevalence of sleep disorders followed a linear trend at the increasing number of shift nights.

## RESULTS

Two hundred and two nursing students completed the questionnaire (202/260, response rate 78%). The main characteristics of the participants are shown in Table 1. Students were from all years of the nursing program: 40.6% were attending the first year, 24.3% the second year, and 35.1% the third year. The mean age was  $22.0 \pm 3.8$  years old, and most participants were female (70.3%). Table 1 also reports the prevalence of risk factors for sleep disorders in the study population: 13.4% were 25 years old or older, 27.2% were smokers (consumption of 10 or more cigarettes per day), 53.5% did not practice adequate physical activity, 13.4% were overweight, 16.3% drank coffee late in the evening, and 19.8% reported a high level of perceived stress (GHQ-12 score  $\geq 5$ ).

Data on the association between insomnia risk factors and sleep disorders symptoms are reported in Table 2. A high level of perceived stress (GHQ-12 score  $\geq 5$ ) was associated with nighttime symptoms ( $p$ -value 0.0006), daytime symptoms ( $p$ -value 0.0050), at least one symptom of sleep disorders ( $p$ -value 0.0028), and poor sleep quality ( $p$ -value  $< 0.0001$ ). Daytime symptoms were also associated with smoking ( $p$ -value 0.0018), as well as the presence of at least one symptom ( $p$ -value 0.0134). Finally, students who drank coffee late in the evening reported fewer nighttime symptoms ( $p$ -value

0.0097) than the others. No association was found between sleep disorders symptoms and gender, age, physical activity, and BMI. All the associations related to smoking and a high level of perceived stress were confirmed by the logistic regression model results (data not shown).

Table 3 shows the association between sleep disorders and the number of night shifts during the internship. Night shifts and their number were not associated with sleep disorders symptoms nor poor sleep quality among students. In other words,

**Table 1.** Characteristics of the study population (n = 202)

Variables	N	%
<b>Program year</b>		
First	82	40.6
Second	49	24.3
Third	71	35.1
<b>Gender</b>		
Male	60	29.7
Female	142	70.3
<b>Age [continuous]</b>		
Mean $\pm$ SD	22.0 $\pm$ 3.8	
<b>Age [categorical]</b>		
<25 yo	175	86.6
$\geq 25$ yo	27	13.4
<b>Smoker</b>		
No	147	72.8
Yes	55	27.2
<b>Physical activity</b>		
Adequate	94	46.5
Inadequate	108	53.5
<b>Body mass index (BMI)</b>		
<25 kg/m <sup>2</sup>	175	86.6
$\geq 25$ kg/m <sup>2</sup>	27	13.4
<b>Coffee intake</b>		
No	169	83.7
Yes	33	16.3
<b>GHQ-12 score</b>		
<5	162	80.2
$\geq 5$	40	19.8

**Table 2.** Association between risk factors for insomnia and symptoms of sleep disorders ( $n = 202$ )

Risk factors	Nighttime symptoms			Daytime symptoms			At least one symptom			Poor sleep quality		
	N	%	p-value	N	%	p-value	N	%	p-value	N	%	p-value
<b>Gender</b>												
Male	8	13.3	0.9929	24	40.0	0.9110	24	40.0	0.4500	5	8.3	0.7343
Female	19	13.4		58	40.9		65	45.8		14	9.9	
<b>Age</b>												
<25	23	13.1	0.8122	71	40.6	0.9867	77	44.0	0.9655	14	8.0	0.1458
≥25	4	14.8		11	40.7		12	44.4		5	18.5	
<b>Smoker</b>												
No	20	13.6	0.8703	50	34.0	<b>0.0018</b>	57	38.8	<b>0.0134</b>	16	10.9	0.2393
Yes	7	12.7		32	58.2		32	58.2		3	5.4	
<b>Physical activity</b>												
Adequate	12	12.8	0.8150	34	36.2	0.2323	37	39.4	0.2096	8	8.5	0.6842
Inadequate	15	13.9		48	44.4		52	48.2		11	10.2	
<b>Body mass index (BMI)</b>												
<25 kg/m <sup>2</sup>	25	15.0	0.3816	70	41.9	0.3997	76	45.5	0.4110	19	11.4	0.0809
≥25 kg/m <sup>2</sup>	2	7.4		9	33.3		10	37.0		0	0.0	
<b>Coffee intake</b>												
No	27	16.0	<b>0.0097</b>	68	40.2	0.8149	75	44.4	0.8361	18	10.7	0.1702
Yes	0	0.0		14	42.4		14	42.4		1	3.0	
<b>GHQ-12 score</b>												
<5	15	9.4	<b>0.0006</b>	57	35.6	<b>0.0050</b>	62	38.8	<b>0.0028</b>	8	5.0	<b>&lt;0.0001</b>
≥5	12	30.0		24	60.0		26	65.0		11	27.5	

**Table 3.** Association between symptoms of sleep disorders and number of night shifts ( $n = 202$ )

Symptoms	Number of night shifts								p-value	
	No night shift		1–3 night shifts		4–5 night shifts		>5 night shifts		Association	Trend
	N	%	N	%	N	%	N	%		
Nighttime symptoms	3	11.1	5	12.8	3	14.3	5	16.1	0.9647	0.5599
Daytime symptoms	13	48.2	16	41.0	8	38.1	14	45.2	0.8927	0.8404
At least one symptom	13	48.2	19	48.7	9	42.9	14	45.2	0.9708	0.7268
Poor sleep quality	4	14.8	5	12.8	2	9.5	1	3.2	0.4450	0.1182

having night shifts during the internship did not affect the participants' quality of sleep, nor did their increasing number. Specifically, there was no difference in the prevalence of sleep disorders symptoms among students who had night shifts compared to students who did not. Similarly, no difference was

found among students who had five or more night shifts compared to students who had only one night shift. Moreover, no association was found between the type of work schedule (i.e., rotating shift with nights or shift fixed daily routine) and the prevalence of sleep disorders (data not shown).

Data on the impact of sleep disorders on academic performance are reported in Table 4. The perception of unsatisfying academic performance was associated with daytime symptoms of sleep disorders ( $p$ -value 0.0159) and poor sleep quality ( $p$ -value 0.0022). Nighttime symptoms were not found to be associated with the perception of academic performance.

## DISCUSSION

Nursing students are a population of university students. Although the latter are already known for the high prevalence of sleep disorders [2, 18], no studies have investigated this issue in this population. We examined the prevalence of risk factors for sleep disturbances and found that inadequate physical activity and smoking were the most frequent. Previous studies on risk behavior among healthcare students have confirmed the high prevalence of physical inactivity and smoking among healthcare students [8].

One of our main findings was the association between perceived stress—measured through self-administered GHQ-12—and sleep disorders symptoms. Specifically, perceived stress was the only risk factor associated with all sleep disorders symptoms and poor sleep quality in nursing students. Tobacco consumption was associated with sleep disorders symptoms, especially with daytime symptoms. This result is comparable to the findings in healthcare workers by analogous studies [19]. Surprisingly, the group of students who were accustomed to drinking coffee late in the evening reported a lower prevalence of nighttime symptoms than students who did not drink coffee. This finding

is inconsistent with previous studies since it is well-known that caffeine has a substantial disruptive effect on sleep [20, 21]. This awareness about the impact of caffeine could explain the seemingly paradoxical result. Specifically, students who suffered from sleep disorders perhaps avoided coffee intake late in the evening since it is a substance notoriously taken to stay awake.

One of the study aims was to assess the impact of night shifts on the prevalence of sleep disorders and the quality of sleep among nursing students. The night-shift work was not associated with sleep disorders symptoms or poor sleep quality. Moreover, the increasing number of night shifts during internships seemed not to impact students' sleep. These findings are inconsistent with the literature since several studies on workers have shown that rotating night shifts may contribute to the development of insomnia-related symptoms and detectable biochemical/endocrine alteration [9, 22–24]. However, a previous study on a small group of participants reports that the first exposition to shift work, including night shifts, has no relevant impact on sleep quality among young nursing students [14]. Students' high motivation during internships, their young age and consequent high resilience to sleep deprivation, and the brief duration of the internship (one or two months) probably hinder the development of sleep disorders. Furthermore, the small number of night shifts might not be sufficient to cause discomfort and sleep disorders in this young population.

Although night-shift work is not associated with sleep disorders among young students, it is essential to consider individual risk factors and amendable habits in this population since they will be exposed for a long time to night-shift work during their

**Table 4.** Association between symptoms of sleep disorders and academic performance ( $n = 202$ )

Symptoms	Academic performance				$p$ -value
	Unsatisfying		Satisfying		
	N	%	N	%	
Nighttime symptoms	3	25.0	24	12.6	0.2050
Daytime symptoms	9	75.0	73	38.4	<b>0.0159</b>
At least one symptom	9	75.0	80	42.1	<b>0.0260</b>
Poor or very poor sleep quality	5	41.7	14	7.4	<b>0.0022</b>

career. In our study population, about one out of two students reported an inadequate level of physical activity, and about one out of four were smokers. Some conditions, such as smoking habits, insufficient physical activity, and other habits, are known to be risk factors for sleep disorders and should be considered and addressed to improve sleep quality and prevent sleep disorders in night-shift workers. Furthermore, poor sleep quality may also be associated with critical chronic health outcomes over time.

Finally, we studied the association between academic performance and sleep disorders. Some authors have identified a vicious cycle between sleep quality and academic performance [2, 25]. Our study seems to confirm that a poor perception about academic performance characterizes students with poor sleep quality and vice-versa; however, the cross-sectional nature of our analysis does not allow us to define a temporal relation between them.

Specifically, inadequate sleep quality may determine sleepiness and difficulty focusing and concentrating during lectures and study sessions. On the other hand, poor academic performance may increase the level of perceived stress, causing, in turn, insomnia and poor sleep quality. For these reasons, sleep quality and sleep disorders among students are essential issues to be considered.

### Strengths and limitations

The main limitation of this study consists in using a self-administered questionnaire, in which participants could minimize the magnitude of their risk factors or symptoms. However, the survey was anonymous, and participation was voluntary; hence, students probably answered honestly. Furthermore, the response rate was high (78%); hence, results may be considered representative and reputable. However, a larger sample size may improve the results and reduce the occurrence of chance findings. Another limit of the study was the cross-sectional design, which did not allow evaluating whether the effect of potential risk factors appeared over a long period of time or after a certain latency period. The short duration of the internship and the small number of night shifts in which students were involved may have posed other limits. Although the survey was

conducted in close temporal proximity to a hospital internship period, we did not collect the exact number of days between the end of the internship and the interview. For this reason, we were not able to assess any difference in the prevalence of symptoms depending on how long before the interview the students had their last internship. Finally, we did not assess participants' chronotype, which may have affected resilience to sleep deprivation and the tolerance to caffeine.

### CONCLUSIONS

Although night shifts seemed to not affect sleep quality among nursing students in our study, sleep disorders represent an important issue in university students and even more so in healthcare students. The presence of daytime symptoms is particularly disturbing, as they represent a critical risk factor for errors and accidents, which may pose a threat not only within future working activity but also to the student engaged in internships due to the presence of biological hazards in such settings. Moreover, daytime symptoms may lead to errors during internships, such as mistakes in medicine administration, with risks for patients. Furthermore, it is essential to consider the relationship between academic performance and sleep disorders, that is, the vicious cycle between low perceived academic performance, student stress, and sleep disorders.

Therefore, it is desirable that nursing educators and occupational physicians consider the potential role of sleep disorders among nursing students, implementing strategies to prevent, early detect, and manage risk factors and symptoms during medical surveillance. Future studies will need to further investigate the association between night shifts and sleep disorders in nursing students and between risk factors and habits and sleep disorders and possibly do so through a longitudinal design.

**FUNDING:** This research received no external funding.

**INSTITUTIONAL REVIEW BOARD STATEMENT:** The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of the University of Milano-Bicocca (protocol code 0011676).

**INFORMED CONSENT STATEMENT:** Informed consent was obtained from all subjects involved in the study.

**DECLARATION OF INTEREST:** The authors declare no conflict of interest.

## REFERENCES

- Jiang XL, Zheng XY, Yang J, et al. A systematic review of studies on the prevalence of insomnia in university students. *Public Health*. 2015;129(12):1579–84. doi:10.1016/j.puhe.2015.07.030.
- Gallego-Gómez JI, González-Moro MTR, González-Moro JMR, et al. Relationship between sleep habits and academic performance in university Nursing students. *BMC Nurs*. 2021;20(1):100. doi:10.1186/s12912-021-00635-x.
- Bruce ES, Lunt L, McDonagh JE. Sleep in adolescents and young adults. *Clin Med*. 2017;17(5):424–8. doi:10.7861/clinmedicine.17-5-424.
- Angelone AM, Mattei A, Sbarbati M, Di Orio F. Prevalence and correlates for self-reported sleep problems among nursing students. *J Prev Med Hyg*. 2011;52(4):201–8.
- Karlson CW, Gallagher MW, Olson CA, Hamilton NA. Insomnia symptoms and well-being: Longitudinal follow-up. *Health Psychol*. 2013;32(3):311. doi:10.1037/a0028186.
- Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. *Sleep Med Rev*. 2002;6(2):97–111. doi:10.1053/smr.2002.0186.
- Singareddy R, Vgontzas AN, Fernandez-Mendoza J, et al. Risk factors for incident chronic insomnia: a general population prospective study. *Sleep Med*. 2012;13(4):346–53. doi:10.1016/j.sleep.2011.10.033.
- Belingheri M, Facchetti R, Scordo F, Turato M, De Vito G, et al. Risk behaviors among Italian healthcare students: a cross-sectional study for health promotion of future healthcare workers. *Med Lav*. 2019;110(2):155. doi:10.23749/ml.v110i2.7573.
- Flo E, Pallesen S, Magerøy N, et al. Shift work disorder in nurses—assessment, prevalence and related health problems. *PLoS One*. 2012;7(4):e33981. doi:10.1371/journal.pone.0033981.
- Kecklund G, Axelsson J. Health consequences of shift work and insufficient sleep. *BMJ*. 2016;355:i5210. doi:10.1136/bmj.i5210.
- Rudman A, Arborelius L, Dahlgren A, Finnes A, Gustavsson P. Consequences of early career nurse burnout: A prospective long-term follow-up on cognitive functions, depressive symptoms, and insomnia. *EClinicalMedicine*. 2020;27:100565. doi:10.1016/j.eclinm.2020.100565.
- Dobrowolska B, Zec A, Tosoratti J, et al. Night shifts as a learning experience among nursing students across Europe: Findings from a cross-sectional survey. *Nurse Educ Today*. 2020;90:104441. doi:10.1016/j.nedt.2020.104441.
- Palese A, Basso F, Del Negro E, et al. When are night shifts effective for nursing student clinical learning? Findings from a mixed-method study design. *Nurse Educ Today*. 2017;52:15–21. doi:10.1016/j.nedt.2017.02.005.
- Fietze I, Knoop K, Glos M, Holzhausen M, Peter JG, Penzel T. Effect of the first night shift period on sleep in young nurse students. *Eur J Appl Physiol*. 2009;107(6):707. doi:10.1007/s00421-009-1181-8.
- Piccinelli M, Bisoffi G, Bon MG, Cunico L, Tansella M. Validity and test-retest reliability of the Italian version of the 12-item General Health Questionnaire in general practice: a comparison between three scoring methods. *Compr Psychiatry*. 1993;34(3):198–205. doi:10.1016/0010-440X(93)90048-9.
- Violani C, Devoto A, Lucidi F, Lombardo C, Russo PM. Validity of a Short Insomnia Questionnaire: The SDQ. *Brain Res Bull*. 2004;63(May):415–21. doi:10.1016/j.brainresbull.2003.06.002.
- Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep*. 1991;14(6):540–5. doi:10.1093/sleep/14.6.540.
- Belingheri M, Pellegrini A, Facchetti R, De Vito G, Cesana G, Riva M. Self-reported prevalence of sleep disorders among medical and nursing students. *Occup Med*. 2020;70(2):127–30. doi:10.1093/occmed/kqaa011.
- Calnan M, Wainwright D, Forsythe M, Wall B, Almond S. Mental health and stress in the workplace: the case of general practice in the UK. *Soc Sci Med*. 2001;52(4):499–507. doi:10.1016/S0277-9536(00)00155-6.
- Shilo L, Sabbah H, Hadari R, et al. The effects of coffee consumption on sleep and melatonin secretion. *Sleep Med*. 2002;3(3):271–3. doi:10.1016/S1389-9457(02)00015-1.
- Drake C, Roehrs T, Shambroom J, Roth T. Caffeine effects on sleep taken 0, 3, or 6 hours before going to bed. *J Clin Sleep Med*. 2013;9(11):1195–200. doi:10.5664/jcsm.3170.
- Smart D, Wilson M. Reported sleep health and viral respiratory illness in nurses. *Medsurg Nurs Off J Acad Med-Surg Nurses*. 2013;22(4):221–7.
- Korompeli A, Chara T, Chrysoula L, Sourtzi P. Sleep disturbance in nursing personnel working shifts. *Nurs Forum (Auckl)*. 2013;48(1):45–53. doi:10.1111/nuf.12005.
- Bukowska A, Sobala W, Peplonska B. Rotating night shift work, sleep quality, selected lifestyle factors and prolactin concentration in nurses and midwives. *Chronobiol Int*. 2015;32(3):318–26. doi:10.3109/07420528.2014.975353.
- Ahrberg K, Dresler M, Niedermaier S, Steiger A, Genzel L. The interaction between sleep quality and academic performance. *J Psychiatr Res*. 2012;46(12):1618–22. doi:10.1016/j.jpsychires.2012.09.008.