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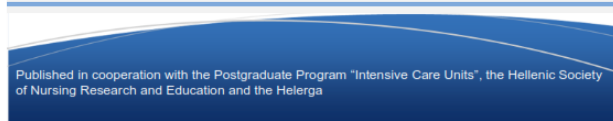
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## RESEARCH ARTICLE

## SUBJECTIVE SLEEP QUALITY AND DAYTIME SLEEPINESS AMONG GREEK NURSING STAFF: A MULTICENTER CROSS-SECTIONAL STUDY

Michalis Mantzanas<sup>1</sup>, Dimosthenis Chrysikos<sup>1</sup>, Ilias Giannakodimos<sup>1</sup>, George Chelidonis<sup>2</sup>, Paraskevi Drymoussi<sup>3</sup>, Evmorfia Pechlivanidou<sup>1</sup>, Emmanouil Pikoulis<sup>3</sup>, Neofytos Basios<sup>3</sup>, Contantinos G. Zografos<sup>4</sup>, George C. Zografos<sup>1</sup>, Ioannis Karavokyros<sup>4</sup>

1. 1<sup>st</sup> Department of Propaedeutic Surgery, Hippocraton Hospital, School of Medicine, National and Kapodistrian University of Athens, 11527 Athens, Greece
2. 1<sup>st</sup> Department of Pathology and Cytology Unit, School of Medicine, National and Kapodistrian University of Athens, 11527, Athens, Greece
3. 3<sup>rd</sup> Department of Surgery, "Attikon" University General Hospital, School of Medicine, National and Kapodistrian University of Athens (NKUA), 11527 Athens, Greece
4. 1<sup>st</sup> Department of Surgery, Laiko Hospital, National and Kapodistrian University of Athens, School of Medicine, Athens, Greece

## Abstract

**Background:** Lack of sleep and sleep of poor quality contribute to fatigue, decreased productivity, increased risk of accidents and errors at work.

**Aim:** The aim of the current study is to further investigate the relationship between sleep quality and daytime sleepiness to demographic and work environment characteristics among the nursing staff.

**Method and Material:** A cross-sectional study was performed on nursing staff, in Athens, from July 2018 to June 2020 focused on characteristics related to poor sleep and sleep disturbance.

**Results:** This cohort investigated 70% poor sleep and 25% excessive daytime sleepiness among nursing staff. Sleep disturbance was related to young age and serving as a ward nurse. Personal as well as departmental and institutional factors affected sleep quality but not excessive daytime sleepiness.

**Conclusion:** Health system managers and nurse leaders should take under consideration not only personal, but also departmental and institutional characteristics when taking support measures to maintain nurses' mental health and patient's safety.

**Keywords:** Nursing workforce, sleep quality, sleep disturbance, Greece, institutional workload.

**Corresponding Author:** Ilias Giannakodimos MD, PhD National and Kapodistrian University of Athens, 75 MikrasAsias str., Goudi, 11527 Athens, Greece, tel: +30-213-2088638, Tel: +306973063590 E-mail: [iliasgiannakodimos@gmail.com](mailto:iliasgiannakodimos@gmail.com)

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## INTRODUCTION

Sleep quality consists a major factor on productivity especially for health care professionals. Lack of sleep and sleep of poor quality contribute to fatigue, decreased productivity, increased risk of accidents and errors at work.<sup>1</sup> This has been shown also for nurses and it represents a threat for both the nurses themselves and the patients.<sup>2,3</sup>

Sleep disturbances among the nursing personnel have been detected in other countries but also in Greece.<sup>4,5</sup> Yet, world literature regarding nurses serving at the Accident and Emergency Department (A&E) or the Operation Room (OR) remains poor.

Nursing practice in these two Departments is different from the rest units of the hospital. In the A&E the prevailing setting is a patient with trauma or a patient with acute disease of varying severity which has just appeared. The nursing intervention should be multidimensional and critical.<sup>6,7</sup> On the other hand, in the OR the nursing intervention is of "limited time", on a patient emotionally distressed who most often is under anesthesia. On the same time the nurse should also team up and interact with the surgeons in a tense environment.<sup>8,9</sup>

The aim of the current study is to further investigate the relationship between sleep quality and daytime sleepiness to demographic and work environment characteristics among the nursing staff by evaluating: (a) nurses' score on Pittsburgh Sleep Quality Index, (b) nurses' score on Epworth Sleepiness Scale and (c) nurses' personal and departmental workload according to each hospital's characteristics related to sleep disturbance.

## METHODS

### *Design and Population*

We conducted a cross-sectional, field study on 11 General Hospitals of the 1st Regional Health Directorate (RHD) of Attica between July 2018 and June 2020. The target population comprised of both registered and vocational nurses typically involved with the treatment of a surgical patient. All nurses had served less than six months in their current position were excluded. Additionally, all improperly or partially filled questionnaires were excluded. The Reporting Guidelines for Observa-

tional Studies in Epidemiology and the "Strengthening the Reporting of Observational studies in Epidemiology" (STROBE) checklist were employed to ensure the quality of the present study (Supplementary File). This study was approved by the Scientific Councils of both "Hippocraton" (DN 60/ 25-11-2014) and "Laikon" (DN 111/13-02-2015) Hospitals. Informed and written consent was obtained from all the participants of our study.

### *Classification of the working environment*

We classified the hospitals into small (less than 400 beds), medium (400-600 beds) and large ones (>600 beds). ORs were classified as small (<30 tables per week), medium (30-60 tables per week), and large ones (>60 tables per week). Similarly, A&E units were classified according to their size as small (<15 examination beds), medium (15-30 examination beds) and large ones (>30 examination beds). Surgical wards were classified as small (<30 beds), medium (30-60 beds) and large ones (>30 beds). Finally, we classified the OR by their work volume relying on the number of elective and emergency operations performed in the last six months of 2014 as provided by the RHD: low, intermediate and high volume. OR had <1000, 1000-2000 and >2000 elective operations and <300, 300-600, >600 emergency operations respectively.

Shifts in most Greek hospitals are scheduled from 7AM to 3PM, evening shifts from 3PM to 11PM, and night shifts from 11PM to 7AM. So, for the cohort we investigated week shifts as three 8-hours shifts per day for five days (weekends are excluded due to their variation among hospitals). Shifts for the workload estimation are defined as the estimation of the Department's need in nursing personnel for one day. Shifts served in the morning are usually the most demanding and night shifts need the least personnel. The multiplication of shifts to beds/tables under department's responsibility and divided by the number of nurses covering this need (Department's workforce) estimates the workload. So, units for departments' workload estimation in this cohort is estimated as beds/week/nurse. Concerning OR as table units were estimated per week, shifts were estimated per day to ensure the measurement units as tables/week/nurse. Thus, the calculation type is configured as:

Department's workload = [Shifts per week x Department's size (in beds)] / Department's nursing workforce

To estimate the personal workload we investigated the number of morning, evening and night shifts, the working hours per week and the supernumerary hours per day of each participants concerning the month before the completion of the cohort's investigation tool.

#### *Instruments and Data collected*

We used a composite multi-item instrument investigating the individual nurse's demographic, professional and employment characteristics; the size and workload of the nurse's Department and Hospital; Pittsburgh Sleep Quality Index (PSQI) and Epworth Sleepiness Scale (ESS). The Greek translations of both PSQI and ESS were kindly provided gratis by MAPI PROCOL-ID®.

PSQI is a self-rated 19-item questionnaire for the subjective evaluation of sleep quality over the previous 4 weeks<sup>10</sup>. Responses to the 19 questions are summed up into 7 clinically derived component scores: Subjective Sleep Quality, Sleep Latency, Sleep Duration, Habitual Sleep Efficiency, Sleep Disturbances, Use of Sleeping Medications, and Daytime Dysfunction. A global score higher than 5 was considered as indicative of poor sleep quality. In our study the inventory was characterized by good internal consistency and reliability for its seven components (Cronbach's alpha =0.796). ESS is a self-administered questionnaire developed by MW Johns (1991) based on what responders recollect from the previous month<sup>11</sup>. Scoring more than 10 was appreciated as indication of daytime sleepiness.

#### *Statistical analysis*

Statistical analysis was performed with IBM SPSS Statistics® Ver.21. All quantitative variables are expressed as mean and standard deviation (MEAN±SD). As for staging, our results are expressed as integer numbers when referred to number of people. Categorical variables are expressed as absolute frequency and percentage. Statistically significant difference was considered if p-value was less than 0.05. Pearson's Chi-Square was the used to examine the relation of the examined factors with the frequencies of PSQI and ESS scores above and below

the cut off limits when the factor was expressed as categorical variable while student's t-test was used for quantitative float factors (e.g. age). Student's t-test was also used to evaluate the relation of the average Total PSQI score with dichotomous factors (e.g. sex). The relation of the average total PSQI score to categorical factors with more than two values, (e.g. marital status) was examined with one-way analysis of variance (1-way ANOVA) followed by post-hoc Bonferroni pairwise comparisons. To confirm our findings logistic regression was also performed using as depended variable PSQI and ESS (as dichotomous variables representing one value above and one below the cut-off point) respectively.

## **RESULTS**

#### *Demographic characteristics*

There were 755 nurses included in this study finally. The mean age of the sample was 41±7.4 years old and 197(26%) were males. Most were married (431, 57.1%), one third "singles" (229, 30.3%) while 50(6.6%) and 45(6.0%) were self-identified "in relationship" and "divorced/widow" respectively. Nurses belonged in a family consisted of 3±1 members. The family members contributed to family's income were 2±1. Half our sample was living with their children (420, 55.6%) and one quarter with their parents (177, 23.4%). One out of five nurses had an additional job (162, 21.5%). The vast majority (506, 67%) was graduates of Universities of Applied Sciences followed by graduates of Vocational Training Institutes (198, 26.2%) and only 51(6.8%) were University graduates. Almost one out of three nurses (225, 29.8%) had specialty training; one out of five (138, 18.3%) enrolled in post-graduate education at the MSc level while only 1% (10 nurses) have been enrolled in PhD studies. Sixty-five (8.7%) nurses participated in our study reported that a family member lost its job the previous year.

#### *Work environment and workload*

The majority of participants, (336, 44.6%) was serving at the OR, 258(34.2%) were Ward nurse and 160(21.2%) were A&E nurses. Concerning the ranking, 399(52.8%) were staff nurses, one out of three (213, 28.2%) were senior nurses, 94 (12.5%) were deputy ward nurses and the rest (49, 6.5%) were ward sisters. According to our classification 324(42.9%) served at

medium hospitals, 235 (31.1%) at large hospitals and 196 (26%) nurses served at small hospitals. Among A&E nurses, most (76/161, 47.2%) worked at medium, 50/161(31.1%) at large and 35/161(21.7%) served at small departments. One out of two OR nurses (172/366, 51.2%) served at small, one out of three (99/366, 29.5%) at large and one out of five (65/366, 19.3%) at medium departments. Most Ward nurses (115/258, 44.6%) served at small, 74/258 (28.7%) at medium and 69/258 (26.7%) at large departments. As for the workforce,  $23 \pm 12$  nurses served at OR,  $22 \pm 10$  at A&E and  $12 \pm 2$  at surgical clinics. Concerning the workload as defined in our survey the workload at A&E departments is  $73 \pm 38$  units, ORs' workload is  $42 \pm 27$  and Wards' workload is  $99 \pm 31$  units. It is estimated that the personal workload of each nurse is  $21 \pm 4$  shifts/month, each one worked for  $41 \pm 5$  hours/month and among them  $1.5 \pm 2.5$  consist supernumerary hours/day.

#### *Frequencies of sleep of poor quality and of daytime sleepiness*

The vast majority of the participants (525 nurses, 69.5%), reported sleep of poor quality. Poor sleep was more frequent in females than males (405/525, 77.1%). The observed frequencies for the distribution of poor sleep quality among the two sexes differ in a high significant level (chi-square=9.4, p-value=0.002) to the expected ones. Poor sleep quality frequencies show unexpected distribution among nurses with different marital status (chi-square=20, p-value<0.001). Married were observed to be the majority (309/525, 58.9%) among nurses with poor sleep quality in the entire cohort while most divorced/widows(43/54, 93.3%) report poor sleep quality. (chi-square=20, p-value<0.001). Nurses who had graduated of Universities of Applied Sciences (340/525, 64.8%) consist the significant majority but the "educational status" which seems to suffer the most by poor sleep quality is the Vocational Training Institute Graduates (154/198, 77.8%) (chi-square=9.5, p-value=0.009). As for the work environment 226/252(43.1%) nurses reported poor sleep worked at "medium" size hospitals. The observed frequencies' distribution among nurses with PSQI>5 and the rest, doesn't differ significant to the expected among the groups created by the other studied parameters. One quarter of our sample (192 nurses, 25.4%) reported excessive daytime sleepiness (ESS>10). Interestingly, nurses with this

characteristic are 2 years younger ( $40 \pm 0.3$  years) than the others ( $42 \pm 0.5$  years). This difference is evaluated significant in the level of 1%. Almost 4/5 were females (153/192, 79.7%, chi-square=4.5, p-value=0.035). Most worked as Ward nurses (83/192, 43.2%) while 70/192(36.5%) were OR nurses and 39/192(20.3%) worked at the A&E. The corresponding frequencies for scorers in  $ESS \leq 10$  were 267/563(47.4%) for OR nurses, 175/563(31.1%) for Ward nurses and 121/563(21.5%) for A&E nurses, significantly different to the expected according to the distribution of "work-units" in the entire cohort (chi-square=10, p-value=0.006). Among 70 OR nurses with  $ESS > 10$ , 31(44.3%) worked at "small" OR departments, 21(30%) at "medium" and 18(25.7%) at "large" while only 44(16.5%) OR nurses reported  $ESS \leq 10$  worked at "medium" departments, 82/267(30.7%) worked at "large" and 141/267(52.8%) worked at "small departments". The difference between the observed and the expected frequencies for this comparison is evaluated significant (p-value=0.04).

Regression analysis confirmed that the prevalence of poor sleep was significantly affected by sex, marital status, level of education and hospital size (Table 1). Excessive daytime sleepiness was significantly more frequent among Ward nurses and significantly negatively related to age (Table 1). Table 2 indicates that Department's workload doesn't affect the quality of sleep or daytime sleepiness. Regarding personal workload, only night shifts worsened sleep quality. Regression analysis showed that sleep of poor quality wasn't correlated to daytime sleepiness ( $B = 1.224$ ,  $p = 0.269$ ), and similarly, excessive daytime sleepiness wasn't correlated to sleep quality ( $B = 0.963$ ,  $p = 0.326$ ).

#### *Analyzing PSQI scores and components*

Total PSQI score was  $7.4 \pm 3.3$ . Females significantly scored 1 point higher than males ( $7.6 \pm 0.2$  vs  $6.7 \pm 0.2$ , p-value<0.001). Significant difference among PSQI score means of nurses with different marital status was revealed; divorced/widows scored 1.8 point higher than singles (p-value<0.001) and 1.4 points higher than married (p-value<0.05). Those with family members who had lost their job recently scored 1.5 points higher ( $8.8 \pm 0.4$  vs  $7.3 \pm 0.1$ , p-value=0.0005). As for the educational level, graduates of Vocational Training Institute significantly

scored 1.3 points higher than University graduates ( $p$ -value=0.04) and 0.9 points higher than graduates of Universities of Applied Sciences ( $p$ -value=0.005). Nurses working at "small" hospitals reported 0.75 lower score than their colleagues at "medium" hospitals ( $p$ -value<0.0001) and 0.3 lower score than those at "high" hospitals ( $p$ -value=0.03). Factors that persisted to worsen significantly sleep quality in regression analysis are presented in Table 3.

## DISCUSSION

Sleep disturbances are a well-known cause of errors and accidents in medical and nursing practice but most studies focused on the effect of shiftwork.<sup>4,5</sup> The prevalence of poor sleep as well as the total PSQI score was high in our study, as well, and several factors found to be negatively related to this condition. Furthermore, 25% of the nurses reported excessive daytime sleepiness (ESS score>10), a condition more frequent in Ward nurses and in nurses of younger age. There was no correlation between bad sleep and daytime sleepiness and vice versa.

Subjective sleep quality and excessive daytime sleepiness among Greek nurses were comparable to those described in the literature. Both prevalence of poor sleep quality and the mean PSQI score were in line with the reported ranges of 63-85%<sup>12,13,14</sup> and 7.02 - 8.35<sup>15-18</sup> respectively. Excessive daytime sleepiness had a prevalence similar to that reported in literature.<sup>12,13</sup>

The reasons worsen sleep quality, or increase its prevalence remain contradictory. In agreement with others our survey suggests as predisposing factors female sex,<sup>15-18</sup> marital status<sup>4,5,18</sup> and night shiftwork,<sup>14-18</sup> but not age<sup>5,12,14</sup> or living with children or parents.<sup>5,14</sup> Remarkably, the opposite findings are also met in literature regarding female sex,<sup>12</sup> marital status,<sup>12,14,15,16,17</sup> night-shift work,<sup>4,5</sup> age<sup>15,16,17</sup> and living with children or parents.<sup>4,18</sup> Educational level in our study is correlated positively with sleep quality while the nurse's rank or the type of the Department had no effect, results that are in contrast to published reports.<sup>4,5,15-18</sup> All these discrepancies can be attributed to social and cultural differences known to exist among different countries and populations, to differences in the organization of the various health systems and hospitals,

but also to differences in the design, setting and sample size of the various studies.

To the best of our knowledge, this is the first report on the significance and independent impact of hospital size and family unemployment on sleep quality. Only the number of night shifts thought was found to contribute to poor sleep and neither Department's nor Hospital's size. The imbalance between job demands, effort and reward might affect sleep quality as already described.<sup>19</sup>

Our study confirms that poor Sleep Quality is not correlated to Daytime Sleepiness.<sup>12,13</sup> Although in terms of occupational health both conditions are of significance, sleepiness is also important for patient safety and good nursing practice.<sup>20</sup> Along with others we confirmed that sleepiness affected more the younger nurses but we also found that it was not affected by factors that may interplay with age i.e. marital status, number of family members, years in the service and rank, as already reported.<sup>15,16,17</sup> We also discovered that sleepiness affected more the Ward nurses than the A&E or the OR nurses.

## Limitations

Our study is a cross sectional study that cannot prove directly a cause-and-effect phenomenon. Its self-reporting design allows self-selection and participation bias. Also, memory and recollection ability may lead to response bias. However, we tried to diminish all potential sources of bias by choosing a random and comparatively large sample. We pursued this sample intensively by the follow up visits and achieved a satisfactory response rate of 65%.

## CONCLUSIONS

The prevalence of bad sleep and of excessive daytime sleepiness in our population was as high as the ones from other countries. Sex, marital status, family unemployment, education level, number of night shifts per month and size of the hospital can possibly provoke poor sleep. Young age and being a Ward Nurse contributes to daytime sleepiness. Remarkably poor sleep does not correlate to excessive daytime sleepiness. The measures needed to alleviate poor sleep and daytime sleepiness should be in both personal and institutional level.



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## ANNEX

**Table 1.** Factors significantly affecting the possibility of PSQI>5 or ESS>10 in regression analysis.

Scorevalue	Characteristic	B	SE	OR	OR 95% CI	P
PSQI score>5	MaleGender	-0.503	0.179	0.605	0.426 – 0.86	0.005
	Married	0.455	0.167	1.577	1.137 – 2.186	0.006
	DivorcedWidows	2.024	0.614	7.572	2.272 – 25.228	0.001
	VocationalTrainingInstituteGraduates	0.454	0.198	1.575	1.068 – 2.322	0.022
	HospitalSize	-0.323	0.11	0.724	0.584 – 0.897	0.003
ESS score>10	Age	-0.033	0.011	0.968	0.946 – 0.989	0.004
	WardNurse	0.496	0.173	0.657	1.643 – 2.36	0.004

ESS: Epworth Sleepiness Scale; PSQI: Pittsburgh Sleep Quality Index; B: Coefficient; O.R.: Odds Ratio; C.I.: Confidence Interval

**Table 2.** Relation of Workload with PSQI>5 or ESS>10

Department's or Personal Workload	PSQI					ESS				
	<5		>5		p-value	<10		>10		p-value
	N	Workload <sup>t</sup>	N	Workload <sup>t</sup>		N	Workload <sup>t</sup>	N	Workload <sup>t</sup>	
OR Nurses	112	25.75	223	24.55	0.368	265	24.8	70	25.5	0.64
A & E Nurses	47	27.85	114	29.95	0.561	122	30.7	39	25	0.062
Ward Nurses	63	127.38	177	124.41	0.538	161	125.1	79	125.4	0.93
Number of morning Shifts (last month)	230	12.8	525	12.6	0.684	563	12.7	192	12.6	0.916
Number of after-noon Shifts (last month)		5.3		4.9	0.198		5.0		5.2	0.549
Number of night Shifts (last month)		2.5		3.1	0.012		2.9		3.1	0.434

Working hours per week		40.5		40.1	0.176		40.2		40.3	0.66
Supernumerary working hours per day		1.4		1.6	0.231		1.5		1.7	0.191

<sup>†</sup>: Workload calculated as the number of "needed shifts" per week divided by the number of nurses working in the department and multiplied with the number of operating tables, examination beds or ward beds respectively; OR: Operation Room; A&E: Accident and Emergency Department; PSQI: Pittsburgh Sleep Quality Index; ESS: Epworth Sleepiness Scale

**Table 3.** Factors affecting significantly Mean Total PSQI score in regression analysis

Studied factors	PSQI value			
	B	S.E.	O.R.	p
<b>HospitalSize (Beds)</b>	-0.002	0.001	-0.136	<b>0.001</b>
<b>Malegender</b>	-0.841	0.267	-0.112	<b>0.002</b>
<b>Specialtytraining</b>	-0.59	0.259	-0.082	0.023
<b>Family members becoming unemployed the previous year (cumulative)</b>	1.064	0.33	0.114	<b>0.001</b>
<b>VocationalTrainingInstitute graduates</b>	0.884	0.271	0.118	<b>0.001</b>
<b>Divorced/Widow</b>	1.223	0.495	0.088	0.014

PSQI: Pittsburgh Sleep Quality Index, B: Coefficient, O.R.: Odds Ratio