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SLEEP AND FATIGUE IN HOSPITAL PHYSICIANS IN RELATION TO SHIFT WORK

Vangelova K., Cekova I., Dimitrova I.**National Center of Public Health and Analyses, Sofia, Bulgaria**

Introduction. Sufficient and good quality sleep is crucial for shift workers because of its implications on performance and health. *The aim of the study* was to follow the effects of night shifts and overtime work on sleep and fatigue of hospital physicians in Bulgaria.

Methods. The study was cross-sectional and comprised 719 physicians, 429 female and 291 male, of average age (44.4 ± 14.2) years from Sofia hospitals. Anonymous questionnaire survey included Karolinska Sleep Diary, demographic information, work place variables, working hours and shift system. The statistical analyses were carried out with SPSS.

Results. 26 % of the physicians worked only in day shifts, 55 % from 1 to 4 night shifts, and 28 % more than 5 night shifts. Great deal of the physicians worked more than 40 hours weekly as follows: 38 % worked 41–50 hours per week, 27 % – 51–60 hours and 14 % > 61 hours. The quality of sleep, estimated by SQI was worse with the increase of the number of night shifts ($F = 4.260$, $p = 0.01$) and sleep duration and insufficiency of sleep with increase of the hours worked weekly.

Discussion. Shift working with more night shifts monthly and overtime hours weekly contributed to impaired sleep in the studied group of physicians. The sleep impairment was more evident within the increase in the number of night shifts.

Key words: Night shifts, overtime, sleep quality index

Introduction

Some of the effects of night shift work are related to circadian disruption, sleep impairment and fatigue [1, 2], but also to higher risk of development of cardiovascular disease [4–6] and peptic ulcer [7]. Night work can also result in type 2 diabetes [8], rheumatoid arthritis [9], multiple sclerosis [10], cancer [11, 12] etc.

Night shift work is more prevalent in health care sector, especially in hospitals. Shortened or disturbed sleep is among the most common health-related effects of night shift work [13, 14]. In a meta-analysis, based on 36 primary studies, Pilcher et al. [15] concluded that within rotating schedules night shifts resulted in the decrease of the length of sleep (mean 5.9 hours), while morning shifts had a moderate detrimental effect on sleep length (mean 6.6 hours). Insufficient sleep and poor sleep quality can contribute to fatigue, a critical issue also in relation to possible medical errors.

Working extended shifts (more than 8 hours per day), working overtime (more than 40 hours per week), and working both extended shifts and overtime can have adverse effects on sleep, alertness and worker's health. Extended shifts have been associated with higher risk of accidents, more psychosocial complaints, more cardiovascular symptoms, higher risk for development of hypertension [1, 16, 17]. Working overtime has also been associated with increased risk of making errors, poorer perceived health, adverse health effects, increased morbidity and mortality [1, 18, 19].

The work of physicians is responsible and decision-rich in changing clinical environments with irregular working hours, often including night work and overtime.

The aim of the study was to study the effect of night shifts and overtime work on sleep and fatigue of hospital physicians in Bulgaria.

Methods

Study design. A cross-sectional survey was conducted which included 19 the largest hospitals (> 150 beds) in Sofia, Bulgaria, as a part of the study of risk factors for health in health care sector. The survey was anonymous, self-administered questionnaire was filled in by the physicians at their workplaces. 719 physicians took part in the study, 429 female and 291 male of the average age of (44.4 ± 14.2) years and the average length of service of (19.2 ± 14.0) years.

Data collection. The questionnaires included information about demographic, physical and behavioral characteristics as well as previous and current work schedules of the physicians. The information was collected on the current schedule with the options: only daily shifts, morning/afternoon shifts, rotating shifts or only night shifts. In the study, night shift was defined as hours worked between 24:00 and 08:00. Also, the information was collected on how many night shifts was worked per month: 0 nights per month, 1–2 nights per month, 3–4 nights per month, more than 5 nights per month. To assess the

history of night work, respondents reported the number of years they worked in night shifts (including rotating and non-rotating night shifts). Also, the participants answered a question on overtime worked in the hospital and how often it happened, whether they had a second job, and taking in account the overtime and the second job how many hours on average they worked per week. The average hours worked per week were specified as follows: 21–40 hours, 41–50 hours, 51–60 hours and > 60 hours/week. In the analysis, we counted over 40 working hours per week for a long working week.

Sleep quality and fatigue. The participants completed a Karolinska Sleep Diary containing questions about «sleep duration», «sleep quality», «insufficiency of sleep», «fatigue in the morning after awakening», «ease of falling asleep», «waking up during sleep», «early awakening», and «sleep throughout». The questions were rated by a 5-point scale (1 – bad sleep, 5 – no sleep problems). A sleep quality index SQI was formed and calculated from questions related to «sleep quality», «fatigue in the morning after awakening», «ease of falling asleep» and «sleep throughout». Fatigue was measured by a questionnaire, consisting of 9 questions concerning «the difficulty to rest after work», «the degree of fatigue at the end of the working day», «the feeling of rest after dinner», «the feeling of rest on the second day off», «the difficulty to concentrate after work», «communication problems after the end of the working day», «the need for more time to feel rested after work», «the desire for seclusion for about an hour after work», «the lack of willingness to do anything after work due to fatigue», «the inability for optimal work performance at the end of the day due to fatigue» and the fatigue was calculated summing the positive answers.

Data analysis. The data was introduced and processed with the SPSS 15.0 statistical package. ANOVA and Pearson correlation coefficient were used for statistical analyses, and the significance level was set at as $p < 0.05$.

Results

The study data showed that 26 % of physicians worked only on day shifts, 10 % worked on morning/afternoon shifts and 64 % worked on rotating shifts. The great part of physicians, working only on day shifts, have history of working rotating shifts with

night work. 28 % of physicians worked more than on 5 night shifts, 43 % worked on 3 to 4 night shifts, 12 % – 1 or 2 night shifts and 30 % didn't have night shifts.

A great deal of physicians reported that they had overtime work (work after the end of the working time) as follows: 33 % had rarely overtime work, 36 % had overtime work 2–3 times per week and 29 % had overtime work every day. A part of physicians – 28 % shared that they were working at the other work place. The additional work led to longer working hours per week. Only 21 % of physicians shared that they worked 21–40 hours a week, while 38 % worked 41–50 hours a week, 27 % worked 51–60 hours a week and 14 % worked over 61 hours a week.

Sleep duration did not differ by the type of the working time arrangements as the number of night shifts per month, but most of the sleep quality characteristics were significantly influenced by the number of night shifts per month, the most significantly the self-estimated insufficiency of sleep, fatigue in the morning after awakening, and sleep quality index (Table 1), followed by self-rated sleep throughout. The fatigue was higher in physicians, working on night shifts.

Sleep duration was shorter with working for more hours per week and the insufficiency of sleep increased (Table 2), but the quality of sleep did not seem to be influenced significantly. The fatigue increased significantly with the number of working hours per week.

Gender differences were found only for sleep duration ($F = 15.240$, $p < 0.001$) and early awakening ($F = 7.166$, $p < 0.01$). The female physicians slept more (7.6 ± 1.1) hours) in comparison with males (7.2 ± 1.2) hours), while the latter had more often early awakening.

The type of work time arrangements correlated negatively with insufficiency of sleep, fatigue in the morning after awakening and sleep quality index. Quality of sleep, insufficiency of sleep, fatigue in the morning after awakening and sleep quality index correlated negatively with number of night shifts per month, and insufficiency of sleep, fatigue in the morning after awakening, sleep duration and sleep quality index correlated negatively with the ratings of additional work after the end of the working time. The characteristics and insufficiency of sleep, fatigue in the morning after awakening and sleep duration correlated negatively with working hours per week (Table 3).

Table 1

Quantity and quality of sleep (1 = poor sleep, 5 = no problems with sleep) and fatigue (1 = low level of fatigue, 9 = high level of fatigue) according to the number of night shifts per month for hospital physicians

Sleep characteristics and fatigue/ number of night shifts/month	0 shifts (n = 226) $\bar{x} \pm SD$	1–2 shifts (n = 85) $\bar{x} \pm SD$	3–4 shifts (n = 224) $\bar{x} \pm SD$	> 5 shifts (n = 198) $\bar{x} \pm SD$	F
Sleep duration	7.4 ± 0.9	7.5 ± 1.2	7.4 ± 1.1	7.4 ± 1.4	NS
Quality of sleep	3.5 ± 0.9	3.5 ± 1.0	3.5 ± 0.9	3.3 ± 0.9	NS
Insufficiency of sleep	2.7 ± 1.3	2.5 ± 1.2	2.4 ± 1.1	2.3 ± 1.1	4.451**
Fatigue in the morning after awakening	2.9 ± 1.0	2.6 ± 0.9	2.6 ± 0.9	2.6 ± 0.9	5.649**
Ease of falling asleep	3.6 ± 1.0	3.4 ± 1.0	3.5 ± 1.0	3.2 ± 1.0	6.196***
Waking up during sleep	3.1 ± 1.1	3.2 ± 1.0	3.4 ± 1.0	3.1 ± 1.0	NS
Early awakening	3.1 ± 1.1	3.4 ± 1.2	3.2 ± 1.1	3.1 ± 1.2	NS
Sleep throughout	3.5 ± 1.1	3.7 ± 0.9	3.6 ± 1.0	3.3 ± 1.1	3.509*
Sleep quality index	3.4 ± 0.7	3.3 ± 0.7	3.3 ± 0.7	3.1 ± 0.7	4.260**
Fatigue	5.0 ± 3.2	6.5 ± 3.2	5.4 ± 2.9	5.5 ± 2.8	5.078**

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 2

Quantity and quality of sleep (1 = poor sleep, 5 = no problems with sleep) and fatigue (1 = low level of fatigue, 9 = high level of fatigue) according to working hours per week

Sleep characteristics and fatigue/ number of working hours/week	21–40 hours (n = 144) $\bar{x} \pm SD$	41–50 hours (n = 276) $\bar{x} \pm SD$	51–60 hours (n = 199) $\bar{x} \pm SD$	61 hours (n = 98) $\bar{x} \pm SD$	F
Sleep duration	7.6 ± 1.1	7.5 ± 1.0	7.3 ± 1.2	7.1 ± 1.5	3.393*
Quality of sleep	3.4 ± 0.9	3.5 ± 0.8	3.4 ± 0.9	3.4 ± 1.1	NS
Insufficiency of sleep	2.7 ± 1.3	2.5 ± 1.1	2.4 ± 1.1	2.1 ± 1.2	6.520***
Fatigue in the morning after awakening	2.8 ± 0.9	2.7 ± 0.9	2.6 ± 0.9	2.6 ± 1.1	NS
Ease of falling asleep	3.4 ± 1.1	3.4 ± 0.9	3.4 ± 1.0	3.5 ± 1.1	NS
Waking up during sleep	3.1 ± 1.1	3.2 ± 1.0	3.2 ± 1.1	3.2 ± 1.2	NS
Early awakening	3.0 ± 1.2	3.3 ± 1.1	3.2 ± 1.1	3.2 ± 1.2	NS
Sleep throughout	3.5 ± 1.0	3.6 ± 1.0	3.4 ± 1.1	3.5 ± 1.1	NS
Sleep quality index	3.3 ± 0.8	3.3 ± 0.6	3.2 ± 0.7	3.2 ± 0.8	NS
Fatigue	5.1 ± 3.2	5.2 ± 2.9	5.6 ± 3.0	6.0 ± 3.0	NS

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Discussion

Shift work, especially night shift work, and long working hours are known to impair sleep and contribute to fatigue [1, 14, 21, 22]. Quantification of shift work and working hours of physicians is a quite difficult issue because of the great diversity of shift schedules, changing work time patterns during work experience, work on call, etc. The physicians in the studied hospitals in Sofia work mainly on rotating shifts with night

work (64 %), part of them work on day shifts, but had history of night shift work. Some of the latter and the ones working on morning/afternoon shifts have 1–4 night shifts on duty monthly, and 71 % of the studied physicians worked on more than 3 night shifts per month during the period of the study.

The present study has demonstrated that the higher percentage of the physicians working in Sofia hospitals had over 40 working hours per week, 38 %

Table 3

Correlation between sleep characteristics and working time arrangement, number of night shifts per month, overtime and working hours per week

Sleep characteristics	Type of work time (day, morning/afternoon, rotating, night shifts)	Number of night shifts per month	Overtime	Working hours per week
Sleep duration	.027	-.019	-.110**	-.131**
Quality of sleep	-.042	-.087*	-.041	-.024
Insufficiency of sleep	-.133**	-.141***	-.230***	-.171***
Fatigue in the morning after awakening	-.146***	-.138***	-.237***	-.095*
Ease of falling asleep	-.102**	-.132***	.003	.016
Waking up during sleep	.045	.011	-.005	.002
Early awakening	.056	-.001	.031	.063
Sleep throughout	.008	-.057	.050	-.042
Sleep quality index	-.087*	-.128**	-.086*	-.047

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

worked for 41–50 hours per week, 27 % worked for 51–60 hours per week and 14 % worked over 61 hours per week, adding to both sleep impairment and fatigue, especially taking in consideration work characteristics of undertaking intense, responsible and decision-making work often in a lack of time.

The sleep quality was highly significantly influenced by the night work, being the worst for physicians, working more than on 5 night shifts monthly. These data are in accordance with earlier findings [1, 20, 23], as well as the data on sleep of hospital nurses in Sofia [21]. The disturbed sleep is considered as a common pathway connecting night shift work with adverse health effects and the medium in between is the insufficient recovery [14]. We were not able to differentiate the effect of duration of night shift work, as the length of service under night shift work was parallel to age of physicians.

While the night work influenced mainly the sleep quality, the long working hours influenced the sleep duration and the subjective rating for insufficiency of sleep, in greater extend in male physicians. The fatigue increased with the longer working hours, but did not reach significance.

We consider that one limitation of the study is that it failed to quantify the number of night shifts worked by the former shift working physicians, covering day shifts

only during the study. A study of Bjorvatn et al [24] showed that seventy percent of nurses (136 women and 14 men) in an intensive care unit in Norway had poor-quality sleep according to the Pittsburgh Sleep Quality Index (PSQI) with shift work including night work. But these sleep problems tended to decrease with lack of exposure and recur with re-exposure. Another study showed that the effect of shift work experience was the greatest among people in their forties and reduced as participants left shift work (i.e. when they transferred to day working or retired), suggesting that the effects of shift work did not persist people to quit once shift work [19]. Another limitation of the study is the lack of the data on the available periods for recovery and their effect on sleep and fatigue because of the complexity and differences in schedule arrangements between different hospitals and departments, as well as working at the other place by 28 % of the physicians.

In conclusion, our results strongly support the suggestion that shift work with 5 and more night shifts monthly contribute to impaired quality of sleep, while long working week hours to reduced sleep duration, insufficiency of sleep and fatigue among hospital physicians. Considering the precaution principle, shift work schedules for physicians should be arranged on the bases of good practice in ergonomics, and overtime work should be avoided, if possible.

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Вангелова К., Чекова І., Димитрова І.

СОН І ВТОМА В ЛІКАРІВ У ЛІКАРНЯХ У ЗВ'ЯЗКУ ЗІ ЗМІННОЮ ПРАЦЕЮ

Національний центр громадської охорони здоров'я і аналізу

Вступ. Достатній і якісний сон має вирішальне значення для працівників, які працюють за змінним графіком, через їхній вплив на працездатність та здоров'я.

Мета дослідження – визначити вплив нічних змін та понаднормової роботи на сон та втому лікарів у лікарнях Болгарії.

Матеріали та методи дослідження. Було проведено поперечне дослідження, яке охоплювало 719 лікарів, 429 жінок і 291 чоловіків середнього віку ($44,4 \pm 14,2$) років у лікарнях Софії. Анонімне анкетне опитування включало Каролінський щоденник сну, демографічну інформацію, зміни на робочому місці, робочі часи та графік змін. Статистичний аналіз проводили за допомогою SPSS.

Результати. 26 % лікарів працювали лише в денні зміни, 55 % від 1 до 4 ночі, і 28 % понад 5 ночей. Велика кількість лікарів працювала понад 40 год на тиждень: 38 % працювали 41–50 год на тиждень, 27 % – 51–60 год і 14 % – 61 год. Якість сну, яку оцінювали за індексом SQI, була гіршою зі збільшенням числа нічних змін ($F = 4,260$, $p = 0,01$), тривалістю сну та недостатністю сну зі збільшенням робочого тижня.

Висновки. Змінна праця зі збільшенням нічних змін щомісячно та понаднормових годин на тиждень сприяла погіршенню сну в досліджуваній групі лікарів. Погіршення сну було більш очевидним у зв'язку зі збільшенням кількості нічних змін.

Ключові слова: нічні зміни, робота поза нормою, індекс якості сну

Вангелова К., Чекова И., Димитрова И.

СОН И УСТАЛОСТЬ У ВРАЧЕЙ В БОЛЬНИЦАХ В ЗАВИСИМОСТИ ОТ СМЕННОГО ТРУДА

Национальный центр общественного здравоохранения и анализа

Вступление. Достаточный и качественный сон имеет решающее значение для работников сменного труда из-за его последствий для производительности и здоровья.

Цель исследования – отследить влияние ночных смен и сверхурочной работы на сон и усталость у врачей больниц в Болгарии.

Материалы и методы исследования. Проведено поперечное исследование, которое включало 719 врачей, 429 женщин и 291 мужчину, среднего возраста ($44,4 \pm 14,2$) года в больницах Софии. Анонимный опросник включал Каролинский дневник сна, демографическую информацию, перемены места работы, рабочее время и сменный график. Статистический анализ проводили с помощью SPSS.

Результаты. 26 % врачей работали только в дневные смены, 55 % имели от одной до четырех ночных смен и 28 % – более 5 ночных смен. Большое количество врачей работало более 40 ч в неделю, а именно: 38 % работали 41–50 ч в неделю, 27 % – 51–60 часов и 14 % > 61 ч. Качество сна, оцененное по индексу SQI, было хуже с увеличением числа ночных смен ($F = 4,260$, $p = 0,01$), продолжительностью сна и недостаточностью сна, с увеличением продолжительности работы в неделю.

Выводы. Работа по сменам с большим количеством ночных смен ежемесячно и в сверхурочное время в неделю способствовали нарушению сна в исследованной группе врачей. Нарушение сна было более очевидным с увеличением числа ночных смен.

Ключевые слова: ночные смены, сверхурочное время, индекс качества сна

ORCID ID of co-authors and their contribution in preparation and writing of the paper:

Vangelova K. K. defining the purpose and design of the study, analyzing the results received, formulation of the conclusions, design and writing of the article;

Cekova I. V. conducting the study, review of literature on the paper subject, statistical processing, analysis of the data received;

Dimitrova I. D. conducting the study, review of literature on the paper subject, statistical processing, analysis of the data received.

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Контактна особа: Вангелова К., Національний центр громадської охорони здоров'я і аналізу, Софія 1413, Болгарія. Електронна пошта: k.vangelova@ncpha.government.bg