

The Effect of Stress, Fatigue, and Sleep Quality on Shift-Work Nurses in Japan

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How to cite this paper: Hosona, M. and Uesugi, Y. (2023) The Effect of Stress, Fatigue, and Sleep Quality on Shift-Work Nurses in Japan. *Health*, 15, 239-250.
<https://doi.org/10.4236/health.2023.153017>

Received: February 3, 2023

Accepted: March 7, 2023

Published: March 10, 2023

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Abstract

Purpose: To investigate the relationship between stress, fatigue and sleep quality among shift work nurses in Japan. **Design:** A descriptive correlation design using self-administered surveys. **Methods:** Questionnaires on stress, fatigue and sleep quality (the Pittsburgh Sleep Quality Index; PSQI-J) among shift work nurses were distributed to 653 nurses in Japan from January 2015 to February 2015. **Results:** Participants who reported higher levels of fatigue reported higher levels of stress ($r = 0.774, p = 0.000$), lower levels of sleep satisfaction ($r = -0.411, p = 0.000$) and overall lower levels of health ($r = -0.323, p = 0.000$). PSQI scores were also significantly correlated with reported levels of stress ($r = 0.294, p = 0.000$), fatigue ($r = 0.291, p = 0.000$) and levels of health ($r = -0.370, p = 0.000$). Nurses who have stress-relieving resources were younger ($t = -2.842, p = 0.005$), reported higher levels of overall health ($t = 2.727, p = 0.007$), had higher levels of sleep quality measured by the PSQI ($t = -2.560, p = 0.011$), and required less time to fall asleep ($t = -3.207, p = 0.001$). **Conclusions:** This study showed an association between stress and sleep satisfaction among shift work nurses in Japan. In addition, nurses that engage in activities to manage stress might achieve higher levels of health and high sleep quality.

Keywords

Shift Work, Nurse, Fatigue, Sleep Quality

1. Introduction

Nurses work in stressful environments [1] and their stress escalates in higher acuity areas [2]. Greater stress erodes work satisfaction [3]. Stress and its sequelae must be controlled so that nurses can maintain quality patient care.

A direct relationship has been shown between stress and medical errors [4]. In fact, more errors occurred when nurses work longer than 12 hours [5]. When high stress is combined with nursing's irregular hours, results include fatigue and lower performance [6].

Recently in Japan, nurse scheduling has changed from 3 eight-hour shifts similar to two unequal shifts. The merits of two shifts include increased free time while not at work. Full time nurses in Japan works for 40 hours a week. At present, the two-shift model is more common in larger hospitals in urban areas. The two shifts model is comprised of a daytime shift of eight hours (8:00-16:00) and a night shift of 16 hours (16:00-8:00). Nurses commonly rotate shifts during the work week, but it is best practice that if a nurse works the longer night shift, he/she will have the next day off to rest. While the night shift is long, it allows a two to three hours break, if the patients are stable and that break does not affect the flow of the unit. Thus, nurses are not assured a break on this 16-hour shift.

Sleep is an important factor to reduce fatigue and increase concentration on work activities. Studies on shift-work nurses in Japan showed that fatigue was decreased if the nurse had adequate sleep and a rest before the night shift work. Nurses were more fatigued if their break and nap lasted less than two hours during the 16-hour night shift [7]. In addition, night shift nurses who took breaks prior to midnight reported more fatigue than those who took breaks after midnight [8]. In fact, lower levels of fatigue were reported the further into the shift breaks were taken [9]. Lastly, sleep quality of shift work nurses has been shown to be related to both increased levels of fatigue and decreased work performance [10].

Nurses who work rotating shift nurses suffer a decline in sleep quality [11]. Shift work has also been shown to affect overall health [12]. Numerous studies have shown the relationship between shift work and disease, such as coronary disease [13], depression [14], hypertension [15], and breast cancer [16]. Similarly, sleep related health has an effect on overall work performance in shift work nurses [17]. The aim of this study was to investigate the relationship between stress, fatigue and sleep quality among shift work nurses in Japan.

2. Methods

2.1. Study Design

A descriptive correlation design using anonymous self-administered surveys was used to study shift work nurses in Japan. Participants included 653 nurses using a two-shift work model in an acute care hospital. Exclusion criteria for the study were: head nurses/nurse managers, since they do not have direct patient care responsibilities; and nurses who were using sleeping medicine regularly, since it might interfere with measurement of sleep quality of the study variables.

2.2. Participants and Setting

This study was conducted at an acute care hospital in Japan with approximately

900 beds, 26 nursing units and 700 full-time nurses. From April 2014 to March 2015, this hospital delivered in-patient services to approximately 306,000 people and out-patient services to nearly 500,000 people.

2.3. Procedure

This study was approved to by the Institutional Review Board, Graduate School of Health Sciences, Kobe University (approval number: 307). Following of the declaration of Helsinki, the study was conducted. Questionnaires were distributed to 653 nurses by each head nurse/nurse manager on nursing units from January 2015 to February 2015. The questionnaire was piloted with one nurse prior to the study to ensure readability of the questionnaire items. Participation was voluntary and, during a two-week period, completed questionnaires were submitted to designated collection bags in sealed envelopes. Completion of the questionnaire served as implied consent.

2.4. Independent Variables

The questionnaires yielded information about the study's primary concerns: demographics, stress levels, sleep quality and quantity, sleep satisfaction, levels of fatigue, and health level. There were also questions about exercise, smoking, alcohol consumption, bedroom/sleeping environment, activities on nonworking days, and stress management.

Basic demographic questions included age, gender, height, weight, marital status, living arrangements with family, and number of children. In addition, the participants were asked questions regarding exercise, smoking status, sleep environments and leisure activities.

Present stress levels on shift-work nurses were investigated using a self-administered visual analog scale (VAS). The VAS consists of 10 cm (100 mm) horizontal line, with one end of line showing 0 mm score as "not having stress at all" and the other end showing 100 mm scores as "having extreme stress." The VAS is widely used as a scale to measure subjective mental state quantitatively and easily [18]. Scale results are shown in mm, where more mm equal more stress.

Sleep quality was measured using the Pittsburgh Sleep Quality Index, Japanese version (PSQI-J). The PSQI-J is a self-administered questionnaire to ascertain sleep quality and quantity during the last month. The PSQI-J has seven component scores: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction. Each item is rated on a 0 - 3 scale [19]. The total of these component scores ranges from 0 - 21 points where higher score means sleep worse quality. The PSQI-J has a cut-off point of 5.5 [20]. Reliability for the PSQI-J is established with reported range of 0.64 - 0.87 [21].

Sleep Satisfaction, Fatigue, Health Level were each measured via a VAS similar to the one described in the section on stress. Participants were asked to rate sleep

satisfaction for usual sleep at night (when they are not working) and sleep as it related to a nap during the time before or after working a night shift. Participants were asked to rate their present fatigue and their fatigue level when they were working the night shift. Lastly, participants were asked to rate their overall health level during the time they filled out the survey.

2.5. Statistical Analysis

The findings were analyzed using IBM Statistics SPSS 22.0. Correlations to stress levels and related factors were calculated using Pearson's correlations. Bivariate analyses were conducted using independent-sample T test to examine the activities that nurses used to manage or decrease stress. For all analyses, the statistical significance threshold was $p < 0.05$.

3. Results

Out of 653 recipients, 435 participants replied to the questionnaire demonstrating a 66.4% response rate. We excluded 30 participants who regularly took sleep medication. Therefore, we analyzed data for 405 participants. The mean age was 29.2 ± 6.8 years, 91.5% were female, 83.9% were not married, 70.5% lived alone, and 89.1% did not have children. The nurses worked on various wards, including post-surgical (30.5%), internal/medical (23.8%), combination of post-surgical and internal/medical (14.5%), the operating department (6.0%), and other (10.3%).

Table 1 showed other sample characteristics.

3.1. Stress Level Scores and How to Manage Stress

Stress levels ranged from 7 - 100 mm (the maximum), with a mean of 68.8 mm (SD \pm 21.8). More than 70.3% ($n = 282$) of the participants reported that they actively manage stress. Most reported that they spent time with friends/family ($n = 76$), engaged in physical activity/exercised ($n = 53$), ate out ($n = 51$), slept/took a nap ($n = 39$), went shopping ($n = 36$), drank alcohol ($n = 22$), went on a trip ($n = 20$), and sang karaoke ($n = 17$).

Participants were also asked how they spent their days off. Overall, 213 (53.8%) reported they went out, while 183 (46.2%) reported that they stayed at home. Most reported that they spent time shopping ($n = 166$), watching TV or a movie ($n = 74$), doing housework/cleaning ($n = 58$), spent time with friends/family ($n = 51$), relaxing or reading ($n = 44$), sleeping ($n = 40$), going out to eat ($n = 39$), and participating in physical activity or exercising ($n = 35$). **Table 2** showed stress, fatigue and sleep quality among nurses.

3.2. Fatigue and Health Level Scores

Fatigue levels ranged from 0 - 100 mm (the maximum), with a mean of 71.5 mm (SD \pm 19.8 mm). However, night shift nurses reported higher levels of fatigue: responses ranged from 5 - 100 mm with a mean of 77.9 mm (SD \pm 19.3 mm). Health levels ranged from 0 - 100 with a mean of 52.8 (SD \pm 21.5).

Table 1. Demographic characteristics (N = 405).

Characteristics		
Age, y (means \pm SD)		29.2 \pm 6.8
Sex, no. (%)	Male	34 (8.5)
	Female	368 (91.5)
Ward, no. (%)	Post-surgical department	122 (30.5)
	Internal/medical department	95 (23.8)
	Combination of post-surgical and internal	58 (14.5)
	ICU, CCU, emergency	60 (15.0)
	Operating department	24 (6.0)
	Others	41 (10.3)
Marriage, no. (%)	Be married	65 (16.1)
	Be not married	339 (83.9)
Children, no. (%)	Have children	44 (10.9)
	Do not have children	359 (89.1)
Live with someone, no. (%)	Living with someone	118 (29.5)
	Living alone	282 (70.5)
Usual exercising, no. (%)	Exercise	88 (22.1)
	Don't exercise	310 (77.9)
Alcohol, no. (%)	Drink	178 (44.2)
	Not drink	225 (55.8)
Smoking, no. (%)	Smoke	20 (5.0)
	Not smoke	384 (95.0)
Body-mass index (kg/m ² , means \pm SD)		20.5 \pm 2.6
>25.0, no. (%)		23 (6.5)
18.5 - 25.0		266 (75.6)
<18.5		63 (17.9)

3.3. Sleep Quantity, Sleep Satisfaction, and Sleep Quality Scores

Sleep times on a usual night averaged 361.6 \pm 65.0 minutes (6.0 \pm 1.08 hours). Sleep satisfaction as measured by the VAS for a usual night was 47.3 \pm 23.5 mm.

Sleep quality was measured using the PSQI instrument (Japanese version), where the range is 0 - 13 and a higher score means worse sleep quality. Mean total scores, after calculations, were 6.2 \pm 2.4 and 61.3% of nurses reported quality above the 5.5 cut-off score. This means that more than half the nurses had decreased levels of sleep quality. These participants averaged sleep quality (1.4 \pm 0.6), sleep latency (1.1 \pm 0.9), sleep duration (1.6 \pm 0.7), habitual sleep efficiency (0.3 \pm 0.6), sleep disturbance (0.9 \pm 0.5), and daytime dysfunction (0.9 \pm 0.8).

Table 2. Stress, fatigue and sleep quality among shift work nurses (N = 405).

Scores of stress, fatigue and sleep quality	
Levels of stress, VAS (mm, means \pm SD)	68.8 \pm 21.8
Levels of fatigue, VAS (mm, means \pm SD)	71.5 \pm 19.8
Levels of fatigue on a night shift work, VAS (mm, means \pm SD)	77.9 \pm 19.3
Levels of Health, VAS (mm, means \pm SD)	52.8 \pm 21.5
Usual Times on sleep at night (minutes, means \pm SD)	361.6 \pm 65.0
Times it takes to get to sleep (minutes, means \pm SD)	28.3 \pm 27.9
Times on sleep before or after a night shift, (minutes, means \pm SD)	534.5 \pm 120.7
Sleep satisfaction, VAS (mm, means \pm SD)	47.3 \pm 23.5
Actively manage stress, no. (%)	282 (70.3)
Spending times with family/friends	76 (27.8)
Engage in physical activity/exercised	53 (19.8)
Eat out	51 (18.7)
Sleep/take a nap	39 (14.3)
Go shopping	36 (13.2)
Drink alcohol	22 (8.1)
Go on a trip	20 (7.3)
Sing karaoke	17 (6.2)
Listening to the music/playing the instrument	14 (5.1)
Not actively manage stress, no. (%)	119 (29.7)
How to spend their day off	
Go out on their day off, no. (%)	213 (53.8)
Stay at home on their day off, no. (%)	183 (46.2)
Shopping	166 (43.3)
Watching TV or a movie	74 (19.3)
Doing housework/cleaning	58 (15.1)
Spending time with friends/family	51 (13.3)
Relaxing or reading	44 (11.5)
Sleeping	40 (10.4)
Going out to eat	39 (9.6)
Participating in physical activity or exercising	35 (9.1)
Go on a trip	11 (2.9)
PSQI component scores (0 - 3) (means \pm SD)	
1) Subjective sleep quality	1.4 \pm 0.6

Continued

2) Sleep latency	1.1 ± 0.9
3) Sleep duration	1.6 ± 0.7
4) Habitual sleep efficiency	0.3 ± 0.6
5) Sleep disturbances	0.9 ± 0.5
6) Use of sleeping medication	0.0 ± 0.0
7) Daytime dysfunction	0.9 ± 0.8
PSQI score (means ± SD)	6.2 ± 2.4
≤5.5 associated with good sleep quality, no. (%)	142 (38.7)
>5.5 associated with bad sleep quality	225 (61.3)

VAS; visual analog scale, PSQI; Pittsburgh Sleep Quality Index, component scores (0-3).

The score for “use of sleeping medication” was 0 and irrelevant because the sample excluded such users.

3.4. Relationship between Stress, Fatigue, and Quality of Sleep

Table 3 shows Pearson’s correlation were calculated for sleep times, sleep satisfaction, stress levels, fatigue levels, health levels, and total scores and subscales for the PSQI.

Participants who reported higher levels of fatigue also reported higher levels of stress ($r = 0.774$, $p = 0.000$), lower levels of sleep satisfaction ($r = -0.411$, $p = 0.000$) and overall lower levels of health ($r = -0.323$, $p = 0.000$).

The overall PSQI score was correlated with minutes of sleep ($r = -0.519$, $p = 0.000$), time it took to get to sleep ($r = 0.567$, $p = 0.000$), and sleep satisfaction ($r = -0.442$, $p = 0.000$). Since higher PSQI scores mean lower sleep quality, nurses who reported lower quality of sleep actually slept less, took longer to get to sleep, and had lower levels of sleep satisfaction. While overall PSQI scores were also significantly correlated with reported levels of stress ($r = 0.294$, $p = 0.000$), fatigue ($r = 0.291$, $p = 0.000$) and levels of health ($r = -0.370$, $p = 0.000$), the strength of the relationships were weak.

Table 4 shows nurses who engage in stress-relieving recourses were younger ($t = -2.842$, $p = 0.005$), reported higher levels of overall health ($t = 2.727$, $p = 0.007$), had higher levels of sleep quality measured by the PSQI ($t = -2.560$, $p = 0.011$), and required less time to fall asleep ($t = -3.207$, $p = 0.001$). However, between nurses who opted for stress-relieving recourses and those who did not, there were no significant differences in stress levels, fatigue levels, or sleep satisfaction.

4. Discussion

The study was conducted to clarify stress conditions and relevant factors among shift-work nurses in Japan. The high response rate for nurses working in an acute

Table 3. Correlations on Stress, Fatigue and Quality of Sleep (PSQI) on shift work nurses. (N = 405).

		Minutes of sleep	Time to Get to sleep (minutes)	Sleep satisfaction (VAS)	Levels of stress (VAS)	Levels of fatigue (VAS)	Levels of health (VAS)
Levels of stress (VAS)	<i>r</i>	-0.104	0.073	-0.411	1.000	0.774	-0.323
	<i>P</i>	0.040	0.146	0.000		0.000	0.000
Levels of fatigue (VAS)	<i>r</i>	-0.115	0.062	-0.429	0.774	1.000	-0.340
	<i>P</i>	0.022	0.217	0.000	0.000		0.000
PSQI							
Subjective sleep quality	<i>r</i>	-0.223	0.268	-0.539	0.393	0.360	-0.412
	<i>P</i>	0.000	0.000	0.000	0.000	0.000	0.000
Sleep latency	<i>r</i>	-0.149	0.835	-0.185	0.044	0.064	-0.153
	<i>P</i>	0.003	0.000	0.000	0.383	0.199	0.002
Sleep duration	<i>r</i>	-0.887	0.191	-0.264	0.067	0.081	-0.139
	<i>P</i>	0.000	0.000	0.000	0.183	0.110	0.006
Habitual sleep efficiency	<i>r</i>	-0.258	0.121	-0.015	0.049	0.036	-0.084
	<i>P</i>	0.000	0.019	0.769	0.349	0.487	0.103
Sleep disturbances	<i>r</i>	-0.097	0.328	-0.239	0.183	0.208	-0.217
	<i>P</i>	0.054	0.000	0.000	0.000	0.000	0.000
Daytime dysfunction	<i>r</i>	-0.090	0.021	-0.244	0.297	0.269	-0.270
	<i>P</i>	0.073	0.673	0.000	0.000	0.000	0.000
PSQI score	<i>r</i>	-0.519	0.567	-0.442	0.294	0.291	-0.370
	<i>P</i>	0.000	0.000	0.000	0.000	0.000	0.000

Pearson's test, *r*, correlation coefficient. PSQI; Pittsburgh Sleep Quality Index, PSQI component scores (0 - 3), VAS; visual analog scale.

care setting was a pleasant surprise. While 30 nurses who completed the survey disclosed the use of sleep medicines and were consequently excluded from the study, it is possible that some nurses may not have honestly disclosed the use of sleeping medications.

In this sample, shift work nurses reported higher stress (68.8 ± 21.8) and fatigue (71.5 ± 19.8) levels. Although participants were young, with a mean age of 28.5 years, self-reported health scores fell in the middle range of the VAS. Because the nurses in this study work in an advanced treatment hospital, it is possible that the shift work along with higher acuties places a physical burden on the nurses and contributes to this moderate level of health. In addition, young nurses may lack experience in caring for acutely ill patients, which may also contribute to higher levels of stress.

We investigated various activities that might affect fatigue and stress levels on

Table 4. Relations of stress-relieving recourses, stress, fatigue and sleep in nurses (N = 405).

Whether to have something to relieve stress	N	Mean ± SD	T score	Pvalue	
Age (years)	Have	280	28.5 ± 6.0	-2.842	0.005
	Not have	119	30.9 ± 8.1		
Minutes of sleep (minutes)	Have	279	365.3 ± 65.5	1.632	0.104
	Not have	119	353.7 ± 63.1		
Times on sleep before a night shift (minutes)	Have	278	538.9 ± 115.9	1.060	0.290
	Not have	119	524.9 ± 131.9		
Levels of stress, VAS (mm)	Have	280	68.3 ± 22.2	-0.495	0.621
	Not have	119	69.5 ± 20.9		
Levels of fatigue, VAS (mm)	Have	280	71.7 ± 20.3	0.445	0.656
	Not have	119	70.8 ± 18.9		
Levels of health, VAS (mm)	Have	280	54.7 ± 21.7	2.727	0.007
	Not have	119	48.4 ± 20.4		
Times to get to sleep (minutes)	Have	279	23.5 ± 19.7	-3.207	0.001
	Not have	117	30.9 ± 23.2		
PSQI score	Have	253	5.9 ± 2.3	-2.560	0.011
	Not have	111	6.6 ± 2.5		

Independent-Samples T test, VAS; visual analog scale, PSQI; Pittsburgh Sleep Quality Index.

days off. Nearly 70% nurses do something to get rid of their stress to help them recharge and feel refreshed. Therefore, it may be helpful to investigate specific effective concrete measures to target stress and reduce fatigue. While the present results did not show that nurses who opted for stress-relieving recourses reported decreased fatigue or stress levels; we need to consider possible activities that may help shift-work nurses to reduce their fatigue and stress.

Nurses who worked the 16-hour shift reported higher levels of current stress which was also correlated to increased levels of fatigue and worse sleep quality as well as lower levels of health and sleep satisfaction. Similarly, Lin *et al.* [22] showed that increased fatigue is associated with low sleep quality and worse health status among shift work nurses in Taiwan. This result suggests that the nurses who work the 16-hour night shift have a more difficult time decreasing stress and fatigue associated with their work. In Japan, nurses who worked two shifts consisting of 8 hours daytime shift work and 16 hours night shift work seem to suffer higher fatigue which may erode their performance. Caruso [23] showed that long hours among shift workers might be associated with lower performance, injuries, chronic diseases, fatigue-related errors. In this sample, nurses who reported stress-relieving recourses tended to be younger, reported higher subjective levels of health, and also fell asleep faster. Additional investiga-

tions in this area should include nurses of various ages, those working in small and medium hospitals with differing levels of patient acuity. Future studies could focus on intervention designs aimed at specific strategies to: increase sleep quality as well as reduce fatigue and stress levels.

Participants of this study were only nurses in one advanced treatment hospital. In addition, the participants in this study were young, with a mean age of 29 years working in a high acuity setting. While the results do shed light on the relationship among shift-work, sleep, fatigue, and stress, the descriptive correlational design does not imply any cause-and-effect relationships. In addition, the use of a convenience sample introduces bias and limits generalizability of the results. As the sample was predominantly female, therefore the findings may also represent gender bias. The instruments used in this study were selected based on their intended purpose and psychometric properties. However, even with careful selection, self-report instruments are known to threaten to internal validity.

5. Conclusions

This study showed association between stress and sleep satisfaction as well as fatigue on shift work nurses in Japan. Therefore, it is important to examine effective concrete measures to decrease stress and fatigue among shift-work nurses, including the optimum use of nutrition, stress management, and other breaks on long shifts.

Acknowledgements

This manuscript was subsidized by JSPS KAKENHI Grant Number 17K12157.

The authors thank the participants in this study.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Sveinsdóttir, H., Biering, P. and Ramel, A. (2006) Occupational Stress, Job Satisfaction, and Working Environment among Icelandic Nurses: A Cross-Sectional Questionnaire Survey. *International Journal of Nursing Studies*, **43**, 875-889. <https://doi.org/10.1016/j.ijnurstu.2005.11.002>
- [2] Tarnow-Mordi, W.O., Hau, C., Warden, A. and Shearer, A.J. (2000) Hospital Mortality in Relation to Staff Workload: A 4-Year Study in an Adult Intensive-Care Unit. *The Lancet*, **356**, 185-189. [https://doi.org/10.1016/S0140-6736\(00\)02478-8](https://doi.org/10.1016/S0140-6736(00)02478-8)
- [3] Shader, K., Broome, M.E., Broome, C.D., West, M.E. and Nash, M. (2001) Factors Influencing Satisfaction and Anticipated Turnover for Nurses in an Academic Medical Center. *The Journal of Nursing Administration*, **31**, 210-216. <https://doi.org/10.1097/00005110-200104000-00010>
- [4] Arimura, M., Imai, M., Okawa, M., Fujiwara, T. and Yamada, N. (2010) Sleep, Mental Health Status, and Medical Errors among Hospital Nurses in Japan. *Indus-*

- trial Health*, **48**, 811-817. <https://doi.org/10.2486/indhealth.MS1093>
- [5] Rogers, A.E., Hwang, W.T., Scott, L.D., Aiken, L.H. and Dinges, D.F. (2004) The Working Hours of Hospital Staff Nurses and Patient Safety. *Health Affairs*, **23**, 202-212. <https://doi.org/10.1377/hlthaff.23.4.202>
- [6] Scott, L., Hwang, W. and Rogers, A.E. (2006) The Impact of Multiple Care Giving Roles on Fatigue, Stress, and Work Performance among Hospital Staff Nurses. *The Journal of Nursing Administration*, **36**, 86-95. <https://doi.org/10.1097/00005110-200602000-00007>
- [7] Matsumoto, S., Sasaki, T. and Sakita, M. (2008) The Effects of the Naps Taken by Hospital Nurses in 16-Hour Nightshifts on Their Subjective Fatigue Feelings and Sub-Sequent Sleeps. *The Journal of Science of Labour*, **84**, 25-29.
- [8] Miyazaki, M. and Hosona, M. (2013) The Relationship between Sleeping Patterns and Fatigue among Nurses on Two-Shift Work Schedules. *Bulletin of Health Sciences Kobe*, **29**, 1-15.
- [9] Kubo, T., Takeyama, H., Matsumoto, S., Ebara, T., Murata, K., Tachi, N. and Itani, T. (2007) Impact of Nap Length, Nap Timing and Sleep Quality on Sustaining Early Morning Performance. *Industrial Health*, **45**, 552-563. <https://doi.org/10.2486/indhealth.45.552>
- [10] Karhula, K., Härmä, M., Sallinen, M., Hublin, C., Virkkala, J., Kivimäki, M., Vahtera, J. and Puttonen, S. (2013) Job Strain, Sleep and Alertness in Shift Working Health Care Professionals—A Field Study. *Industrial Health*, **51**, 406-416. <https://doi.org/10.2486/indhealth.2013-0015>
- [11] Hasson, D. and Gustavsson, P (2010) Declining Sleep Quality among Nurses: A Population-Based Four-Year Longitudinal Study on the Transition from Nursing Education to Working Life. *PLOS ONE*, **5**, e14265. <https://doi.org/10.1371/journal.pone.0014265>
- [12] Shields, M. (2002) Shift Work and Health. *Health Reports*, **13**, 11-33.
- [13] Knutsson, A., Åkerstedt, T., Jonsson, B.G. and Orth-Gomer, K. (1986) Increased Risk of Ischaemic Heart Disease in Shift Workers. *The Lancet*, **328**, 89-92. [https://doi.org/10.1016/S0140-6736\(86\)91619-3](https://doi.org/10.1016/S0140-6736(86)91619-3)
- [14] Skipper, J.K. Jr., Jung, F.D. and Coffey, L.C. (1990) Nurses and Shiftwork: Effects on Physical Health and Mental Depression. *Journal of Advanced Nursing*, **15**, 835-842. <https://doi.org/10.1111/j.1365-2648.1990.tb01915.x>
- [15] Morikawa, Y., Nakagawa, H., Miura, K., Ishizaki, M., Tabata, M., Nishijo, M., Higashiguchi, K., Yoshita, K., Sagara, T., Kido, T., Naruse, Y. and Nogawa, K. (1999) Relationship between Shift Work and Onset of Hypertension in a Cohort of Manual Workers. *Scandinavian Journal of Work, Environment & Health*, **25**, 100-104. <https://doi.org/10.5271/sjweh.411>
- [16] Hansen, J. (2001) Light at Night, Shiftwork, and Breast Cancer Risk. *Journal of the National Cancer Institute*, **93**, 1513-1515. <https://doi.org/10.1093/jnci/93.20.1513>
- [17] Phiri, L.P., Draper, C.E., Lambert, E.V. and Kolbe-Alexander, T.L. (2014) Nurses' Lifestyle Behaviours, Health Priorities and Barriers to Living a Healthy Lifestyle: A Qualitative Descriptive Study. *BMC Nursing*, **13**, Article No. 38. <https://doi.org/10.1186/s12912-014-0038-6>
- [18] Wewers, M.E. and Lowe, N.K. (1990) A Critical Review of Visual Analogue Scales in the Measurement of Clinical Phenomena. *Research in Nursing & Health*, **13**, 227-236. <https://doi.org/10.1002/nur.4770130405>
- [19] Buysse, D.J., Reynolds 3rd, C.F., Monk, T.H., Berman, S.R. and Kupfer, D.J. (1989)

The Pittsburgh Sleep Quality Index: A New Instrument for Psychiatric Practice and Research. *Psychiatry Research*, **28**, 193-213.

[https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4)

- [20] Doi, Y., Minowa, M., Uchiyama, M. and Okawa, M. (1998) Development of the Japanese Version of the Pittsburgh Sleep Quality Index. *Japanese Journal of Psychiatry Treatment*, **13**, 755-763.
- [21] Doi, Y., Minowa, M., Uchiyama, M., Okawa, M., Kim, K., Shibui, K. and Kamei, Y. (2000) Psychometric Assessment of Subjective Sleep Quality Using the Japanese Version of the Pittsburgh Sleep Quality Index (PSQI-J) in Psychiatric Disordered and Control Subjects. *Psychiatry Research*, **97**, 165-172.
[https://doi.org/10.1016/S0165-1781\(00\)00232-8](https://doi.org/10.1016/S0165-1781(00)00232-8)
- [22] Lin, S., Liao, W.C., Chen, M.Y. and Fan, J.Y. (2014) The Impact of Shift Work on Nurses' Job Stress, Sleep Quality and Self-Perceived Health Status. *Journal of Nursing Management*, **22**, 604-612. <https://doi.org/10.1111/jonm.12020>
- [23] Caruso, C.C. (2014) Negative Impacts of Shiftwork and Long Work Hours. *Rehabilitation Nursing*, **39**, 16-25. <https://doi.org/10.1002/rnj.107>