

Relation between subjective sleepiness and changes in some vital signs among the clinical night workers

Alireza Khammar¹, Raze Nabi Amjad², Mitra Moghadasi³, Marzieh Rohani⁴, Arezoo Poursadeghian⁵, Mahsa Hami⁶, Mohammad Khandan⁷, Hamed Yarmohammadi⁸, Mohsen Poursadeghian⁹

¹Department of Occupational Health Engineering, School of Public Health, Zabol University of Medical Sciences, Zabol, ²Department of Nursing, School of Nursing and Midwifery, Alborz University of Medical Sciences, Karaj, ³Department of Surgical Technologies, Shariati Hospital, Tehran University of Medical Sciences, ⁴Student Research Committee, Department of Epidemiology, School of Public Health, Shahid Beheshti University of Medical Sciences, Tehran, ⁵Student Research Committee, Gonabad University of Medical Sciences, Gonabad, ⁶Department of Economic Development and Planning, University of Firoozkooch Branch, Islamic Azad University, Firoozkooch, ⁷Department of Ergonomics, Faculty of Health, Qom University of Medical Sciences, Qom, ⁸Research Center for Environmental Determinants of Health (RCEDH), Kermanshah University of Medical Sciences, Kermanshah, ⁹Rofeideh Rehabilitation Hospital, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

ABSTRACT

Background: Individuals with shift work sleep disorder are at risk for significant behavioral and health related such as emotional, psychological, and somatic issues. Sleeping problems in the health-care workers can lead to medication error incidents, resulting in undesired patients' safety. **Objective:** The aim of this study was to assess the relationship between the subjective sleepiness and changes in some vital signs of the night shift health care workers. **Materials and Methods:** This was a cross-sectional and descriptive-analytical study that has been done in a hospital in Iran, 2017. Clinical staffs were as the study population; all of them were in shift working schedule. Seventy-nine personnel were selected in random. Data gathered using a researcher-developed demographic questionnaire and Stanford Sleepiness Scale to measure the intensity of the sleepiness. Data were analyzed using *t*, ANOVA, and Pearson's tests by SPSS V20. Responders were aged 35.24 ± 6.35 (mean \pm standard deviation) years. **Results:** Staff had the lowest amount of sleepiness at around 22:30 and the highest at the end of the shift. Sleepiness was significantly correlated with age, work experience, and body mass index (BMI), and level of education. A significant relationship was observed between age, work experience, BMI, and education level ($P < 0.05$). Beat and breath rates were in diverse and significant relationship with sleepiness ($P < 0.05$). **Conclusions:** Sleepiness in two studied groups was similar. Sleepiness can decrease beat and breath rates, so decision makers should pay attention to physical health of staffs, especially on health-care centers to increase staff and patients safety.

Key words: Beat rate, breath rate, clinical staff, shift workers, sleepiness

Introduction

Sleepiness is a major risk factor for serious injury and death in accidents. Sleepiness is a main result of insufficient sleep. Sleepiness, a consequence of insufficient sleep, plays a key role in accidents leading to injury and death.^[1,2]

Several subjective ratings such as Karolinska Sleepiness Scale (KSS), a tool in Likert type can easily be used as alternatives.^[3,4]

Researchers have also used subjective measures where drivers are asked to rate their level of drowsiness either

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

Cite this article as: Khammar A, Amjad RN, Moghadasi M, Rohani M, Poursadeghian A, Hami M, *et al.* Relation between subjective sleepiness and changes in some vital signs among the clinical night workers. *Ann Trop Med Public Health* 2017;10:1179-83.

Access this article online

Quick Response Code:



Website:
www.atmph.org

DOI:
10.4103/ATMPH.ATMPH_303_17

Correspondence:

Dr. Mohsen Poursadeghian, Rofeideh Rehabilitation Hospital, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran.
E-mail: mo.poursadeghian@uswr.ac.ir

verbally or through a questionnaire. These ratings indicate drowsiness intensity.^[5,6] On the other hand, given the public health-care quality, improvement is directly related to occupational and individual factors of these centers' employees.^[7,8] The effect of hospital works on health staffs' performance, communication, and quality of life has been considered in some research projects.^[9,10] Shift work is described as any work regularly done at the time out of the day work time.^[11,12] Evidence indicates that sleep disorder is the major complaint among the staff working at industrial, hygienic, and medical environments based on a shift work system. According to the definition, shift works are the works that regularly should be done out of the traditional working hours.^[11,12] Sleep disorder is the most common complaint reported by the shift workers in industrial, hygiene, and medical environments.^[13] Sleep disorder are likely to be able to affect individuals' general^[14] and mental conditions.^[15,16]

A normal sleep contains 7–7.5 h in a day, whereas a shift worker sleep around 4–6 h as mean, that is, 5–20% lower than the sleep time of day shift workers.^[17] A sleepiness which happens at an undesirable time can also be considered abnormal.^[18] To keep the mental balance, a person needs sleeping, and sleeping disorder is considered as a psychological disease.^[19] The imbalance in the cycle of sleeping-waking^[20] results in inconsistency of the individual's psychological and somatic state, and as a consequence, disorders such as digestive problems, heart problems, panic attacks, hallucination, aggression, poor emotional health, and lack of concentration. An imbalanced sleeping-waking cycle^[20] may result in psychological and somatic disorders including digestive problems, heart problems, panic attacks, hallucination, aggression, poor emotional health, and lack of concentration.^[21]

On the other hand, sleeping problems, associated with the shift working, may cause problems in the vital sleeping problems in the health-care workers can lead to medication error incidents, resulting in undesired patients' outcome. Probability of errors occurred,^[22,23] and then accidents^[24] among people working in shift schedules were higher than in other groups, present conditions are encouraging.^[25,26]

Sleep disorders and breathing problem relation has been studied in some researches and their relation was demonstrated. Research shows a significant relation between sleep disorders and breathing problems.^[27] A study was developed to investigate sleep patterns and occupational incidents' history. The relation between sleep patterns and occupational incidents was investigated.^[28]

Sleep disorders associated with shift working are by 10% more among night and rotating shift workers.^[29] Heart rate variability monitoring, alone, or in combination with other physiologic measures can be used in safety devices to warn about drowsy operators.^[30] It has been reported that staff's degree of awareness varies during the different hours of a shift work; as time closes to the last hours of a shift work, the degree of awareness and attention is decreased.^[30]

Objective

This study was aimed to assess sleepiness and its relation with breath and beat rate among the clinical staff at a hospital in Iran.

Materials and Methods

This was a cross-sectional and descriptive-analytical study that has been done in a hospital in Iran, 2012. Clinical staffs were as the study population; all of them were in shift working schedule with an experience of at least for 1 year. Furthermore, they had no history of long-term medicine consumption or working at night work shift for two consecutive nights. Seventy-nine personnel were selected randomly based on the confidence level of 95%, test power of 8%, and absolute error of 25%. The subjects of the present study included all clinical staff's shift who are working with at least 1 year of experience. Those with a history of long-term medicine consumption and those with two consecutive night shifts were excluded from the study. Finally, adopting a confidence level of 95%, a test power of 8%, and an absolute error of 25%, 79 participants were selected in random. Personnel were in two shift work programs.

Data gathered using a researcher-developed demographic questionnaire (age, gender, body mass index [BMI] score, education level, marital status, time of working on shift work system, and smoking)^[31] and Stanford Sleepiness Scale to measure the intensity of the sleepiness. Its validity (0.68) and reliability (0.88) have been proved previously.^[32]

The questionnaires were completed by the group working 8 pm to 3:30 am at 9:00 pm, 10:30 pm, 12:00 pm, 1:30 am, and 3:00 am and by the second group at 9:00 pm, 10:30 pm, 12:00 pm, and 1:30 am. Breath and beat rates were simultaneously monitored directly at the mentioned times.

Pearson's correlation test was used to examine the relationship of the sleepiness variable with BMI score, years of shift work experience, age, and marital status, and *t*-test and ANOVA were employed to compare the

mean values through SPSS V16 SPSSr version 21.0 (SPSS Inc., Chicago, IL). Using Pearson's correlation test, the relationship between BMI score, years of shift work experience, age, and marital status was investigated. *T*-test and ANOVA were also used to compare the mean values.

Results

Responders were aged 35.24 ± 6.35 (mean \pm standard deviation) years. Nearly 45% of participants were male. The mean years of work experience were 14 ± 3.6 . Married responders outweighed singles with 69.6%. BMIs mean score was 24 ± 3 . Only one participant (1.26%) was a smoker. Furthermore, 57% of the participants had the education degree lower than bachelor. Nearly 36.7% had B.Sc., and people with a degree higher than B.Sc. were in minority (6.33%).

Figure 1 compares the intensity of sleepiness along the shift work time between two groups of working schedules. Staff had the lowest amount of sleepiness at around 22:30 and the highest at the end of the shift in both groups. Figures 2 and 3 show the changes in beat rate, and Figures 4 and 5 show the changes in breath rate during the shift work time between the two groups.

Difference of sleepiness level among groups of ages (20–30, 30–45, and >45 years) was significant ($P = 0.001$). Furthermore, employees with different BMI (<18.5, 18.5–25, and > 25) ($P = 0.027$) and levels of education (lower than B.Sc., B.Sc., and higher than B.Sc.) depicted significant differences in terms of sleepiness ($P = 0.001$). Sleepiness was also different significantly among participants with various work experiences ($P = 0.001$). No significant difference in sleepiness was identified with respect to marital status ($P > 0.05$). A significant difference was observed in differences of sleepiness level among age groups (20–30, 30–45, and >45) ($P = 0.001$). A significant difference was also observed regarding sleepiness in employees with different BMI (<18.5, 18.5–25, and >25) ($P = 0.027$) and different levels of education (lower than B.Sc., B.Sc., and higher than B.Sc.) ($P = 0.001$). A significant difference was identified in participants with various work experiences ($P = 0.001$). Meanwhile, marital status had no significant impact on sleepiness ($P > 0.05$).

Correlations between sleepiness and age, work experience, and BMI were found to be significant and direct by Pearson ($r = 0.240$ – 0.589 , $P < 0.05$). Beat rate was in diverse and significant relationship with

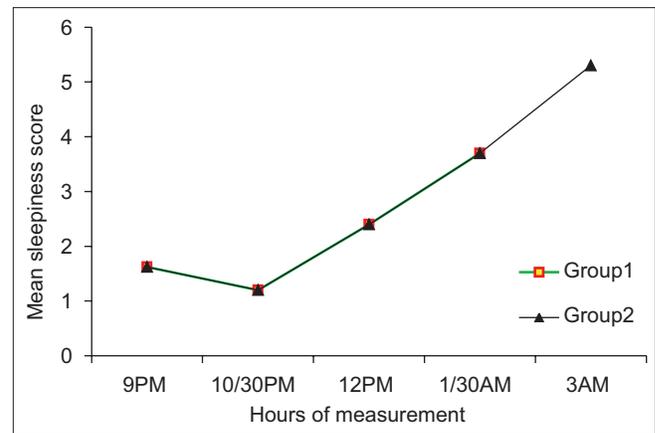


Figure 1: Trends of sleepiness at different work hours of both groups' staff

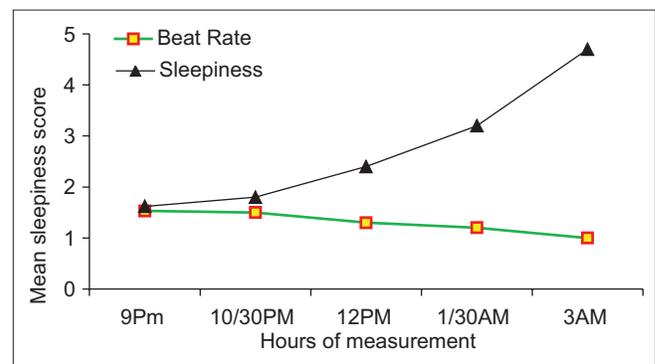


Figure 2: Trends of beat rate regards to sleepiness at different work hours (Group 1)

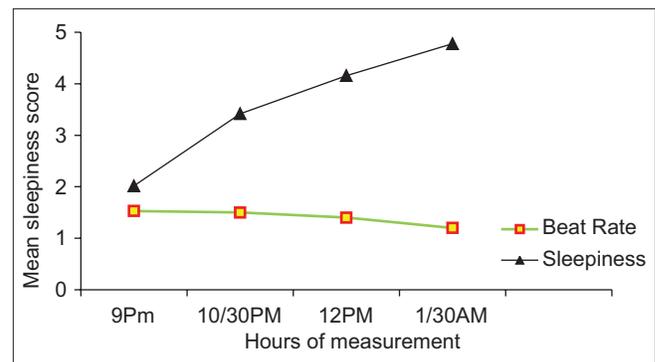


Figure 3: Trends of beat rate regards to sleepiness at different work hours (Group 2)

sleepiness ($r = 0.328$, $P < 0.05$). In addition, breath rate was in negative and significant correlation with sleepiness ($r = 0.199$, $P < 0.05$).

Discussion

Findings represented at 3:00 am could be found the highest level of sleepiness at first and then at 1:30 am. This result is similar to outcomes of a study that tells the maximum drowsiness occurs at 2:00, 4:00, and 6:00 am

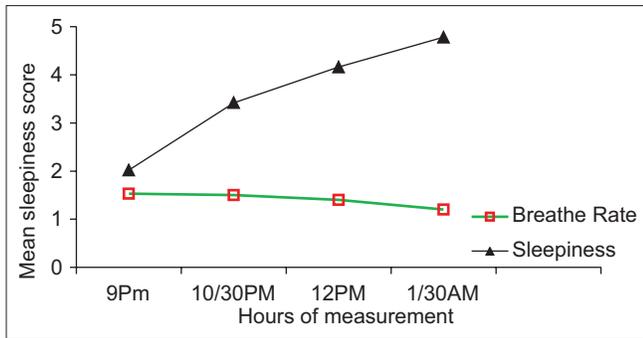


Figure 4: Trends of breath rate regards to sleepiness at different work hours (Group 1)

in night shift. As the findings of the study show, the highest levels of sleepiness happened at 3.00 and 1.30 am, respectively.^[32] Hence, this could be concluded that work shift influences sleeping quality. Melatonin secretion, as a hormone that helps to feel sleepy, is increased in the morning. Therefore, it can be said that work shift affects sleeping quality. The reason is an increase in melatonin secretion, a hormone that causes feeling sleepy, in the morning.^[33] Results of a research among nurses have demonstrated that the melatonin secretion reaches the peak at 4:00 am, and it is significantly higher than at other hours of the day. According to some studies conducted among nurses, melatonin secretion reaches its highest level at 4.00 am.^[34]

As mentioned above, Figures 2-5 illustrate that increased sleepiness leads to a reduction in breath and beat rates. Some documents concluded that changing in heart rate could be used as an alarm to sleepiness,^[35] and sleep disorders are in relation with breathing problem.

Researchers found that there is a direct relationship between work experience on shift working system and drowsiness. A direct relationship was observed between the experience of working in a shift working system and drowsiness; it means more work experience leads to more issues in fitting to shift working. Performance of the shift working employees is negatively affected by sleepiness.^[36] The significant difference in the level of sleepiness among participants with various ages has been shown in the present study it is in line with findings of Härmä *et al.*^[37] Furthermore, there was a significant difference between staff's sleepiness and their BMI as like as some other studies.^[38,39]

Conclusions

Altogether, sleepiness in two studied groups was similar. Although there were some significant differences among demographic groups regards to drowsiness. It is crucial to consider demographic and physiological features of

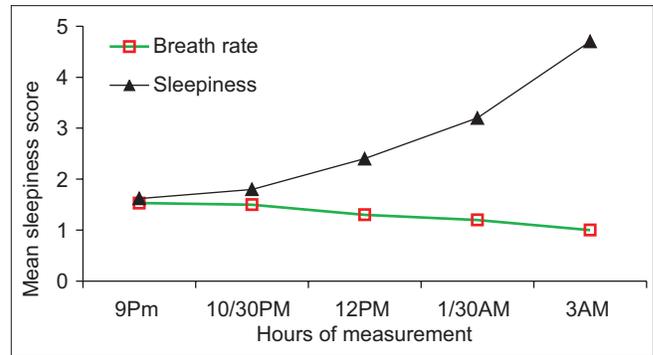


Figure 5: Trends of breath rate regards to sleepiness at different work hours (Group 2)

staff to find suitable individuals for shift working as a main managerial action to minimize shift working systems problems. Sleepiness can decrease beat and breath rates, so decision makers should pay attention to physical health of staffs, especially on health-care centers where nurses are dealing with patients and their own and patient safety would be at risk.

Acknowledgment

The authors gratefully acknowledge the financial support for this work provided by University of Social Welfare and Rehabilitation Sciences, Iran. We are thankful to University of Social Welfare and Rehabilitation Sciences for its financial supports.

Financial support and sponsorship

This study was supported by grant No 1901 in University of Social Welfare & Rehabilitation Sciences.

Conflicts of interest

There are no conflicts of interest.

References

1. Karchani M, Kakooei H, Yazdi Z, Zare M. Do bright-light shock exposures during breaks reduce subjective sleepiness in night workers? *Sleep Biol Rhythms* 2011;9:95-102.
2. Karchani M, Mazloumi A, NaslSaraji G, Akbarzadeh A, Niknezhad A, Ebrahimi MH, *et al.* Association of subjective and interpretive drowsiness with facial dynamic changes in simulator driving. *J Res Health Sci* 2015;15:250-5.
3. Khammar A, Moghimian M, Ebrahimi M H, Abbasi M, Baneshi MM, Yari AR, *et al.* Effects of Bright light shock on sleepiness and adaptation among night workers of a hospital in Iran. *Annals of Tropical Medicine and Public Health* 2017;10:595-9.
4. Poursadeghiyan M, Mazloumi A, Saraji GN, Niknezhad A, Akbarzadeh A, Ebrahimi MH. Determination the Levels of Subjective and Observer Rating of Drowsiness and Their Associations with Facial Dynamic Changes, *Iranian Journal of Public Health* 2017;46:93-102.
5. Poursadeghiyan M, Mazloumi A, Saraji G N, Baneshi MM, Khammar AR, Ebrahimi M H, Using image processing in the proposed drowsiness detection system design, *Iranian Journal of Public Health* 2017. [In press].
6. Tremaine R, Dorrian J, Lack L, Lovato N, Ferguson S, Zhou X, *et al.*

- The relationship between subjective and objective sleepiness and performance during a simulated night-shift with a nap countermeasure. *Appl Ergon* 2010;42:52-61.
7. Aiken LH, Clarke SP, Sloane DM, Sochalski J, Silber JH. Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *JAMA* 2002;288:1987-93.
 8. Knezevic B, Milosevic M, Golubic R, Belosevic L, Russo A, Mustajbegovic J, *et al.* Work-related stress and work ability among Croatian university hospital midwives. *Midwifery* 2011;27:146-53.
 9. Abbasi M, Zakerian A, Akbarzade A, Dinarvand N, Ghaljahi M, Poursadeghiyan M, *et al.* Investigation of the Relationship between Work Ability and Work-related Quality of Life in Nurses. *Iranian Journal of Public Health* 2017;46:1404-12.
 10. Poursadeghiyan M, Amjad RN, Baneshi MM, Farrokhi M, Poursadeghiyan A, Rohani M, *et al.* Drowsiness trend in night workers and adaptation to night shift in hospital staff. *Ann Trop med Public Health* 2017;10:989-92.
 11. Khammar A, Amjad RN, Rohani M, Yari AR, Noroozi M, Poursadeghiyan A, *et al.* Survey of shift work disorders and occupational stress among nurses: A cross-sectional study. *Ann Trop Med Public Health* 2017;10:978-84.
 12. Jaffe MP, Smolensky MH, Wun CC. Sleep quality and physical and social well-being in North American petrochemical shift workers. *South Med J* 1996;89:305-12.
 13. Weitzman ED. Reversal of sleep-waking cycle: Effect on sleep stage pattern and certain neuro endocrine rhythms. *Trans Am Neuro Assoc* 1988;93:153-7.
 14. Soleimany M, Masoodi R, Sadeghi T, Bahrami N, Ghorban M, Hassanpoor A. General health and its association with sleep quality in two groups of nurses with and without shift working in educational centers of Iran University of Medical Sciences (IUMS). *J Shahrekord Univ Med Sci* 2008;10:70-5.
 15. Yarmohammadi H, Pourmohammadi A, Sohrabi Y, Eskandari S, Poursadeghiyan M, Biglari H, *et al.* Work shift and its effect on nurses' health and welfare. *Soc Sci* 2016;11:2337-41.
 16. Poursadeghiyan M, Abbasi M, Mehri A, Hami M, Raei M, Ebrahimi MH. Relationship between job stress and anxiety, depression and job satisfaction in nurses in Iran. *Soc Sci* 2016;11:2349-55.
 17. Ruggiero JS. Health, work variables, and job satisfaction among nurses. *J Nurs Adm* 2005;35:254-63.
 18. Poursadeghiyan M, Moghimian M, Amjad RN, Baneshi MM, Yari AR, Noroozi M, *et al.* Effects on job stress on Iranian clinical nurses. *Ann Trop Med Publ Health* 2017;10:985-88.
 19. Haack M, Mullington JM. Sustained sleep restriction reduces emotional and physical well-being. *Pain* 2005;119:56-64.
 20. Pease EC, Raether KA. Shift working and well-being: A physiological and psychological analysis of shift workers. *UW L J Undergrad Res* 2003;5:1-5.
 21. Muecke S. Effects of rotating night shifts: Literature review. *J Adv Nurs* 2005;50:433-9.
 22. Saremi M, Fallah M. Subjective fatigue and medical errors among nurses in an educational hospital. *Iran Occup Health J* 2013;10:1-8.
 23. Poursadeghiyan M, Omid L, Hami M, Raei M, Biglari H, Epidemiology of fatal and non-fatal industrial accidents in Khorasan Razavi Province, Iran. *Int J Trop Med* 2016;11:170-4.
 24. Hänecke K, Tiedemann S, Nachreiner F, Grzech-Sukalo H. Accident risk as a function of hour at work and time of day as determined from accident data and exposure models for the German working population. *Scand J Work Environ Health* 1998;24 Suppl 3:43-8.
 25. Khandan M, Maghsoudipour M, Vosoughi Sh. Ranking of working shift groups in an Iranian petrochemical company using ELECTRE method based on safety climate assessment results. *Journal of the Chinese Institute of Industrial Engineers* 2011;28:537-42.
 26. Abbasi M, Zakerian A, Mehri A, Poursadeghiyan M, Dinarvand N, Akbarzadeh A, *et al.* Investigation into effects of work-related quality of life and some related factors on cognitive failures among nurses. *Int J Occup Saf Ergon* 2017;23:3:386-92.
 27. Punjabi NM, Bandeen-Roche K, Marx JJ, Neubauer DN, Smith PL, Schwartz AR, *et al.* The association between daytime sleepiness and sleep-disordered breathing in NREM and REM sleep. *Sleep* 2002;25:307-14.
 28. Drake CL, Roehrs T, Richardson G, Walsh JK, Roth T. Shift work sleep disorder: Prevalence and consequences beyond that of symptomatic day workers. *Sleep* 2004;27:1453-62.
 29. Chua EC, Tan WQ, Yeo SC, Lau P, Lee I, Mien IH, *et al.* Heart rate variability can be used to estimate sleepiness-related decrements in psychomotor vigilance during total sleep deprivation. *Sleep* 2012;35:325-34.
 30. Fischer FM, Teixeira LR, Borges FN, Goncalves MB, Ferreira RM. How nursing staff perceive the duration and quality of sleep and levels of alertness. *Cad Saude Publica* 2002;18:1261-9.
 31. Poursadeghiyan M, Omid L, Hami M, Raei M, Biglari H, Drowsiness and its relation with individual characteristics among night workers in a desert hospital in Iran. *Int J Trop Med* 2016;11:98-101.
 32. Farvareh E, Monazam MR, Abbasian M, Asghari M, Sadeghi A, Mohammadian F. Investigation the relationship between sleepiness and general health of shift workers in the automobile industry. *J North Khorasan Univ Med Sci* 2012;4:7-12.
 33. Wetterberg L. Melatonin in humans physiological and clinical studies. *J Neural Transm Suppl* 1978;(13):289-310.
 34. Kakooei H, Zamanian Ardakani Z, Karimian SM, Ayattollahi ST. Twenty four-hour circadian melatonin profile among women shift work nurses. *J Zanjan Univ Med Sci Health Serv* 2009;17:75-84.
 35. Sukanesh R, Vijayprasath S. Certain investigations on drowsiness alert system based on heart rate variability using labview. *Wseas Trans Inf Sci Appl* 2013;11:368-79.
 36. Akerstedt T, Wright KP Jr. Sleep loss and fatigue in shift work and shift work disorder. *Sleep Med Clin* 2009;4:257-71.
 37. Härmä MI, Hakola T, Akerstedt T, Laitinen JT. Age and adjustment to night work. *Occup Environ Med* 1994;51:568-73.
 38. Mani K, Fazelin N, Ismail S. Association of body mass index, sleep quantity, sleep quality and sleepiness among express bus driver. *Inj Prev* 2010;16 Suppl 1:A13-4.
 39. Karchani M, Mazloumi A, Saraji GN, Nahvi A, Sadeghniai Haghighi Kh, Makki Abadi B, *et al.* Relationship Between Subjective Sleepiness and Demographic Characteristics in Night Work Drivers. *Advances in Environmental Biology* 2015;9,3:1012-5.

Reproduced with permission of copyright owner. Further reproduction prohibited without permission.