Original Article

A survey of the relationship between work schedule and its effect on the fatigue of rescue personnel in Isfahan with a standard method of CIS202

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ABSTRACT

Context: Fatigue is a factor that can have negative effects on family life, social relationship and work. Work schedule is one of the affective factors on personnel's fatigue in different jobs. In this study, the work schedule and its effect on rescue personnel in Isfahan are explored. **Aims:** The purpose of this study was to investigate the relationship between work schedules and fatigue among rescue personnel. **Settings and Design:** This study is periodical and has been conducted on 72 employees of rescue personnel in Isfahan. **Materials and Methods:** Random sampling was done and the primary data that was collected through fatigue assessment questionnaire after being conducted as a pilot study on 10% of samples were collected to confirm the validity of this study. Finally, the data was given to SPSS11.5 software and were analyzed by descriptive statistics and linear digression. **Results:** The results showed that from the statistical point of view some parts of work schedules like work hours satisfaction, resting time and work order on total fatigue are effective in linear and inverse way but the item "predictibility of work conditions" does not have a meaningful relationship with total fatigue. Furthermore, the results showed that there is a meaningful and inverse relationship with work hours, resting time and work order with mental fatigue and also the work schedule has a meaningful, linear and inverse relation with mental fatigue and total fatigue. **Conclusions:** By increasing the satisfaction of working hours, increasing resting time and also with an increase of work order the total fatigue of rescue personnel will decrease.

Key words: Fatigue, rescue personnel, work schedule

INTRODUCTION

Fatigue is a self-detecting situation that a person experiences, a continuing feeling of exhaustion and a decline of potentiality in body and mental operations.[1] In most cases, the strain is causing the fatigue. Usually, strain leads to stress and if stress gets high or continues for a long time it can lead to irrevocable changes.[2] Fatigue can be detected by these symptoms; languor and exhaustion, decline in body's ability, droop, lack of energy, incapability, sleepiness, low understanding, insufficient concentration, incompetency feeling and decrease of motivation that in a healthy person will vanish by sleeping and resting.[3]

Fatigue has multidimensional structure and many reasons and the stable and lasting mental feelings of exhaustion

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lead to weakness and lack of energy that cause a decrease of operational potentials.[4] Since fatigue is a complicated phenomenon, finding a comprehensive and deterministic definition for it, is difficult. The existence of different reasons in relation to creation of fatigue and the difficulties for investigation of its amount and intensity are some reasons that make this sign indescribable.[5,6]

Individuals can show specific behaviors in fatigue and sleepiness that these symptoms are easily recognizable in appearance such as eye, head, and face.[7]

Fatigue Symptoms are different from person to person, which is generally divided into two categories: Physical signs and symptoms associated with functional impairment. Physical symptoms are include drowsiness, irritability, depression, dizziness, loss of appetite, digestive problems, susceptibility to disease and dysfunction related symptoms include slowed reaction (physical reaction speed and the speed of thought), defects in response to stimuli, deficits in reasoning, judgment, and inability to concentrate, increase memory errors, including amnesia, loss of consciousness, loss of motivation.[8]

Fatigue in different work conditions is different in. Dijeck in his study concludes that about 20% of the participants have expressed a kind of fatigue, and other studies have reported 7–45% prevalence of fatigue.[9]

In the US the problems related to fatigue that leads to decline of performance and causes accidents have cost 18 million a year. Annually more than 1500 deaths, 100,000 accidents, 76,000 injuries happen due to sleepiness resulted from fatigue in highways.[10] In general, the drivers' fatigue is the cause of 25% of the accidents as the main reason and 60% of road accidents leading to death or serious injuries.[7] Fatigue is a pretty rampant sign in an emergency ward.[11] In a study that Papp *et al*. conducted in five university health center in America, it was shown that lack of sleep and fatigue in resident doctors had significant effects on their personal lives, welfare, their relationship with their spouses and family and quitting personal and social activities and it also has affected their job functionality.[12] Sleep and fatigue management in work conditions have remained as a challenge.[13,14] One of the effective factors on fatigue is work schedule.[15] Work schedule can affect the employees or workers through sleepiness or adaptability mechanism.[16] Rhythm disorders and lack of sleep can lead to the decline of alertness, operational malfunction and worsen of mental condition of a person.[17]

In December 2011, The Joint Commission published a Sentinel Event Alert dealing with healthcare worker fatigue and patient safety. They acknowledge the research to date linking extended-duration worked shifts, fatigue, and impaired performance and safety. The Joint Commission has suggested several actions to help mitigate the risks of fatigue that result from extended work hours. In December 2011, The Joint Commission published a Sentinel Event Alert dealing with healthcare worker fatigue and patient safety. They acknowledge the research to date linking extended-duration worked shifts, fatigue, and impaired performance and safety. The Joint Commission has suggested several actions to help mitigate the risks of fatigue that result from extended work hours.[18]

The IOM has published papers on patient and personal safety as they relate to resident duty hours. In its 2008 report, Resident Duty Hours: Enhancing Sleep, Supervision, and Safety, the IOM cites prolonged wakefulness, shifts longer than 16 consecutive hours, the variability of shifts, and the volume and acuity of patient load as factors that increase the risk of harm to patients.[19]

Disruptions in circadian rhythm, fatigue, and sleep deprivation may affect the NNP's clinical performance during night and extend shifts, with specific impact on levels of alertness.[20]

Nursing research suggests that shift length impacts vigilance and safety.[21,22]

Conducted descriptive, self-report studies and found statistically significant increases in errors and near errors when staff nurses worked shifts 12.5 h or longer. Trinkoff *et al.* found a significant relationship between nurse work schedules and patient mortality.[23]

Emergency personnel must have quickness, precision, alertness and a high focus so that they can do their duties well. One of the factors that may become a barrier in accomplished the personnel's mission is fatigue caused from non-standard schedule that result in the lack of focus, lack of alertness, increase in the possibility of error and consequently endangering injured people and emergency personnel. The effective factors and their impact should be assessed for finding an appropriate plan for this problem.

MATERIALS AND METHODS

This study is a cross-sectional study and was conducted in 1390 on rescue base personnel of Isfahan. 72 subjects participated in this study (confidence interval 95%, power of test 80%, estimated error 0.25, standard deviation 0.75). Samples were randomly taken. The variables included age, marital status, education, satisfaction of work hours, and predictability of duties, work order, rest, mental fatigue, physical activity, motivation and focus.

For the assessment of the relationship between work schedule and fatigue of the participants, we used work schedule questionnaires and fatigue questionnaires[24] that have been used in Ku and Smith study in 2006.

The questionnaire consisted of four main areas: 1 - Discipline, 2 - Satisfaction while working hours and working conditions, 3 - Recreation, 4 - predictability and It contains 23 questions. Fatigue questionnaire used in this study was CIS20R questionnaire, which was used in 57 studies.[25]

In order to check the validity of it, first the English version of the questionnaire was translated into Persian. Then comments of experts on communication, simplicity and intelligible were taken and to evaluate the reliability of them they were implemented in the final version. The translated questionnaires were distributed among 20% of samples (14 cases) and reliability of the questionnaire was assessed by Cronbach's alpha test of reliability in order to beat fatigue scale questionnaire schedule and they were 0.76 and 0.86, respectively. The questionnaire consisted of four main areas, including mental fatigue, concentration, motivation and physical activity, and 6-point Likert-scale questions were designed. Then the questionnaires were completed by the researcher and the participants. After completing the questionnaires, data was given to SPSS11.5 (SPSS Inc. Chicago.) software and were analyzed by descriptive statistics and linear regression analysis that was performed on the data, and the regression equations were obtained.

RESULTS

Results show that 25% of participants were single, and 75% were married. Education 26.4% of participant's diploma, 19.4% associate, 52.8% had a bachelor's degree. The age of participants ranged from 20 to 50 years, and the mean and standard deviation respectively 32.3 and 10.45 years, respectively.

After data collection, analysis and original questionnaire schedule, the mean and standard deviation of the scores of satisfaction with working hours is equivalent to 66.05 ± 27.1, predictability of schedule equal to 45.75 ± 8.5, rest of 50.10 ± 10.53 and working order of 60.05 ± 13.43 respectively.

The analysis of questionnaire fatigue in four main areas, the mean and standard deviation of scores for fatigue, mental equivalent of 49.4 ± 14.75, and focus is equivalent to 45.4 ± 10.7, motivation equivalent to 38.75 ± 12.75 and physical activity equivalent to 37.27 ± 13.11, respectively.

Then the relationship between the four main areas work schedule and the total score of fatigue was investigated. As shown in Table 1, regression equations and significance levels were obtained. The relationship between four main areas of fatigue and the final score of work schedule were determined [Table 2]. Next, the relationship between all domains of questionnaires was calculated based on simple linear regression [Table 3]. A simple linear regression analysis showed a significant relationship between work schedules and general fatigue ($P < 0.001$). And the estimated regression equation is equal to: (76.26–0.52 work schedules) [Figure 1].

Table 1: Relationship between main areas of fatigue questionnaire schedule and total fatigue scores

Main areas	R^2	P	Regression equation
Satisfaction during working hours	0.155	0.001	Total fatigue=64.71-0.86 satisfaction
Work discipline	0.07	0.025	Total fatigue=67.44-1.46 work discipline
Rest	0.083	0.014	Total fatigue=69.53-1.15 rest
The predictive capability		0.12	There is no significant relationship between predictability and total fatigue

Table 2: Relationship between key areas of fatigue questionnaire and final score of schedule

Main areas	R^2	P	Regression equation
Mental fatigue	0.232	0.001	Mental fatigue=41.06-0.39 schedule
Mental focus		0.13	There is no significant relationship
Motivation		0.12	There is no significant relationship
Physical activity		0.89	There is no significant relationship

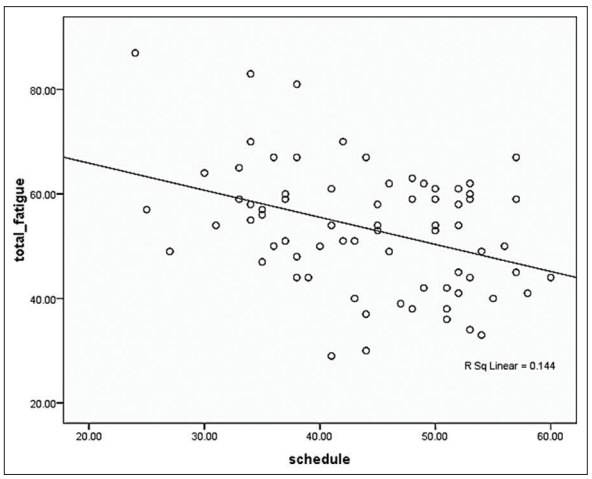

Figure 1: The relationship between the program of work and fatigue ($P = 0.001$)

DISCUSSION

The results of this study show that there is a significant and inverse relationship between the amount of satisfaction of work hours and fatigue and by increasing the satisfaction of work hours, the satisfaction also increases. There is also a significant and inverse relationship between the amount of rest and fatigue [Table 1] and based on the results in Table 3 there is a significant and inverse relationship between rest and mental fatigue. The results of a study by Ku and Smith on the staff of the locomotive which was carried out in 2010 showed that the work schedule, working hours and rest factors have the greatest impact on social welfare and fatigue.[24]

The results indicate that there is a significant and inverse relationship between mental fatigue and work schedule and work schedule and total fatigue, thereby by increasing the mental fatigue the total fatigue increase directly and positively. In a study that was conducted on nurses by Bonnet in 1989 their mental and physical fatigue was reported, and there was a significant relationship between workplace variables like shift hours and work hours.[25] Also, the results show that there is a significant and inverse relationship between work

Table 3: Relationship between key areas of the questionnaire fatigue and key areas questionnaire schedule

Main areas	R^2	*P*	Regression equation
Satisfaction during working hours and mental fatigue	0.209	0.001	Mental fatigue=31.6-0.596 satisfaction
Satisfaction during working hours and mental focus		0.19	There is no significant correlation
Satisfaction during working hours and motivation		0.08	There is no significant correlation
Satisfaction during working hours and physical activity		0.24	There is no significant correlation
The ability to predict and physical activity	0.096	0.008	Physical activity=2.78+0.54 predictability
The ability to predict and mental fatigue		0.27	There is no significant correlation
The ability to predict and focusing		0.98	There is no significant correlation
The ability to predict and motivation		0.51	There is no significant correlation
Work discipline and mental fatigue	0.102	0.006	Mental fatigue=33.90-1.05 work discipline
Work discipline and focus	0.236	0.046	Focus=17.04+0.35 work discipline
Work discipline and motivation		0.79	There is no significant correlation
Work discipline and physical activity		0.65	There is no significant correlation
Resting and mental fatigue	0.164	0.001	Mental fatigue=37.33-0.97 rest
Resting and concentrating		0.53	There is no significant correlation
Resting and motivation		0.10	There is no significant correlation
Resting and physical activity		0.31	There is no significant correlation

order and fatigue, that is, by increasing work order the total fatigue decreases.

There was no significant relationship between predictability and total fatigue [Table 1] predictability has only relationship with physical activity and does not have any relationships with the subsets of total fatigue. In a study conducted by Ku and Smith on locomotive personnel in 2010 they mentioned to the significance of predictability in work schedule, but they did not deal with the relationship between predictability and fatigue.[24]

In this study, there was a relationship between work order and focus, in a study conducted by Patterson and Yealy by using a fatigue questionnaire of CIS20R in 2010 the medical errors were related to the residents with fatigue, sleepiness and anxiety.[26] Also as the results of this study and a study conducted by Joffe MD, Mark D on emergency personnel's fatigue in the US, it was shown that the strategies for prevention of medical error can control and decrease fatigue and the managers of emergency ward must have policies and plans for controlling this fatigue.[11] A simple linear regression analysis showed a significant relationship between work schedules and general fatigue.[27-44]

CONCLUSIONS

Generally in investigation of work schedule and total fatigue despite the lack of significance and relationship, the statistical relation resulted from the questionnaires indicate a significant, linear and Meanwhile, in order to reduce the risk of fatigue-related errors among employees should also pay attention to the working hours and rest factors such as the stability of the schedule of work and good working schedules and strategies to reduce fatigue causes promoting of awareness of job satisfaction and will reduce human errors.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Barnett M. Oncology Nursing. 4th ed. St. Louis: Mosby Co.; 2001.
2. Habibi E, Pourabdian S, Rajabi H, Dehghan H, Maracy M. Development and validation of a visual fatigue questionnaire for video display terminal users. Health Syst Res 2011;7: 492-503.
3. Iop A, Manfredi AM, Bonura S. Fatigue in cancer patients receiving chemotherapy: An analysis of published studies. Ann Oncol 2004;15:712-20.
4. Adamsen L, Midtgaard J, Andersen C, Quist M, Moeller T, Roerth M. Transforming the nature of fatigue through exercise: Qualitative findings from a multidimensional exercise programme in cancer patients undergoing chemotherapy. Eur J Cancer Care (Engl) 2004;13:362-70.
5. Barnes EA, Bruera E. Fatigue in patients with advanced cancer: A review. Int J Gynecol Cancer 2002;12:424-8.
6. Schwartz AH. Validity of cancer-related fatigue instruments. Pharmacotherapy 2002; 22:1433-41.
7. Bergasa L, Nuevo J, Sotelo M, Barea R, Lopez E. Visual monitoring of driver inattention. Stud Comput Intell (SCI) 2008; 132:19-37.
8. Fatigue and Safety at the Workplace. Available from: http://work.alberta.ca/documents/WHS-PUB-ERG015-1.pdf [Last accessed on 2015 May 21].
9. van Dijk F, Swean G. Fatigue at work. Occup Environ Med 2000;60:20-3.

10. Rogers A. The effects of fatigue and sleepiness on nurse performance and patient safety and quality. An evidenced-based. Handbook for Nurses. Agency for Healthcare Research and Quality (US); 2008. p. 509-46.
11. Joffe M. Emergency department provider fatigue and shift concerns. Clin Pediatr Emerg Med 2006;7:248-54.
12. Papp KK, Stoller EP, Sage P, Aikens JE, Owens J, Avidan A, *et al*. The effects of sleep loss and fatigue on resident-physicians: A multi-institutional, mixed-method study. Acad Med 2004;79:394-406.
13. Muzet A, Nicolas A, Tassi P, Dewasmes G, Bonneau A. Implementation of napping in industry and the problem of sleep inertia. J Sleep Res 1995;4:67-9.
14. Sallinen M, Härmä M, Akerstedt T, Rosa R, Lillqvist O. Promoting alertness with a short nap during a night shift. J Sleep Res 1998;7:240-7.
15. Barker L. Measuring and modeling the effects of fatigue on performance: Specific application to the nursing profession, 2009.
16. Soroush A, Hamedi AS, Dabiran S. Assessment of sleep deprivation and fatigue among general surgery residents: Is it necessary toreduce residents' work hours. Hakim J 2009;7:35-41.
17. Costa G, Akerstedt T, Nachreiner F, Baltieri F, Carvalhais J, Folkard S, *et al*. Flexible working hours, health, and well-being in Europe: Some considerations from a SALTSA project. Chronobiol Int 2004;21:831-44.
18. Health care worker fatigue and patient safety. Sentinel Event Alert 2011:1-4.
19. Medicine IO. Resident Duty Hours: Enhancing Sleep, Supervision and Safety. Available from: https://www.iom.edu/Reports/2008/Resident-Duty-Hours-Enhancing-Sleep-Supervision-and-Safety.aspx [Last accessed details on 2015 May 21].
20. Lee SK, Lee DS, Andrews WL, Baboolal R, Pendray M, Stewart S, *et al*. Higher mortality rates among inborn infants admitted to neonatal intensive care units at night. J Pediatr 2003;143:592-7.
21. Scott LD, Rogers AE, Hwang WT, Zhang Y. Effects of critical care nurses' work hours on vigilance and patients' safety. Am J Crit Care 2006;15:30-7.
22. Rogers AE, Hwang WT, Scott LD, Aiken LH, Dinges DF. The working hours of hospital staff nurses and patient safety. Health Aff (Millwood) 2004;23:202-12.
23. Trinkoff AM, Johantgen M, Storr CL, Gurses AP, Liang Y, Han K. Nurses' work schedule characteristics, nurse staffing, and patient mortality. Nurs Res 2011;60:1-8.
24. Ku CH, Smith MJ. Organisational factors and scheduling in locomotive engineers and conductors: Effects on fatigue, health and social well-being. Appl Ergon 2010;41:62-71.
25. Bonnet MH. Effect of sleep disruption on sleep, performance, and mood. Sleep 1985;8:11-9.
26. Patterson PD, Yealy DM. Resident fatigue, distress, and medical errors. JAMA 2010;303:329.
27. Habibi E, Zare S, Keshavarzi M, Mousavi M, Yousefi HA. The application of the Layer of Protection Analysis (LOPA) in Sour Water Refinery Process. Int J Env Health Eng 2013;2:32-6.
28. Habibi E, Garbe G, Reasmanjeyan M, Hasanzadah E. Human error assessment and management in Isfahan oil refinery work station operators by Sherpa technique. Injury Prev 2012;18:229.
29. Habibi E, Zare M, Amini NR, Pourabdian S, Rismanchian M. Macroergonomic conditions and job satisfaction among employees of an industry. Int J Env Health Eng 2012;1:34.
30. Habibi E, Kazemi M, Dehghan H, Mahaki B, Hassanzadeh A. Hand grip and pinch strength: Effects of workload, hand dominance, age, and body mass index. Pak J Med Sci 2013;29:22-5.
31. Dehghan H, Habibi E, Khodarahmi B, Yousefi HA, Hasanzadeh A. The relationship between observational perceptual heat strain evaluation method and environmental/physiological indices in warm workplace.Pak J Med Sci 2013;29:35-8.
32. Habibi E, Hoseini M, Asaadi Z. The survey of student anthropometric dimensions Coordination with Settee and desks dimensions. Iran Occup Health 2009;6:51-61.
33. Habibi E, Dehghan H, Zeinodini M, Yousefi H, Hasanzadeh A. A Study on Work Ability Index and Physical Work Capacity on the Base of Fax Equation VO2 Max in Male Nursing Hospital Staff in Isfahan, Iran. Int J Prev Med 2012;3:776-82.
34. Habibi E, Pourabdian S, Atabaki AK, Hoseini M. Evaluation of work related psychosocial and ergonomics factors in relation to low back discomfort in emergency unit nurses. Int J Prev Med 2012;3:564-8.
35. Habibi E, Zare M, Haghi A, Habibi P, Hassanzadeh A. Assessment of physical risk factors among artisans using occupational repetitive actions and Nordic questionnaire. Int J Env Health Eng 2013;2:14.
36. Habibi E, Dehghan H, Eshraghy Dehkordy S, Maracy M. Evaluation of the effect of noise on the rate of errors and speed of work by the ergonomic test of two hand coordination. Int J Prev Med 2013;2:878-9.
37. Habibi E, Dehghan H, Safari S, Mahaki B, Hassanzadeh A. Effects of work-related stress on work ability index among refinery workers. J Edu Health Promot 2014;3:18.
38. Habibi E, Haghi A, Maracy MR. Investigating the predictive of risk-taking attitudes and behaviors among Iranian drivers. J Edu Health Promot 2014;3:19.
39. Habibi E, Dehghan H, Moghiseh M, Hasanzadeh A. Study of the relationship between the aerobic capacity (VO2 max) and the rating of perceived exertion based on the measurement of heart beat in the metal industries Esfahan. J Edu Health Promot 2014;3:55.
40. Dehghan, H., Habibi, E., Habibi, P., Maracy, M. Validation of a Questionnaire for Heat Strain Evaluation in Women Workers. Int J Prev Med 2013;4:631-40.
41. Habibi E, Soury S, HasanZadeh A. Precise Evaluation of Anthropometric 2D Software Processing of Hand in Comparison with Direct Method. J Med Sign Sens 2012;3:195-256-61.
42. Rajabi-Vardanjani H, Habibi E, Pourabdian S, Dehghan H, Maracy MR. Designing and Validation a Visual Fatigue Questionnaire for Video Display Terminals Operators. Int J Prev Med 2014;5:841-8.
43. Lotfizadeh M, Moazen B, Habibi E, Hassim N. Occupational stress among male employees of esfahan steel company, iran: Prevalence and associated factors. Int J Prev Med 2013;4:803-8.
44. Habibi E, Zare M, Haghi A, Habibi P, Hassanzadeh A. Assessment of physical risk factors among artisans using occupational repetitive actions and Nordic questionnaire. Int J Env Health Eng 2013;2:14.