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ORIGINAL ARTICLE

Occupational Risk Factors in Iranian Professional Drivers and their Impacts on Traffic Accidents

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ABSTRACT

In many countries road crashes are the main cause of fatal accidents related to job. The aim of our study was to characterize a population of Iranian professional drivers with regard to history of drivers' road crash incidents and some occupational factors. Using Swedish version of the Nordic Questionnaire information about musculoskeletal pain prevalence in last 12 months, demographic features, smoking habits, age, job experience, road crash, job consent, self-perceived job stress, working load and fatigue were obtained from 403 drivers. Ninety seven (25%) of the study population reported having one or more traffic accident during their driving job history. The association between self-report incident of road crash and driving duration, smoking, lack of exercise, fatigue, lack of health education and musculoskeletal complaints were statistically significant(p<0.05). Data analysis also revealed positive significant association between fatigue as dependent variable and driving duration, self perceived stress and lack of job consent as independent variables (p<0.01). The questionnaire data indicated that signs of fatigue in smoker drivers, old drivers (>50 years), high experienced drivers (>10 years), drivers without sport activities, night drivers, fat and over weighted drivers, old vehicle drivers (age of vehicle >10 years), bus and truck drivers were more than other groups of professional drivers but the differences were not significant. It can be said that occupational risk factors influence the safe operation of drivers. However, prevention strategies such as organizational changes for reducing work-related stress, recording and analysis of road incidents, national health and safety law for drivers are needed.

Keywords: *Professional Drivers, Road Accident, Occupational Fatigue, Iran*

INTRODUCTION

The profession of driving has been widely shown to be a challenging one in terms of occupational risks and health outcomes. Professional driving is a potentially high risk activity, involving hazards far higher than those encountered in any other profession or most other activities of ordinary life. Additionally, driver's activity creates high risk condition for other groups of road users [1, 2]. Professional drivers had a higher probability of encountering serious injuries and severe permanent disability as compared to other occupational categories [3]. Work-related road safety is one of the

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critical areas of concern for all nations [4]. Several factors such as the health status of individuals and human error play important role in the occurrence of accidents, but human factors apparently account for 65% of all U.K. road accidents [5]. Human error is affected by internal or external factors such as sickness, poor mental and physical conditions and other health problems [3].

In the researches of traffic accidents especially regarding bus drivers, there has been consideration of particular factors. Age and drivers experience appear to affect accident risk (negative association between the prevalence of driving accidents and driving employment experience, adjusted to some extent by age). What is of specific interest however, is accident causation as a direct or indirect outcome of the demands of the job. It has been reported that healthy drivers working under proper job situations rather than unusual extreme workload will be less prone to experience road accidents [6].

Act of operating a vehicle is highly vulnerable to fatigue and this occupation involves many of the skills that are affected by tiredness. Fatigue is defined as a combination of symptoms, comprising weakened performance, slower reaction times and subjective sensation of tiredness. Driver fatigue is a special prevalent reason of work-related road traffic crashes resulting in injury or fatality [4]. When a driver is exposed to a combination of personal, environmental and job-related agents, a noticeable level of fatigue may be experienced. Most of these agents cause fatigue by diminishing sleeping periods, expanding durations of wakefulness or interrupting the timing of rest and wakefulness. Fatigue is accounting for up to 20% of serious casualties on motorways and monotonous roads in Britain [4, 7]. In Australia almost 20–30% of fatal road accidents are believed to be happened by fatigue and in the USA the National Highway Traffic Safety Administration has estimated that fatigue was connected with an average of 56,000 vehicle crashes per year in the mid-1990s. The similar investigation concluded that fatigue was responsible for more than 1,500 fatalities on the road every year [2].

Driver fatigue is prevalent and imposes noticeable expense to nations. In spite of the adverse outcomes that fatigue has for health, safety and productivity cannot be omitted entirely, efficient management strategies can reduce the risk it poses [4]. According to literature, there is necessity for ameliorating workplace practices to decrease occupational risk factors and improve the work conditions of professional drivers. Policy makers need to cooperate with investigators, business unions, policy makers and drivers themselves, to devise initiatives that protect drivers against work-related harmful agents.

Work-related motor vehicle crashes in the US, Australia, and for European countries, are estimated to contribute at least 25% to over 33% of all work-related fatalities [2]. In Iran Traffic accident is the second cause of death after cardiovascular diseases. In Iran traffic accidents have resulted in 20,068 deaths and 297,257 injuries in 2011 [8]. It appears that road incidents are one of the most important reason of fatality in Iran.

The current study was arranged to investigate work-related situations of professional drivers in order to explore and highlight health aspects especially musculoskeletal conditions of professional drivers and their impacts on road accident.

MATERIAL AND METHODS

Subjects and design

This cross-sectional investigation was conducted among professional drivers working on a transportation company from June 2010 to August 2011. The subjects referred to a medical center to be checked and receive driving health certificate. A total of 500 full-time male drivers were randomly recruited to the study, without consideration of their health status. Since the number of female drivers was negligible, they were excluded from the study. Drivers with a background of traumatic road or work injures were also excluded from the survey. All the subjects were briefly coached regarding the data gathering questionnaire and asked to fill in a consent form to participate in the study. Finally, at the moment the questionnaire of every driver were checked by the investigators to verify that all the necessary information had been gathered. The population was relatively collaborative, and 403 completed questionnaires recognized qualified for analyzing process. The drivers that had not cooperated to given complete information about their working status were also excluded from the study.

Questionnaire

A Swedish version of the Nordic Questionnaire, which includes items with dichotomized response alternatives regarding symptoms (ache, pain, or discomfort) originating from different regions of the musculoskeletal system, was used for assessment of musculoskeletal symptoms within the last 12 months in the neck, shoulders, upper back, elbows, wrists/hands, lower back, hip, knees and ankles [9]. Moreover, the questionnaire comprised background information such as, age, height, weight, marital status, education level, smoking habits, exercise, and working information like job experience, type of vehicle, age of vehicle, continuous driving duration, total driving duration per 24 hours, night driving duration per 24 hours, total rest (sleep) per 24 hours, background road accident occurrence, falling asleep at the wheel, sense of sleep while driving (fatigue) and health education. Similarly job stress and job consent were assessed by two distinct questions that asked the drivers to assign a rank to their job stress and consent from 0 to 10. The data was

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Table 1. The Pearson chi-square test results regarding to history of drivers' traffic accident and some occupational factors

Factors	Had accident		Had no accident		Odds Ratio	*p*-value (95%)
	n	%	n	%		
Marital status:						
Single	20	36.4	35	63.6	1.9	0.15
married	74	23.1	246	76.9		
Working Experience:						
< 10 Years	50	26.3	140	73.7	1.1	0.38
>10 Years	47	24.5	145	75.5		
Age of vehicles:						
>10 Years old	20	29.9	47	70.1	1.3	0.2
<10 Years old	74	24	234	76		
Smoking habit:						
Smoker	30	36.1	53	63.9	1.9	0.02*
Not smoker	63	26.4	206	76.6		
Job Stress:						
High stress(6-10)	29	32.6	60	67.4	1.6	0.05*
Low stress(0-5)	62	23.1	206	76.9		
Job consent:						
Low consent(0-5)	69	29	169	71	1.7	0.02*
High Consent(6-10)	25	19.1	106	80.9		
Driving duration per 24hr (hr):						
>8 hr	66	26.2	186	73.8	1.2	0.26
<8 hr	31	22.6	106	77.4		
Total sleep per 24hrs (hr):						
< 6 hr	35	33.7	69	66.3	1.8	0.01*
> 6 hr	60	21.7	217	78.3		
Continues driving duration(hr):						
>2 hr	88	28.2	224	71.8	2.8	0.002*
<2 hr	9	12.2	65	87.8		
Exercise activity						
No	20	26.3	56	73.7	1.1	0.4
Yes	71	24.2	222	75.8		
Health and safety training:						
No	27	27.6	71	72.4	1.2	0.3
Yes	68	24.2	213	75.8		
Sense of sleep in driving(fatigue):						
Yes	73	29.6	174	70.4	2	0.005*
No	24	17.4	114	82.6		
Falling asleep at the wheel(fatigue):						
Yes	48	43.2	63	56.8	3.5	<0.001*
No	49	17.8	226	82.2		
Eating nods:						
Yes	66	27.7	172	72.3	1.6	0.05*
No	26	19	111	81		

collected by two safety and health experts and essential instructions were directions to the subjects.

Statistical analysis

All the subjects were divided into two or three subgroups according to the variable in question and the analytical analysis. For the musculoskeletal symptoms a non-symptom group and a symptom group were taking into account. The Fisher's Exact and Pearson chi-square tests were utilized in statistical analysis and the relationships were described by the odds ratio (OR) with 95% confidence interval for dual status variables. Significance refers to the 95% confidence interval; and SPSS 17 was used for the statistical estimations.

RESULTS

The study group comprised 403 professional drivers. All participants were male, with a mean age of 38.6 ± 16.5 years, weight of 74.4 ± 13.7 kg, and BMI 24.5 ± 3.9Kg/m^2. Among them, 97 drivers (25%) reported having one or more traffic accident in their history of driving activity so far.

Data on the traffic accident history of drivers with their smoking habits are presented in Table 1. Data

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Table 2. The results of Pearson chi-square test showing association between musculoskeletal complaints and previous road accident

Feel pain in	Had accident		Had no accident		Odds Ratio	*p*-value (95%)
	n	%	n	%		
Neck:						
Yes	29	34.5	55	65.5	1.9	0.02*
No	68	22.2	238	77.8		
Shoulders:						
Yes	20	30.8	45	69.2	1.4	0.15
No	77	23.7	248	76.3		
Upper back:						
Yes	23	39.7	35	60.3	2.3	0.005*
No	74	22.3	258	77.7		
Elbows:						
Yes	11	42.3	15	57.7	2.4	0.03*
No	86	23.6	278	76.4		
Lower back:						
Yes	31	30.7	70	69.3	1.5	0.08
No	66	22.8	223	77.2		
Wrists/hands:						
Yes	9	24.3	28	75.7	1	0.56
No	88	24.9	265	75.1		
Hip:						
Yes	18	33.3	36	66.7	1.6	0.09
No	79	23.5	257	76.5		
Knees:						
Yes	33	33	67	67	1.7	0.08
No	64	21.2	225	77.9		
Ankles:						
Yes	25	36.8	43	63.2	2	0.01*
No	72	22.4	250	77.6		

analysis showed that smokers to compare with those who never smoked, were more involved in traffic accidents (p<0.05). In the crude analyses, continues continuous driving duration showed significant association with driving accidents of professional drivers (p<0.01) (Table 1). Comparison between drivers who had pause after every 2 or fewer hours of continuous driving and drivers who had been driving more than 2 hours without any intervals showed that the latter group had higher possibility of accident.

The results of a comparison between drivers with and without previous involvement in road crashes regarding to PMSC are shown in Fig 1. Crude analysis of the 12 months PMSC stratified by having traffic accident (had accident, had no accident) in Table 2 revealed that drivers with musculoskeletal complaints specially in neck, upper back and ankles more frequently experienced traffic accidents (p<0.05).

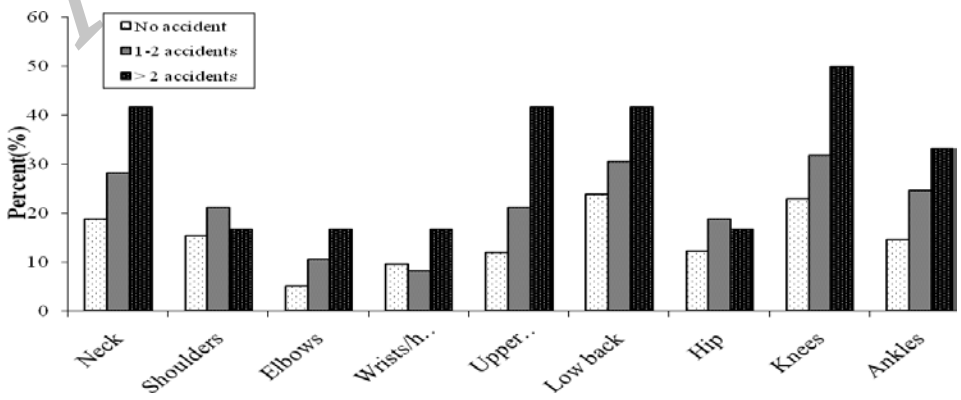

Fig 1. The prevalence of musculoskeletal complains among drivers with and without previous traffic accident experience

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Table 3. The Pearson chi-square test results regarding to history of drivers' traffic accident and some occupational factors

Factors	Had accident		Had no accident		*p*-value (95%)
	n	%	n	%	
Age of drivers:					
< 36 years old	48	24.9	145	75.1	
36-50 Years old	38	24.8	115	75.2	0.995
> 50 years old	11	25.6	32	74.4	
Sort of vehicle:					
Taxi	10	29.4	24	70.6	
Mini-bus	8	21.6	29	78.4	
Bus	7	18.9	30	81.1	0.7
Truck	72	25.9	206	74.1	
Education level:					
elementary	17	21.5	62	78.5	
guidance school	35	24.6	107	75.4	
high school	16	22.5	55	77.5	0.16
diploma	22	26.5	61	73.5	
AS and more	7	53.8	6	46.2	
BMI:					
< 20	13	24.5	40	75.5	
20.1-25	50	26.6	138	73.4	
25.1-30	27	22.3	94	77.7	0.7
> 30	4	17.4	19	82.6	

"Falling asleep at the wheel" and "Sense of sleep in driving" considered the most important outcomes of occupational fatigue regarding to professional drivers and probably there is close contribution between fatigue and road crashes. So stratified by "falling asleep at the wheel" and "Sense of sleep in driving" (yes, no), the crude estimates of accident occurrence were shown in Table 1. The data concerning drivers' signs of fatigue, indicated that there is high significant association between experiencing of road accident and drivers' fatigue (p<0.001).

Having analyzed the history of traffic accident, surprisingly no significant statistical association was detected between age and job experience of the subjects with drivers' chance of accident. Moreover the results confirmed the positive association between chance of road crashes and self-perceived job stress and lack of job consent (p<0.001).

The Pearson chi-square test showed that drivers without sport activities and health and safety training were more likely to be involved in traffic accidents but the result was not statistically significant (Table 1). The association of accident history of drivers and eating nods while driving, remained statistically significant (p<0.05) (Table 1). Compared with drivers who sleep 6 or more hours per 24hr, the crude odds ratio of accident occurrence for drivers who sleep fewer than 6 hours per 24hr was 1.8 (Table 1).

Crude estimates of the accident history of drivers stratified by total driving duration per day (≤8, and >8 hours) showed in table 1. It was shown that total driving duration has positive association with drivers' accident involvement history but the association was not statistically significant (Table 1).

Data analysis also revealed positive significant association between fatigue as dependent variable and driving duration, self perceived stress and lack of job consent as independent variables (p<0.01). The questionnaire data indicated that signs of fatigue in smoker drivers, old drivers (>50 years), high experienced drivers (>10 years), drivers without sport activities, night drivers, fat and over weighted drivers, old vehicle drivers (age of vehicle >10 years), bus and truck drivers were more than other groups of professional drivers but the differences were not statistically significant (result not shown). To compare with other drivers, taxi drivers showed higher chance of traffic accident but it was not statistically significant (Table 3).

DISCUSSION

The analysis of gathered information in this study revealed that symptoms from the musculoskeletal system were common among professional drivers studied. Based on the results it may be said that most often drivers suffer from the symptoms related with the lower back area, knee and neck that account for 25.2.18 %, 24.8 and 21% respectively, and it complies with the literature data [5]. Comparison of the results of this study with the results of the National Health Survey of Iran revealed that prevalence of musculoskeletal problems were higher in professional drivers to compare with general Iranian male population [10]. This indicates that professional driving should be considered as a high-risk occupation for developing musculoskeletal disorders.

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A professional driver is essentially restricted to the driver's cabin, which does not supply much space for flexing and motion of limbs. A static position exacerbates accumulated muscle tautness with little release. This is further deteriorated from prolonged hours behind the wheel. As previously recognized, back pain specifically is an often-reported stressor for drivers, though other regions of pain origin from the neck, shoulder and knee are also evident [6].

The task of professional drivers can be dangerous because of health harmful impacts of their occupational risk factors. A number of investigations have found associations between occupational stressors evident in the job, with the health of professional drivers and secure performance. This study conform further support to this statement. Fatigue for drivers is commonly apparent ''when an individual cannot fulfill self-imposed or externally imposed performance purposes but is compelled to continue working under adverse situations by a perception of duty and/or the necessity to safeguard the lives of others [6]. On the basis of the obtained information it was found that drivers' fatigue have explicit association with road accident experiences of drivers. The results approve the idea that occupational fatigue negatively impacts on safe performance of drivers. Such a deduction thus signifies that by reducing job fatigue will have knock on effects on road misadventure frequency, thus improving the well-being of drivers and bring about less road incident.

It may be said that neck problems may influence visual performance by deviating of driver visual direction that may resulted into a road crash. Upper back has a close relationship with hands, so its disorder may interfere with driver manual operation on critical conditions. Ankles are the nearest driver body part to vehicle pedals, so any discomforting condition of ankles influences the controlling duties of drivers especially in critical situations. The road transportation is a business where safety must be a priority and therefore the link between drivers' musculoskeletal disorders and traffic accidents should warrant attention. So from this particular analysis, past research has been confirmed.

The improper behavior of smoking was seen to be different from those drivers involved in road accident versus those drivers who didn't report any road accident. Smoking is often consider to relieving sensation of stress; however with the growing awareness that tobacco consumption is connected with a range of adverse health impacts such as cancer. Possibly smoking is not as widespread today as it was in the past. Therefore, drivers who might be under job tension may be looking towards other methods of getting over with job pressures.

In the current investigation, successive driving more than 2 hours were connected to a higher possibility of road accident among professional drivers. The observed association approve the earlier researches on other occupational groups often operating small vehicles. A British investigation discovered that car and light vehicle drivers with extremely high proportions of work related mileage tend to have an increases crash risk and drive while tired out(e.g. driving on long travels after an entirely day's work) [2]. Study undertaken in some EU member states showed that driver fatigue is an influential factor in nearly 20% of heavy commercial transport crashes. The results from various investigations revealed above 50% of long haul drivers have at some time fallen asleep at the wheel [11]. One of the most noticeable findings regarding the reasons of all fatigue-related incidents is that peak levels at night are often 10 times higher than daytime levels. "French research into lorry driver working times and habits showed that risk levels vary with three fundamental factors as concerns the overall problem of fatigue" [12-13]. There is an enlarged risk of crashes at night as consequences of greater the length of the working day, and also with irregular working hours. Driving time is just a part of the entire working time for commercial drivers, who have plenty of tasks than apart from driving. Most researches explain that it takes approximately 9 or 10 hours of driving, or 11 hours of work, before mishap risk begins to rise. Following 11 hours of work, the risk of being entangled in an accident increase twofold [2].

It is debatable to what extent bus operators have knowledge of and access to the investigation results. Awareness of such work might enable them to collaborate with investigators to develop interventions that are evidence-based rather than ad-hoc assays, and two special areas for consideration are recruitment and management policies [6].

Our findings showed that the utilization of safety and health instructions for drivers to improve their coping of occupational risk factors and enhancing the occupational aspects of the job for drivers (e.g. proper rest breaks, trying to establish regular shift patterns, employing two crews in a vehicle) can be beneficial in decreasing road crashes incidents. However, formal defensive driver training for professional drivers, instruct at the workplace, integrated in well-known companies with motivation and incentive systems for crash-free driving, has been found to diminish the crash rate by approximately 20% [2].

One of the less expected results of the present study was the lack of relationship between road crashes incidents and the age and working experience of the drivers. The most reasonable explanation for this fact is the so-called healthy worker phenomenon. It is known that drivers leave their job due to negative influences of road crashes and hostile job conditions [15]

Wellness prospectus are necessary for professional drivers, since they need to sustain a high level of physical fitness, manage and restrain their overall weight, select and adjust suitable driver seating, and more than ant thing else, take breaks away from driving at regular intervals, during which they do some

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moderate amount of exercises to break up the risk of road crashes. A successful workplace ergonomics program can meaningfully decrease the number and sorts of musculoskeletal problems [16].

Generally speaking, there has been minor attention to addressing the risks from work-related road traffic crashes in national health and safety law. One of the outcomes of allowing road traffic law to take priority over health and safety at work legislation has been that, other than for large vehicles, there has been slight incentive for employers or enforcing authorities, to inspect whether a failure in health and safety management systems might have contributed to an incident [2].

A system for collecting, recording and analysis of data about road incidents and injury crashes is essential as well as information about driver and vehicle history. In several countries, health and safety legislation necessitates employers to conduct risk assessments for work-related road utilization and national instruction is supplied to assist organizations in this mission.

CONCLUSION

Our findings are mostly similar to those reported from other countries. The lifestyle of professional drivers at work is inevitably linked to their well- being. A predisposition to ill health as a result of the work condition is clear from the results presented in this paper. According to the results obtained from this study it can be said that occupational health factors influence the safe operation of drivers. On the other hand there is a close relationship between job fatigue and road crashes incidents. These associations should be further confirmed in prospective studies. What the study investigated indicated that a necessity for improving workplace conditions to reduce job stressors and ameliorate the work environment of professional drivers. However, even at the present stage, prevention strategies such as the transition to comfortable seats, encouragement of sports activities, and organizational changes for reducing work-related stress, recording and analysis of information about road incidents and injury crashes, national health and safety legislation for drivers are essential.

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