

Risk Factors of Musculoskeletal Disorders in Bus and Truck Drivers

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Abstract

Background: Heavy vehicle drivers are at risk of musculoskeletal disorders due to risk factors that are present in their job. The aim of this study was to investigate the prevalence and risk factors of musculoskeletal disorders in bus and truck drivers. **Methods:** This cross-sectional study was carried out on 275 bus and 272 truck drivers using random sampling method. Nordic Musculoskeletal Questionnaire (NMQ) was used to assess the prevalence of musculoskeletal disorders. All analysis was performed by R software. **Results:** The mean age of bus and truck drivers was 42.74 and 39.76 years, respectively. In total, 26.9% of bus drivers and 31.6% of truck drivers reported pain in one of their nine body parts at least once during the previous year. The waist and knee with a prevalence of over 17% had the highest frequency. The results showed high frequency of exposure to vibration and smoking in the both groups. About 61% of drivers in both groups reported lack of job satisfaction. **Conclusion:** The prevalence of musculoskeletal disorders, especially low back pain in drivers was high. It seems that the development of an appropriate program for improving occupational health in drivers especially ergonomic interventions is necessary.

Keywords: Musculoskeletal Diseases; Occupational Health; Human Engineering; Automobile Driving

Introduction

Work-related musculoskeletal disorders (WMSDs) are one of the most important groups of factors in the loss of working time and increase in the direct and indirect costs in industries. WMSDs are also one of the most important occupational health problems in industrialized countries, and an important issue in occupational ergonomics.¹ The National Institute of Occupational Safety and Health (NIOSH) has

categorized musculoskeletal disorders as the second most important workplace issue based on their prevalence.² The issue of controlling and preventing these disorders has become extremely important and has attracted the attention of many researchers and research institutes across the globe. The World Health Organization has proclaimed 2000-2010 as the decade of prevention of musculoskeletal disorders, and the UK health and safety administration has recognized

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WMSDs as one of its priorities in improving occupational health.³ The most common symptom associated with WMSDs is pain. In some cases, the joint may be stiff and dry, and the muscles are stiffened. Musculoskeletal disorders a multifactorial phenomenon and the prevalence and severity of these disorders are age and sex dependent. However, occupational and work environment features such as applying force, awkward postures, duration of work, sound and vibration co-exposure, cold and heat stresses, psychosocial factors and genetic factors are also other modifying factors.⁴

Design of an interventional program based on genetic and demographic factors for prevention of musculoskeletal disorders is not feasible.⁵ Therefore, workplace assessment and implementation of controls based on workplace characteristics is more desired. Drivers are faced with several risk factors which result in high prevalence of WMSDs due to the unfavorable working conditions. In particular, drivers of heavy vehicles are in a constant posture for a long time, facing vibration, sound, etc. During the last 50 years, the health of this group of workers has attracted a lot of attention and many empirical studies have been carried out on them.⁶ Previous studies focused on the relationship between driving and prevalence of symptoms in the back, lumbar disc degeneration.⁷

Despite large number of studies carried out on this group of workers, there is no consensus on the prevalence of WMSDs in them. The aim of this study was to determine the prevalence of musculoskeletal disorders and determine the possible risk factors affecting its prevalence in bus and heavy vehicle drivers in Iran.

Methods

This study was a cross-sectional study conducted in 2015 and 2016 at Isfahan intercity passenger terminals, as well as cargo locations. The study was conducted according to the codes of ethics and its design and implementation process approved by university ethics committee (Registration code: IR.IUMS.REC

1395.9411139005) The study population included two groups of bus drivers and heavy vehicle drivers (truck). The inclusion criteria were a) being an intercity bus driver or truck driver, b) at least three years of work experience, and c) driving regularly. Exclusion criteria included a) having a second job, and b) having a history of specific diseases and trauma (motor disabilities and hereditary musculoskeletal pain). An informed consent was given to drivers and they were asked to sign the forms. The sample size was 540, assuming $\alpha=0.05$ and $\beta=0.08$ according to the literature search. The sampling method was simple random sampling from two groups of bus drivers and heavy vehicle drivers (truck). In total, 275 bus drivers and 272 truck drivers were investigated.

In this research, after selecting the samples, driver data was collected by Nordic Musculoskeletal Questionnaire (NMQ). NMQ is a standardized research tool developed by Kuorinka et al. in 1987 and widely used in Denmark, Finland, Norway, Sweden, and in various projects across the globe.^{8,9} It has also been validated and used in studies in Iran.³

The questionnaire used in this study consists of two parts. The first part was related to information regarding age, weight, height, specific disease history, left or right hand history, exercise history and physical activity, job satisfaction, vibration exposure estimation, smoking, and work experience. The second part of the questionnaire was completed for assessing musculoskeletal disorders of drivers. In this section, questions were asked to evaluate motor disorders in different parts of the body for the past 12 months and previous week. Data collection was performed in two ways; a) through interviewing drivers and b) completion of the questionnaires by drivers. All data analyses were performed by R software.

Results

All participants in this study were males. Table 1 shows descriptive statistics about age, height, weight, body mass index and work experience of bus and truck drivers. About 65.1% of all participants were

bus drivers and the rest of them were truck drivers. In addition, 84.7% of the bus drivers and 88.6% of truck drivers were right-handed. About 65.5% of bus drivers and 64% of truck drivers stated that they have regular physical activity. Table 2 shows the prevalence of smoking in bus and truck drivers.

It was also found that 62.6% of bus drivers and 61% of truck drivers have no satisfaction about their job. In addition, 11.3% of bus drivers and 10.7% of truck drivers stated that they were somewhat satisfied with their work and eventually 25.1% of bus drivers and 28.3% of truck drivers were satisfied with their job.

Table 3 shows the exposure to vibration in bus and truck drivers. According to the statistical analysis and the results of the Mann-Whitney test, it was found that there was a significant difference between the two groups of bus and truck drivers in terms of exposure to vibration ($p < 0.001$). The results of NMQ indicated that 26.9% of bus drivers and 31.6% of truck drivers suffered from musculoskeletal disorders during the past year and had experienced pain in one of their limbs at least once. Table 4 shows the prevalence of musculoskeletal disorders in the nine parts of the body during the past year and during last one week in two groups of bus and truck drivers.

The results of the Chi-square test for nine areas of the body showed that the prevalence of musculoskeletal disorders in the shoulders, back, waist, thighs, knees and legs in the past year was significantly different between bus drivers and truck drivers ($P < 0.001$). In addition, results of Spearman's correlation test showed that there was a significant relationship between the prevalence of musculoskeletal disorders and vibration exposure. We also found significant relationship between the prevalence of musculoskeletal disorders and smoking ($P < 0.05$).

Discussion

In the present study, the average body mass index of both groups of drivers was slightly higher than 25, which could be alarming and can be considered as a warning for future overweight. Although more than

60% of both groups stated that they had physical activity. Their relatively good body mass index (BMI) and high prevalence of physical activity can prevent occurrence of musculoskeletal disorders in this group of workers. This study showed that despite the non-significant difference in mean age and work experiences between two groups, the rate of musculoskeletal disorders was different. Bus drivers with work experience ranging from 15 to 30 years and truck drivers with work experience under 15-year had the highest prevalence of musculoskeletal disorders. The results of this study indicate that the most prevalent musculoskeletal disorders during the past year were in the neck and waist for bus drivers and in the lower back, knee and shoulder areas for truck drivers. In fact, the prevalence of musculoskeletal disorders in both groups was alarming. Regarding these discomforts during the previous week, it was also noticeable that drivers in both groups stated that they experienced most problems in the waist and knee. In some studies, it has been demonstrated that there is a relationship between driving occupation and disorders of the lower back, neck and upper extremities.¹⁰⁻¹²

Table 1. Demographic characteristics of bus drivers (n=275) and heavy vehicle drivers (n=272)

Demographic Characteristics	Bus drivers Mean (SD)	Truck drivers Mean (SD)
Age (year)	42.74 (9.54)	39.76 (10.79)
Height (cm)	170.71 (8.79)	172.86 (7.31)
Weight (kg)	74.48 (11.58)	76.26 (13.21)
BMI (kg/m ²)	25.56 (3.51)	25.52 (4.13)
Work experience (years)	15.94 (8.99)	14.77 (10.39)

Table 2. Distribution of smoking and exposure to vibration bus drivers (n=275) and heavy vehicle drivers (n=272)

Factor	Truck drivers n(%)	Bus drivers n(%)
Smoking status		
Non-smoker	96(34.90)	159(58.50)
Less than one per day	76(27.60)	52(19.00)
One per day	88(32.00)	54(19.90)
More than one per day	15(5.50)	7(2.60)
Vibration exposure		
Low	7(2.50)	24(8.90)
Moderate	84(30.50)	87(32.00)
High	179(65.10)	76(27.90)
Very high	4(1.50)	5(1.80)
Severe	1(0.40)	80(29.40)

Table 3. The prevalence of musculoskeletal disorders in different areas of the body in the past year and past one week in the participants

Body organs	Bus drivers		Truck drivers	
	In past year n(%)	In past month n(%)	In past year n(%)	In past month n(%)
Neck	26.90(74)	3.30(9)	25.40(69)	8.50(23)
Shoulder	19.30(53)	3.60(10)	29.80(81)	6.60(18)
Elbow	5.80(16)	1.10(3)	8.10(22)	2.10(8)
Hand/wrist	5.80(16)	1.10(3)	8.10(22)	2.10(8)
Back	15.50(51)	3.60(10)	9.90(27)	1.10(3)
Waist	23.30(64)	16.70(46)	36.00(98)	15.40(42)
Hip/hips	2.50(7)	0.70(2)	8.80(24)	2.60(7)
Knee	17.50(48)	4.00(11)	31.60(86)	10.70(29)
Leg and ankle	8.00(22)	2.50(7)	14.30(39)	3.70(10)

In most studies on professional drivers, it seems that the problem of back pain and upper limb disorders are the most common types of musculoskeletal disorders. A study on relationship between musculoskeletal disorders and occupational stress among truck drivers in Iran showed that 88.5% of individuals during the course of one year had musculoskeletal pain related to their job in at least one of their organs. Also, pain in the lower back and neck were the most common complains.¹⁰ In other studies in European countries, the incidence of back pain has been reported among over 60% of drivers.^{13, 14}

The results of a study on taxi drivers in Japan showed that 45.8% of the subjects had back pain.¹⁵ A study on truck drivers reported that the incidence of back pain in one month was 53%.¹¹ Studies have also shown that musculoskeletal disorders in drivers are more prevalent than other occupations,¹⁶ and the most frequent of these discomforts was low back pain.¹⁷ The findings of the above study are in accordance with the results of our study, suggesting that musculoskeletal disorders, particularly low back pain, are serious problems in most developed and developing countries. In another important study on 300 taxi drivers, it was found that the highest rate of incidence of complains in lumbar region in the last 12 months.¹⁸ A review study showed that driving occupations requires activities that are common risk factors of musculoskeletal disorders.¹⁹ We also

found statistically significant difference between the prevalence of shoulder, back, knee and leg disorders in the group of bus and truck drivers. The situation was worse for bus drivers only in the back, while regarding the truck drivers, it was much worse in the shoulders, waist, thighs, knees and legs. Some probable causes may include the fact that regular bus drivers have a more regular resting-cycle, and most of the buses are modernized and have more appropriate chassis and seats, while many trucks have been used for several years, and the comfort of their cabin and seats are not acceptable. In this study, many truck drivers did not have a regular work-rest cycle in their daily working time. Another important problem identified in this study was knee discomfort. Driving occupation requires constant and repetitive movements of the legs and joints, and the contraction and extension of the knee muscles in order to exert pressure on the pedal. These regular movements in many cases cause pain and discomfort to the knees and cause discomfort and difficulty for drivers.

According to the previous studies, musculoskeletal disorders of the upper limb may be due to prolonged exposure to vibration and driving.²⁰ Studies have shown that there is a relationship between back pain, vibration levels and driving history.²¹ The results of study on Tehran Bus Company drivers showed that there is several ergonomic health hazards in bus drivers

routine jobs.²² A study in Sweden and the United States showed that 50% of the surveyed drivers reported low back pain and the most important risk factor for back and neck pain, was prolonged exposure to vibration, heavy lifting and frequent manual handling.²³ In this study, more than 59% of drivers in both groups stated that they had high exposure to vibration, which could be one of the main risk factors for musculoskeletal discomfort in drivers. A considerable point in this study is that there was a statistical significant difference between bus drivers and truck drivers in terms of vibration exposure.

Smoking rates in both groups were high, especially in bus drivers, of whom more than 65% were smokers. The high rates of smoking of drivers can be considered as one of the most important risk factors associated with musculoskeletal disorders, which is also considered in other studies. A study on the prevalence of musculoskeletal pain in intercity bus drivers showed that the highest prevalence of these pains has been observed in the waist and neck regions during the past 12 months. There was a significant relationship between smoking and age with pain in these areas in drivers.²⁴ We also found in our study that the low job satisfaction in the both groups of drivers. It indicates that the status of psychosocial factors can contribute to observed health effects.

Our study has several limitations. First of all, we used subjective self-report method to measure our outcome in the study. However, the NMQ used extensively in researches, but it suffers from several limitations. It is suggested that in future studies, use more accurate exposure and outcome assessment methods such as accelerometers and clinical examinations to accurately measure ergonomic risk factors and workload. Another most important limitation of our study is its cross sectional nature. Generally, with this design we cannot investigate cause effect hypothesis. Use of prospective design

can enhance our insight in to this exposure outcome relationship.

The results of this study showed that the prevalence of musculoskeletal disorders, especially back pain in bus and truck drivers is high. Ergonomic risk factors in combination with other risk factors such as overweight, smoking and exposure to vibration can be considered as a serious warning to the health of this group of workers. Working in such an un-ergonomic situation can lead to more serious complications and even disability in drivers. It seems that further efforts are necessary to control the risk factors such as vibration, smoking and overweight for improving the physical and mental health of drivers.

Conflict of interest

The authors declare no conflicts of interest.

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References

1. Bussi res AE, Taylor JA, Peterson C. Diagnostic imaging practice guidelines for musculoskeletal complaints in adults—an evidence-based approach—part 3: spinal disorders. *Journal of manipulative and physiological therapeutics*. 2008;31(1):33-88.
2. SolhiM, Khalili Z, Zakerian S, Eshraghian M. Prevalence of symptom of musculoskeletal disorders and predictors of proper posture among computer users based on stages of change model in computer users in central Headquarter, Tehran University of Medical Sciences. *Iran Occupational Health*. 2014;11(5):43-52. [Persian]
3. Molla Agha Babaei AH, Yazdi M, Barakat S. Prevalence of musculoskeletal disorders and its relationship with occupational stress among workers at a steel industry. *Iran Occupational Health*. 2016;13(3):63-72.[Persian]
4. Falaki S, Akbari H, Derakhshan M, Hannani M, Motalebi Kashani M. Prevalence and postural risk factors associated with musculoskeletal disorders among medical laboratory personnel in Kashan 2012. *Iran Occupational Health*. 2016;12(6):58-68.[Persian]
5. SaremiM, Fallah MR. Subjective fatigue and medical errors among nurses in an educational hospital. *Iran Occupational Health Journal*. 2013;10(4):1-8. [Persian]

6. Ezoddini Ardakani F, Haerian Ardakani A, AkhavanKarbas M, Tezerjani D. Assessment of musculoskeletal disorders prevalence among dentists. *Journal of Dental Medicine*. 2004;17(4):52-60. [Persian]
7. Yeung SS, Genaidy A, Deddens J, Sauter S. The relationship between protective and risk characteristics of acting and experienced workload, and musculoskeletal disorder cases among nurses. *Journal of safety research*. 2005;36(1):85-95.
8. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied ergonomics*. 1987;18(3):233-37.
9. Nasl-Saraji J, Zeraati H, Pouryaghub GR, Gheibi L. Musculoskeletal Disorders study in damming construction workers by Fox equation and measurement heart rate at work. *Iran Occupational Health Journal*. 2008;5(1):55-60. [Persian]
10. Khandan M, Sakhaei Z, Koohpaei AR. Survey of musculoskeletal disorders prevalence and its relationship with Occupational stress among Iranian truck drivers. *Iran Occupational Health Journal*. 2016;13(2):39-49. [Persian]
11. Miyamoto M, Shirai Y, Nakayama Y, Gembun Y, Kaneda K. An epidemiologic study of occupational low back pain in truck drivers. *Journal of Nippon Medical School*. 2000;67(3):186-90.
12. Rehn B, Bergdahl I, Ahlgren C, From C, Järvholm B, Lundström R, et al. Musculoskeletal symptoms among drivers of all-terrain vehicles. *Journal of sound and vibration*. 2002;253(1):21-9.
13. Porter JM, Gyi DE. The prevalence of musculoskeletal troubles among car drivers. *Occupational Medicine*. 2002;52(1):4-12.
14. Leinonen V, Kankaanpää M, Vanharanta H, Airaksinen O, Hänninen O. Back and neck extensor loading and back pain provocation in urban bus drivers with and without low back pain. *Pathophysiology*. 2005;12(4):249-55.
15. Funakoshi M, Tamura A, Taoda K, Tsujimura H, Nishiyama K. Risk factors for low back pain among taxi drivers in Japan. *Journal of Occupational Health*. 2003;45(6):235-47.
16. Sadri Gh. Risk factors of musculoskeletal disorders in bus drives. *Arch Iranian Med*. 2003;6(3):214-5.
17. Prado-Leon LR, Aceves-González C, Avila-Chaurand R. Occupational driving as a risk factor in low back pain: a case-control study in a Mexican population. *Work*. 2008;31(4):387-96.
18. Ziaei M, Izadpanah S, Sharafi K, Barzegar Shangol A, Izadi laybidi M. Prevalence and risk factors of musculoskeletal disorders in inside and outside-city taxi drivers Andisheh city, 2011. *Razi Journal of Medical Sciences*. 2014;21(118):41-50. [Persian]
19. Teschke K, Nicol A-M, Davies H, Ju S. Whole body vibrations and back disorders among motor vehicle drivers and heavy equipment operators: a review of the scientific evidence. 2008.
20. Rehn B, Nilsson T, Järvholm B. Neuromusculoskeletal disorders in the neck and upper extremities among drivers of all-terrain vehicles—a case series. *BMC musculoskeletal disorders*. 2004;5(1):1.
21. Gallais L, Griffin MJ. Lowback pain in car drivers: A review of studies published 1975 to 2005. *Journal of sound and vibration*. 2006;298(3):499-513.
22. Khavanin A, Mirzaee R, Safari M, Soleimanian A. Evaluation of whole Body Vibration in Bus Drivers of Tehran Bus Company in 2010. *Iranian Journal of Health and Environment*. 2012;5(2):253-62. [Persian]
23. Magnusson ML, Pope MH, Wilder DG, Areskoug B. Are occupational drivers at an increased risk for developing musculoskeletal disorders? *Spine*. 1996;21(6):710-7.
24. Arghami Sh, Kamali K, NasabAlhosseini M. A Survey on Musculoskeletal Pain in Suburban Bus Drivers. *Journal of Occupational Health Engineering*. 2015;2(2):72-81. [Persian]