Original Article

Prevalence of work-related musculoskeletal disorders (WRMSDs) and its association with modifiable risk factors in metropolitan bus transit drivers: A cross-sectional comparison

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Abstract

Background: Bus drivers are one of the top three occupations with the highest prevalence of work-related musculoskeletal disorders (WRMSDs). The present study aimed to determine the pattern and prevalence of WRMSD among metropolitan bus transit drivers, whose job profiles differ from traditional long-distance bus drivers, and to explore the effect of modifiable lifestyle-related risk factors. **Materials and Methods:** In this cross-sectional study, consenting 254 metropolitan transit bus drivers (with at least five years of job duration) and 73 age-matched indoor desk job workers (administration staff of the same department) as a comparison group enrolled. Sociodemographic and occupational profile were collected on a semi-closed questionnaire. A modified Nordic questionnaire was used to determine musculoskeletal problems. Anthropometric measurement and haematocrit estimation were performed with standard techniques. All statistical analyses including logistic regression were performed with SPSS 26.0. **Results:** The prevalence of WRMSDs among bus drivers was twice higher than administration staff (49.2% v/s 28.8%). Drivers experienced significantly higher pain for the lower back (36.6% v/s 11%), knee (29.5% v/s 15.1%), and hip (7.5% v/s 1.4%) in comparison with administration staff. Study reported age, tobacco usage, body mass index (BMI) and job profile of drivers (compared to administration staff) as significant predictors of WRMSDs. **Conclusion:** WRMSDs were significantly higher among metropolitan bus transit drivers in comparison with administrative staff. Furthermore, WRMSDs are strongly associated with tobacco use and BMI. These modifiable risk factors may be the targets for preventive strategies to reduce the burden of WRMSDs among bus drivers.

Keywords: Association study, drivers, lifestyle risk factors, Nordic questionnaire, tobacco smoking, work-related musculoskeletal disorders (WRMSDs)

Introduction

Musculoskeletal disorders consist of more than one-hundred-fifty different conditions that adversely affect the musculoskeletal system including but not limited to impairments in bones, joints, muscles and connective tissues all of which lead to temporary or chronic limitation in functioning.[1]

Work-related musculoskeletal disorders (WRMSDs) are conditions in which the work environment and performance of work contribute significantly to the condition and/or the condition is made worse or persists longer due to work

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conditions.[2] The predominant sites for WRMSD are the upper extremities, neck, back and lower extremities and have been shown to cause pain, discomfort and sometimes even disability and hospitalization.

WRMSDs are associated with considerable healthcare costs and economic loss to society.[3,4] A labour force survey conducted by UK Health and Safety Executive (HSE) during the year 2019 reported that musculoskeletal disorders account for 37% of all work-related illnesses and 29% of all work-absenteeism due to work-related ill health.[5]

Bus drivers are one of the top three occupations (other being emergency responders and nurses) with the highest prevalence of work-related musculoskeletal disorders as published by US Bureau of Labour Statistics during the year 2017. Previous studies have reported a high prevalence of WRMSD in bus drivers (80%),[6] truck drivers (81%)[7] and taxi drivers (71%)[8] with low back pain being one of the most commonly reported musculoskeletal disorder.[9-11] Other types of MSD such as shoulder and knee pain are also reported among the professional driving populations.[11-13] Studies have also shown that each of duration and frequency of work, job satisfaction, job stress, working for more than four days in a week and constrained posture and fatigue are significantly associated with WRMSDs in commercial drivers.[14]

Metropolitan bus transit drivers in Ahmedabad have to travel on an average of eight hours a day every day, on roads that range from well-engineered to completely broken tarmac, with many speed bumps. In a developing country like India, poor condition of roads is responsible for road shocks resulting in musculoskeletal discomfort, most commonly low back pain.[15] Furthermore, metropolitan bus transit drivers are predisposed to certain risk factors specific to their jobs such as prolonged sitting and driving, tight running schedules, traffic congestion, the sedentary nature of the job, continuous feet and hand movement due to gear-clutch operation, and pollution (air and noise).

Interestingly, although most studies show significant associations between WRMSD among professional bus/truck drivers and work-related physical risk factors, the association with modifiable lifestyle-related risk factors is less clear. Moreover, we did not find any evidence of WRMSD among city transport bus drivers. Metropolitan bus transit system in Ahmedabad is a wide network of about 259 bus routes, which includes 3935 bus stops being managed by the enormous efforts of drivers, conductors, administration and support staff of the department. The drivers and staff working in this organized sector have fixed duty shifts of eight hours, transit within city limits and gets rest breaks during duty hours as well as off day each week. Therefore, it is our assumption that the pattern and prevalence of WRMSD and the risks involved are different in metropolitan bus transit drivers and our focus is on modifiable lifestyle-related risk factors. Since investigations into intracity metropolitan bus transit drivers with respect to modifiable risk factors are sparse in India, the current research is aimed to establish the prevalence and pattern of musculoskeletal disorders among metropolitan bus transit drivers and its association with modifiable risk factors.

Materials and Methods

Study design and study setting

The present cross-sectional study was conducted from June 2019 to March 2022 in Ahmedabad, a metropolitan city situated in the western part of India. However, due to the COVID-19 pandemic and restrictions, data collection was not possible between March 2020 and Sep 2021. Local transport buses governed by the municipal corporation, considering its decentralized network across the city, are one of the preferred modes of travel for day-to-day commute for habitants of the city.

Study population

Metropolitan bus transit drivers in Ahmedabad municipal corporation were the source population. Only drivers with at least five years of service were included in the study, whereas drivers with a bony skeletal abnormality or history of any kind of accidental injuries in the last 3 months or major operative procedures in the last three months were excluded from the study to avoid overestimation bias. All administrative staff with more than five years of experience in indoor desk jobs, age and sex matched with drivers were invited to participate in this study as a comparator group.

Sample size determination and subject enrolment plan

Considering the 39.4% prevalence of MSDs among heavy bus drivers along with unitary design effect, 5% confidence limit and 15% relative precision, a minimum required sample size $n = 254$ calculated with Open Epi Version 3.01 was found to adequate for the present cross-sectional study.[16] The study investigators visited the transit depot every morning to recruit the participants. From the entire line list of metropolitan bus transit drivers, the investigators recruited the participants fulfilling the inclusion and exclusion criteria, until the desired sample size was achieved. As a comparison group, all office staff ($n = 73$) engaged in administration work (white-collar job) at the office were invited to participate in the study.

Study tools and variables

A prestandardized semi-closed questionnaire was used to collect relevant sociodemographic, occupational and medical details of study participants, which incorporates age, marital status, education, income, current and previous job experience, job profile, tobacco usage (both forms, smoke and chewable), detailed medical history along with musculoskeletal discomfort, anthropometric details, etc. Based on verbal responses about tobacco smoke participants were categorized as current smokers, ex-smokers and nonsmokers. Similarly, based on tobacco chewing habits participants were categorized as current chewers, ex-chewers and nonchewers. Modified BG Prasad classification

updated as per the Consumer Price Index (CPI) Year 2019 was used to determine the socioeconomic class of study participants.[17] Both height and weight were measured with the accuracy of 0.1 cm and 0.1 kg, respectively, following standardized method of assessment. World Health Organization (WHO) Asian – Body Mass Index (BMI) classification – was followed to categorize subjects according to their BMI.[18]

With adequate aseptic precautions and standard technique, about 2 ml of venous blood samples was collected from participants. Blood samples were transferred to EDTA vials and stored at 2-8°C until laboratory analysis. After the initial run of tri-level internal quality control in an automated blood cell counter (Mindray-BC 5300), haemoglobin (Hb) levels of participants were estimated. According to WHO guidelines (adult men: normal Hb ≥13 gm/dL and <13 gm/dL as anaemia) participants were categorized as anaemic and normal person.[19]

Prevalence of musculoskeletal discomfort for specific locomotive regions of the body was determined through the Modified Nordic questionnaire.[20] After seeing a pictorial locomotive region of body parts, discomfort expressed by participants for the particular body part during past one year was considered an MSD episode. Furthermore, it was asked whether participant experienced same episode of MSD in past one week, and whether it prevented them from performing their normal work.

Data management and statistical analysis plan

For statistical analysis purpose, variables such as age, job tenure, income, BMI, and Hb were recorded as continuous (scale) variables, whereas variables such as tobacco habit, educational status, and locomotor region-specific MSDs were recorded as categorical variables. Statistical Package for Social Science version 26.0 was used for data analysis. The difference between frequencies of two groups was calculated with the Chi-square test. To perform binary logistic regression, variables for tobacco habit (smoking and chewing) were converted to binary form (ever tobacco smoke: Yes/No and ever tobacco chewer: Yes/No). A binary logistic regression was modelled with consideration of age, tobacco habit, job duration, job profile (bus driver v/s admin; admin staff as reference), BMI and Hb as independent predictors of MSDs among studied population. A value of $P < 0.05$ was considered a statistically significant difference for statistical analysis.

Ethical consideration

The study was approved by Institutional Ethical Committee of ICMR – National Institute of Occupational Health, Ahmedabad with document reference No. ICMR-NIOH/ethics/2018/Agenda 3.9 on 28-09-2018 and followed the Declaration of Helsinki (1975). Permission from the metropolitan bus transit department was received prior to the initiation of data collection. Informed written consent from each study participant was received prior to their enrolment into the study.

Results

A total of 254 metropolitan bus transit drivers and 73 administrative office staff participated in this study.

Sociodemographic characteristics of participants

All study participants were males. The mean age of drivers was 47.7 ± 6.4 years. Majority of the drivers were educated till secondary/higher secondary (63%), were married (97.6%) and belonged to upper middle class (52%). The average duration of their job was 205 ± 90 months, whereas the average duration of driving per day was eight hours. The mean age of metropolitan bus transit office staff was 48.4 ± 7.5 years, and majority (93.2%) were married. However, the proportion of highly educated i.e., graduate (16.4%) and postgraduate (8.2%) was significantly higher in office staffers. Significantly higher proportion of office staff belonged to upper class (76.7%). The average duration of their job was 204 ± 129 months, which was statistically similar to drivers [Table 1].

Lifestyle factors and medical characteristics of participants

Among driver groups, 48 (18.9%) were current smokers and 130 (51.2%) were current tobacco chewers whereas among office staffers, 9 (12.3%) and 26 (35.6%) were current smokers and chewers respectively. However, no statistically significant difference was found. Similarly, the observed differences in mean BMI and mean Hb% in driver and office staff group were not

Table 1: Basic sociodemographic details and job tenure of the participants

Variables	Bus driver (*n*=254)	Office staff (*n*=73)	Significance
Age in years, *n* (%)			
<35	15 (5.9%)	3 (4.1%)	*P*=0.71
35-44	32 (12.6%)	9 (12.3%)	
45-54	183 (72.0%)	51 (69.9%)	
≥55	24 (9.4%)	10 (13.7%)	
Education, *n* (%)			
Illiterate	4 (1.6%)	1 (1.4%)	*P*<0.001*
Primary	76 (29.9%)	12 (16.4%)	
Secondary/Higher	160 (63.0%)	42 (57.5%)	
Graduate	13 (5.1%)	12 (16.4%)	
Post-graduate	1 (0.4%)	6 (8.2%)	
Marital status, *n* (%)			
Unmarried	4 (1.6%)	5 (6.8%)	*P*=0.40
Married	248 (97.6%)	68 (93.2%)	
Divorce/separated	2 (0.8%)	0 (0.0%)	
Socioeconomic classification, *n* (%)			
Upper	103 (40.6%)	56 (76.7%)	*P*<0.001*
Upper middle	132 (52.0%)	8 (11.0%)	
Middle	17 (6.7%)	8 (11.0%)	
Lower middle	2 (0.8%)	1 (1.4%)	
Job tenure in months, mean (SD)			
Duration of job	205 (90)	204 (129)	*P*=0.94

found to be statistically significant. Moreover, it is worth noting that 29.1% among drivers and 38.4% among office staff were anaemic [Table 2].

Prevalence and pattern of WRMSDs

Significantly higher proportion of drivers (49.2%) reported any musculoskeletal discomfort in at least one body region in the last twelve months as compared to office staff (28.8%). The prevalence of low back pain (36.6%), knee pain (29.5%) and hip pain (7.5%) among drivers was significantly higher than low back pain (11%), knee pain (15.1%) and hip pain (1.4%) reported in office staffers. Shoulder pain was reported higher (5.5%) among office staffers compared to bus drivers (2%) [Table 3].

Bivariate logistic regression analysis

Driver profile, age, job tenure, tobacco usage, BMI and Hb% were included in multivariable binary logistic regression model. The dependent variable was occurrence of any WRMSD in entire study population. The variance inflation factor (less than 2) was acceptable on testing multicollinearity between independent variables. The data in the model had good enough fit on testing with Hosmer–Lemeshow goodness of fit test. After adjusting for all variables in multivariate analysis, being driver (adjusted OR = 2.59, 95% CI = 1.44-4.64), age (adjusted OR = 1.95, 95% CI = 1.80-2.06), tobacco usage (adjusted OR = 1.83, 95% CI = 1.14-2.93) and BMI (adjusted OR = 1.05, 95% CI = 1.01-1.12) were found to be significantly associated with WRMSD [Table 4].

Table 2: Lifestyle and nutritional characteristics of the participants

Variables	Bus driver (*n*=254)	Office staff (*n*=73)	Significance
Smoking habit, *n* (%)			
Non smoker	187 (73.6%)	61 (83.6%)	*P*=0.21
Ex-smoker	19 (7.5%)	3 (4.1%)	
Current smoker	48 (18.9%)	9 (12.3%)	
Tobacco chewing, *n* (%)			
Non chewer	112 (44.1%)	40 (54.8%)	*P*=0.37
Ex-chewer	12 (4.7%)	7 (9.6%)	
Current chewer	130 (51.2%)	26 (35.6%)	
BMI (kg/m^2), *n* (%)			
Underweight	19 (7.5%)	3 (4.1%)	*P*=0.51
Normal	65 (25.6%)	19 (26.0%)	
Overweight	53 (20.9%)	21 (28.8%)	
Pre-obese	89 (35.0%)	21 (28.8%)	
Obese	28 (11.0%)	9 (12.3%)	
BMI, mean (SD)	24.8 (4.4)	25.0 (3.9)	
Anaemia, *n* (%)			
Normal	180 (70.9%)	45 (61.6%)	*P*=0.13
Anaemic	74 (29.1%)	28 (38.4%)	
Hb, mean (SD)	14.0 (1.5)	13.7 (1.4)	

Table 3: Prevalence of MSDs as per Modified Nordic scale among participants

Site of MSDs	Bus driver (*n*=254) *n*, (%)	Office staff (*n*=73) *n*, (%)	Significance
Neck	12 (4.7%)	0 (0.0%)	*P*=0.075
Shoulder	5 (2.0%)	4 (5.5%)	*P*=0.116
Elbow	5 (2.0%)	1 (1.4%)	*P*=0.737
Wrist and Hand	1 (0.4%)	0 (0.0%)	*P*=0.591
Upper back	16 (6.3%)	2 (2.7%)	*P*=0.382
Lower back	93 (36.6%)	8 (11.0%)	*P*<0.001*
Hip	19 (7.5%)	1 (1.4%)	*P*=0.039*
Knee	75 (29.5%)	11 (15.1%)	*P*=0.013*
Ankle	16 (6.3%)	2 (2.7%)	*P*=0.382
Any MSDs	125 (49.2%)	21 (28.8%)	*P*=0.001*

Table 4: Binary logistic regression analysis for risk factors of musculoskeletal disorders (MSDs) among study population

Variable	Crude OR (95% CI)	Adjusted OR (95% CI)	Significance
Job profile (driver)	2.55 (1.45-4.48)	2.59 (1.44-4.64)	0.001*
Age (years)	1.88 (1.88-2.12)	1.95 (1.80-2.06)	0.047*
Job tenure (months)	1.00 (0.99-1.00)	1.00 (0.99-1.01)	0.053
Tobacco usage (yes)	1.79 (1.15-2.79)	1.83 (1.14-2.93)	0.011*
BMI (kg/m^2)	1.05 (1.00-1.10)	1.05 (1.01-1.12)	0.043*
HB (%)	0.93 (0.81-1.07)	0.91 (0.78-1.06)	0.267

Discussion

This study aimed to estimate prevalence and pattern of work-related musculoskeletal disorder in metropolitan bus transit drivers and to explore association of WRMSDs with modifiable lifestyle-related risk factors. Administrative staff of metropolitan bus transit system were included as comparator group in this study. The age, marital status, job tenure, smoking habits, tobacco chewing, BMI and Hb% were comparable among drivers and office staff.

The results showed that prevalence of any musculoskeletal disorders among drivers was 49.2%. This was lower than the reported findings of 78.4% in Ghana,[21] 72.5% in the Nigeria,[22] 62.1% to 73.5% prevalence in India,[23,24] 60% in the UK[7] and 59% in Brazil,[25] but higher than 24.3% in Iran.[8] Furthermore, 36.6% prevalence rate of low back pain (the predominant musculoskeletal disorder in this study) is also lower than low back pain prevalence rate in previous studies conducted among truck or commercial bus drivers, that is 60% in the UK,[7] 60.4% in Malaysia,[26] 64.8%[27] and 73.5%[22] in Nigeria. It is however higher than 34.3% in the previous study among taxi drivers in Ghana.[28] These variations with previous studies could be due to the fact that all such previous studies were conducted among long distance commercial truck/bus drivers, but this study was conducted among city bus transport drivers whose shift work is mostly limited to eight hours per day with rest breaks in between. Furthermore, variation due to other differences in sample size, road conditions and population characteristics (ethnicity) cannot be excluded. However, it is worth noting that proportion of

musculo-skeletal complaints in knee and hip region was 2-4 times higher in driver group as compared to administrative staff group. This could be explained by continuous involvement of leg and feet muscles during frequent operation of clutch and brakes in heavy city traffic.

It has been stressed that WRMSD is complicated in nature, and therefore, in-depth exploration of causal relationships between WRMSD and risk factors is necessary.[11] Evidence from a systematic review on causal association between risk factors and WRMSDs in professional drivers demonstrated that physical and psychosocial risk factors have strong causal association with development of WRMSDs among professional drivers. However, it also reported inconclusive evidence of association between job tenure, age and BMI.[29] A study from Malaysia reported no significant association between age, BMI and smoking habit with MSDs among bus drivers.

In other relevant studies, experimental mouse model study has demonstrated that iron-deficiency triggers reduction in pain threshold and an increment in feeling of pain.[30] A population-based cohort study has demonstrated that iron supplementation reduces muscle fatigue in individuals with iron deficiency, although the mechanism is not fully explained.[31] A Turkish study done on 550 patients admitted to rehabilitation clinic reported iron-deficiency and iron-deficiency anaemia rates in large number in various musculoskeletal pain conditions.[32] However, in contrast to all such studies, this study does not report any significant association of anaemia with respect to musculoskeletal disorders. With this study, we try to plug the gap of knowledge regarding association of modifiable lifestyle factors and WRMSDs. It is evident from this study that modifiable risk factors such as tobacco usage and BMI were found to be significantly associated with WRMSD. A study *Abdelu et al.* (2014) has reported that lack of physical activity was associated with increased odds of WRMSDs among commercial minibus drivers.[21] Given this evidence, we strongly suggest that studies that explore the role of tobacco and BMI in WRMSDs among professional drivers should be conducted so that appropriate health promotion/intervention can be initiated to prevent occurrence of WRMSDs effectively.

The findings of this study are limited by cross-sectional nature of design where causality cannot be established, ergonomic design factors were not considered, and quantification of tobacco in terms of pack year could not be analysed. However, this study comprises relatively long duration of occupational exposure (more than five years), included socio-demographically matched comparator group and studied the adjusted effect of modifiable risk factors on musculo-skeletal disorders, all of which are not considered together in any single previous study.

Conclusion

The prevalence of WRMSDs among metropolitan bus transit drivers is high compared to administrative staff. Furthermore, WRMSDs is strongly associated with tobacco use and BMI. These modifiable risk factors may be the targets for preventive strategies to reduce the burden of WRMSDs among bus drivers. Current observations recommend the need for preventive as well prospective management of WRMSDs in transit drivers, in addition to modification of lifestyle factors, such as tobacco cessation program. In addition to emphasis on ergonomic design factors, future interventional studies should also explore the role of modifiable risk factors such as tobacco smoking and obesity.

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Conflicts of interest

There are no conflicts of interest.

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