



Original Research Article

Prevalence of musculoskeletal disorders among bus conductors in Nagpur city: An observational study

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ABSTRACT

Introduction: A wide range of inflammatory and degenerative conditions affecting muscles, tendons, joints, peripheral nerves, are categorized as “musculoskeletal disorders” (MSDs). Exposure to vibration and noises, the varying climatic conditions and the standing posture needs to be considered as a stress factor contributing to his/her health status. As conductors do constant work for 5 to 6 hours with 1-2 breaks in between while working they are constantly exposed to vibrational forces.

Aim: To assess the musculoskeletal problems in bus conductors of Nagpur city.

Objective: To assess the musculoskeletal problems in bus conductors in last one year (based on site of musculoskeletal problem using Nordic musculoskeletal questionnaire).

Materials and Methodology: It was an observational study conducted on 100 bus conductors between age group of 20-50 years working with Nagpur Mahanagar Parivahan Limited (NMPL-AAPLI BUS). Nordic musculoskeletal questionnaire was used to assess musculoskeletal pain at various regions of body.

Results and Conclusion: The most commonly affected area was knee joint (37%) followed by lower back (17%) and ankles/feet (11%).

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1. Introduction

Road safety has been a major concern globally with increasing number of vehicles and distance of travel per day. Of the many problems that have been addressed, disorders of the musculoskeletal system among drivers have become a growing public health problem worldwide.¹ Transport or transportation is the movement of people or goods from one place to another. The term is derived from the Latin words trans (across) and portare (to carry). In India multiple forms of public conveyance are available for passengers, among them buses play a significant role.² The safety of the general public both within the bus and on the road is given little priority. Musculoskeletal symptoms are very common condition worldwide. It affects people's activity performance in their everyday

life. Key risk factors for musculoskeletal symptoms are long working hours, employment duration and posture.³ A wide range of inflammatory and degenerative conditions affecting muscles, tendons, joints, peripheral nerves are categorized as “musculoskeletal disorders” (MSDs). The disorders that result from work related event are known as “work related musculoskeletal disorders” (WMSDs), where workers experience discomfort in one or multiple body parts, pain in joints, tingling and swelling.²

Work-related musculoskeletal disorders (WMSDs) are a common health problem and a major cause of disability. A range of workplace, individual, and psychosocial risk factors are associated with the development of WMSDs. Workplace risk factors include the physical demands imposed by performing the task, such as posture adopted, force applied, frequency and repetition of movement, task duration and vibration experienced.⁴ Urban bus transportation workers have been found to have high prevalence rates of musculoskeletal problems. Nagpur,

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India is a populated city with numerous public buses that constitute a major means of public transportation. Both physical and psychosocial risk factors affect WMSDs. There are many physical factors that may contribute to increased physical loading in the bus conductor's musculoskeletal system, resulting in discomfort and pain. The most commonly recognized physical factors are prolonged standing, whole-body vibration, strenuous work load and prolonged working time. In terms of individual factors, age, gender, the body mass index (BMI) as well as the general health status of the conductors are also important risk factors associated with WMSDs.²

The conductors work place, which includes the environmental condition within the bus, exposure to vibration and noises, the varying climatic conditions and the standing posture needs to be considered as a stress factor contributing to his/her health status. Job-related psychosocial factors have been receiving increasing attention as potential significant etiologic factors of Musculo-skeletal disorders.⁵ Body regions commonly involved are the leg, knee, shoulder and back areas

1.1. Need for study

The bus conductors carry on a number of tasks when they are on job i.e. selling tickets to passengers, conductors stand on the stairs of the bus and constantly screams out the precise route that the bus will cover. After conducting such hazardous tasks involving constant standing for hours, he most often gets into arguments with passengers on different issues, e.g. tendering exact fares and the slow speed of the bus. All this makes the conductors work extremely hectic and stressful.² The regular work schedule of these conductors is alarming i.e. 8-10 hours each day. They undertake 5-6 trips each day, where one trip means a to and fro journey i.e. starting at the depot, going to the final destination and returning to the depot. The conductors don't work at a fixed door, they alternate at both doors of the bus.² There are many studies available in international level on musculoskeletal problems faced by bus conductors but only few studies are available in India. Globally, protection of workers against work-related injuries and illnesses has over the years been an issue of great concern to employees, workers, governments, and the general public. This is because a safe working environment does not only promote the physical, mental and social well-being of workers, but also saves cost associated with medical bills, compensation, work interruption, loss of experienced personnel, and others resulting from accidents at the workplace⁶ In India, the working conditions of bus conductors are poor and stressful. However, this problem has not been investigated much. Where health services for bus conductors in respect to their working conditions is less, the monitoring of musculoskeletal problems either by health physicians/physiotherapist is low. Thus, the purpose of the

study is to find the prevalence of musculoskeletal problems among Nagpur city bus conductors.

1.2. Research question

What is the percentage of musculoskeletal problems among the Nagpur Mahanagar Parivahan Limited bus conductors?

2. Aim

To assess the musculoskeletal problems in bus conductors of Nagpur city.

3. Objective

To assess the musculoskeletal problems in bus conductors in last one year (based on site of musculoskeletal problem using Nordic musculoskeletal questionnaire).

Table 1: Age distribution

Age Group	N	%
20-30	46	46
31-40	42	42
41-50	12	12
Total	100	100

Table 2: Gender distribution

Gender	N	%
Male	79	79
Female	21	21
Total	100	100

Table 3: Significance of NPRS scale

	NPRS Scale	
	On Activity	On Rest
Mean	3.12	4.78
S.D.	1.70	1.89
t value	7.02	
p value	0.000	

Table 4: Trouble during the last 12 months (discomfort, pain, numbness)

Site	N (Yes)	%
Neck	4	4
Shoulder	5	5
Upper Back	3	3
Elbows	3	3
Wrist/Hand	5	5
Lower Back	17	17
Hip/Thigh	3	3
Knees	37	37
Ankle/Feet	11	11

Table 5: Discomfort(pain) at different times among conductors. (At work, at rest, during sleep at night).

	N (Yes)	%
At Work	39	39
At Rest	62	62
During Sleep AT Night	09	09

Table 6: Type of discomfort.

Symptom	N (Yes)	%
Pain	68	68
Tingling	19	19
Numbness	05	05

4. Materials and Methodology

The study was done to know ‘‘Prevalence of musculoskeletal disorders among bus conductors in Nagpur city — An Observational study Permission and approval to carry out the research work was obtained from the institutional ethical committee and the head of the institution. Procedure followed was as follows- Preparation of research proposal was done.60 subjects/bus conductors were selected who met the criteria. They were asked to fill up the inform consent form. Nordic musculoskeletal questionnaire was explained to each and every conductor. They were asked to fill the questionnaire. Filled Questionnaires were collected and data was analysed.

4.1. Study design

The study design was Observational study. The observations were documented by the responses obtained through the Nordic questionnaire.

4.2. Study setting

Nagpur Mahanagar Parivahan Limited (NMPL)

4.3. Target population

Bus conductors, who were present on the day of survey

4.4. Sample size

The sample size was 100 Bus conductors

4.5. Type of sampling

The type of sampling was Convenient sampling

4.6. Duration of study

The duration of study was 1 year

4.7. Sample size estimation: -100

The estimation of sample size is done on the basis of study done in urban bus conductors in Kolkata.

1. Confidence interval = 95% (α error = 5%)
2. Power of study = 80% (β error= 20%)
3. Prevalence was taken as 83.3%
4. $P = \% \text{ of knee pain} = 83.3\%$
5. $Q = 100 - P = 16.7\%$
6. L = allowable error or precision or variability i.e. ± 10
7. $N = 4PQ/L^2$
8. $= 4 * 83.3 * 16.7 / 10 * 10 = 56 \sim 60$

4.8. Sampling technique

1. Sampling frame will consist of all the bus conductors under NMPL
2. Random sample of 100 conductors will be selected by simple random sampling

5. Criteria

5.1. Inclusion criteria

1. Conductors who are willing to participate.
2. Those who are having more than 1 year of experience
3. Age 20 to 50 years
4. Both genders

5.2. Exclusion criteria

1. Recent trauma
2. Conductors who are not willing to participate.
3. Any neurological disorders

5.3. Equipment and material

1. Nordic musculoskeletal questionnaire
2. Writing board
3. Pen

6. Results

Inference:- Results obtained from this study shows that most conductors experience more pain in Knees(37%), Lower back (17%), Ankle/feet (11%), Wrist and Hands(5%), Shoulder (5%), Neck(4%), Upper back(3%), Elbow(3%). Table 4 shows that 32 conductors experienced no discomfort anywhere in the body. Out of 68 conductors who experienced discomfort, 37 experienced knee pain, out of which 2 experienced neck, shoulder, elbow, wrist, ankle/feet pain respectively, 3 experienced hip/thigh pain, 4 experienced low back pain.

Also, out of 4 who experienced neck pain, 1 experienced shoulder, elbow, low back pain respectively, 2 experienced wrist and knee respectively. And out of 5 who experienced

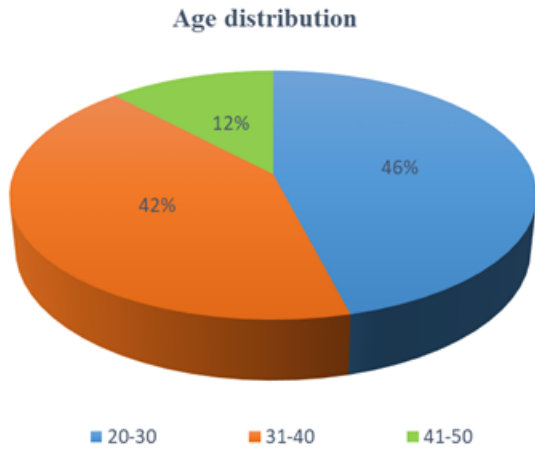


Fig. 1: Age distribution

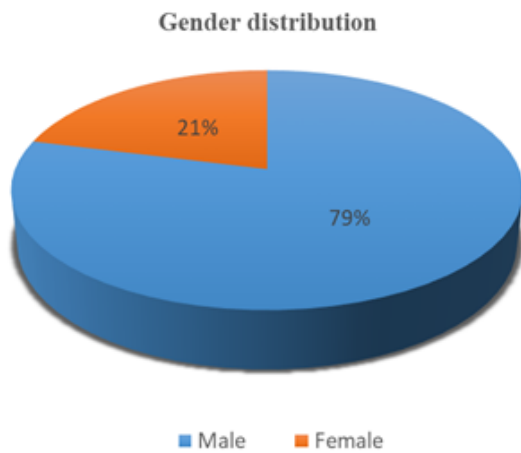


Fig. 2: Gender distribution

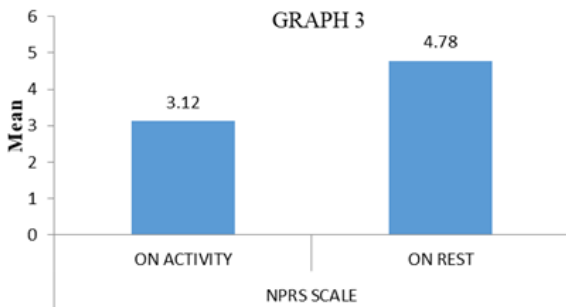


Fig. 3: Significance of NPRS Scale

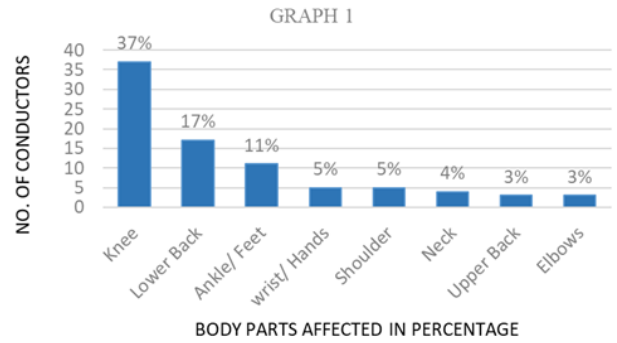


Fig. 4: Trouble during the last 12 months (discomfort, pain, numbness)

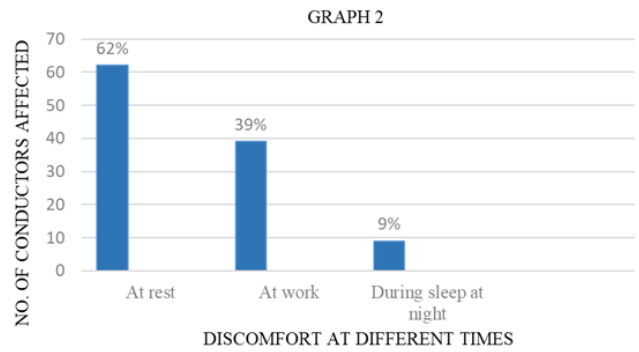


Fig. 5: Discomfort (pain) at different times among conductors.

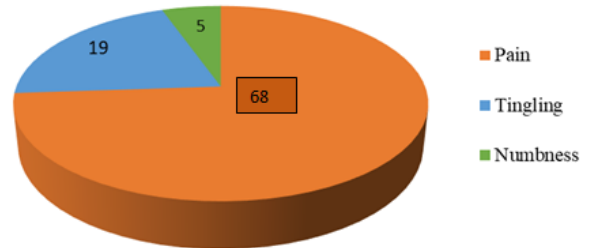


Fig. 6: Type of discomfort among conductors

shoulder pain, 1 experienced neck, elbow, and wrist pain respectively, 2 experienced knee pain. Out of 3 who experienced elbow pain, 1 experienced neck and shoulder pain respectively, 2 experienced knee pain. Out of 5 who experienced wrist/hand pain, 1 each experienced shoulder and low back pain respectively, 2 experienced neck and knee pain. Out of 17 who experienced low back pain, 1 each experienced neck, wrist, hip/thigh, ankle/feet pain respectively, 4 experienced knee pain. Graph 5 showed that, conductors experience pain while working, but as conductors are too engrossed during their working hours,

they experience less pain/discomfort when compared to conductors while they are at rest. Graph 5 also showed, conductors at rest experience more pain as they are more conscious/sensitive to pain/discomfort while they are at their leisure. Graph 3 showed, after assessment of pain using NPRS scale the mean significance of pain on activity is 3.12 and on rest is 4.78. Table 1 shows, out of 100 subjects, 46 subjects were at the age group of 20-30 years, 42 at the age group of 31-40 years and 12 subjects were at the age group of 41-50 years. Table 2 shows, that total 100 subjects participated in a study out of which 79 were male and 21 were female. Table 6 shows, that out of 100 subjects participated, 08 subjects experience no discomfort, 68 subjects experienced pain (68%), 19 experienced tingling (19%) and 05 experienced numbness (5%) at different parts of body.

7. Discussion

The bus conducting is a skill-oriented job, analyzed from the questionnaire. The bus conductors worked when there was a demand; more work provided them with the opportunity to earn more. This study examined the bus conductors' musculoskeletal discomfort in all body areas. It was evident that all conductors suffered from great discomfort in different body parts. This can be attributed to their prolonged working hours that involved repetitive work. When age factor examined for the areas of musculoskeletal pain or discomfort, it was found that the younger age group or those with few years of experience tended to show less prevalence rates than those who were older or had more experience; discomfort (pain) increased year by year.

The prevalence rates for these four major body areas in this study can be considered high or comparable to figures reported in previous studies from other countries. The high prevalence rates of musculoskeletal discomfort in the knee, back and wrist areas may be related to occupational factors contributing to undue stress on the various body parts. Findings of the present study are in line with the study named An Ergonomic Study on the Prevalence of Musculoskeletal Disorders Among Indian Bus Conductors done by *Somnath Gangopadhyay et al 2015*. They reported that regions that were affected included the knees (83.3%), ankles (83.3%), feet (83.3%), shoulders (80%), wrists (70%), hands (63.3%) and lower back (56.7%). Our results also showed that a large proportion of these complaints had been experienced for over one year, with many subjects experiencing prolonged discomfort for 5 years or more. However, most of those with discomfort were still able to continue with their work. Due to constant use of Electronic ticketing machine and maintaining abnormal posture while using ETM's it may contribute to discomfort in neck, shoulder, elbow, wrist and fingers.²

From analysis, the constant alternating motion of the conductors between the front and rear doors of bus,

for collecting fares, issuing tickets and monitoring the passengers of bus. The distance covered by the bus conductors is also very long, and it is multiplied many times during the several trips that they make each day and they get exposed to constant mechanical vibrational forces. The problem of mechanical vibration has often been reported as a major factor affecting professional transportation workers.⁷ This problem may also be prevalent in buses because of improper or poor engineering designs.

The discomfort or pain experienced in the knee may be due to constant standing position and exposure to vibrational forces which puts undue pressure and stress on joints more commonly in Tibio-femoral joint which results in mechanical damage to joint and results in structural change to joint. The results showed that, in addition to the knee region, the back and ankle & feet were also affected. Some of the discomfort or pain experienced in the leg region may possibly be referred pain caused by prolonged standing hours. It may have a local origin in the mechanical loading of these joints associated with sustained postures and repetitive movements.²

Twisting or torque, posture in standing, and muscle forces and stiffness generated to maintain posture, affect the ligaments, tendons and muscles of the back, and in addition, may alter the spinal load and risk of incurring an injury which may result in low back pain. Discomfort experienced in ankles or feet is due to constant standing position in running bus and also the forces on the ankle joint more commonly talocalcaneal joint may contribute to discomfort or pain.² Because of carrying heavy side bags (2-2.5 kgs) on their shoulder, the discomfort in shoulder seemed to be prominent. Thus, it is clear that they have strenuous jobs and musculoskeletal disorders

8. Conclusion

From this study it can be concluded that, the bus conductors work for long duration and their work load may result in the development of musculoskeletal disorders. This study provided a positive indication and reasons behind the onset of musculoskeletal disorders among bus conductors being constant standing, prolonged working hours and excessive job stress caused by performing multiple tasks at the time.

8.1. Clinical implications

This study shows ergonomics, stretching and strengthening exercises should be taught to the conductors. A standardized ergonomics approach would allow preventing or promoting the management of work-related musculoskeletal symptoms amongst bus conductors.

8.2. Limitations

Sample size was 100, so results could not be generalised. There are also other factors that have not been investigated,

such as psychosocial factors, a more comprehensive posture analysis and whole-body vibration. These factors may also have an impact on the workers' musculoskeletal health.

9. Source of funding

None.

10. Conflict of Interest

None.

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