



Research Article

Prevalence of Work-Related Upper Extremity Symptoms and Functional Impairment in Heavy Vehicle Drivers

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Abstract

Background: Heavy vehicle drivers are exposed to occupational hazards like prolonged static postures, poor ergonomics, repetitive upper limb uses. These factors contribute to a high prevalence of upper extremity musculoskeletal disorders. Such conditions can cause pain, dysfunction, and decreased work efficiency, especially with increasing age and prolonged driving hours, significantly impacting upper limb function and daily activities.

Objective: This study aimed to determine the prevalence of work-related upper extremity symptoms and assess their impact on functional impairment among heavy vehicle drivers using the DASH (Disabilities of the Arm, Shoulder, and Hand) questionnaire.

Methodology: A cross-sectional study was conducted among 51 heavy vehicle drivers aged 28–54 years in Greater Noida. Inclusion criteria included age (25–55 years), driving experience (5–15 years), and daily driving duration (6–7 hours). Drivers with recent injuries, surgeries, or irregular work schedules were excluded. Statistical analysis explored the relationship between age and upper extremity function.

Result: The mean age of participants was 39.37 ± 7.77 years, and the mean DASH score was 17.63 ± 7.55 , indicating mild to moderate upper extremity disability. A strong, statistically significant positive correlation ($r = 0.8675$, $p < 0.0001$) was found between age and DASH scores, suggesting that older drivers reported more significant upper extremity functional impairment.

Conclusion: The study revealed a high prevalence of upper extremity musculoskeletal symptoms among heavy vehicle drivers, with age being a significant factor in increasing functional impairment. Regular screening, ergonomic interventions, preventive strategies and promoting occupational health.

Keywords: Heavy vehicle drivers, Musculoskeletal disorders, Upper extremity symptoms, DASH questionnaire, Functional impairment, Occupational health

1. Introduction

Heavy vehicle driver leads unhealthy lifestyle because of numerous limitations, particularly in underdeveloped nations. Their health is severely harmed by several issues they deal with on the job, such as poor road condition, air pollution, inclement weather, poor posture, etc. Additionally, prolonged periods of sitting in a fixed position while driving result in increased physical stress [1]. When vehicle accelerates, decelerates, maneuvers, and steers through traffic, vibration is created communicated to driver's upper extremities [2]. Long period of sitting, bad posture, repeated motions like steering and shifting gears, and exposure to whole body vibrations from rough surfaces all increase the risk of these illnesses in professional drivers [3].

Repetitive to sustained static force application can cause or worsen upper extremity problems. When the components of the musculoskeletal system are unable to withstand with mechanical workload. Bone, ligament, and muscle injuries (e.g., strains, ruptures), degenerative changes, and undiscovered microfracture are among the anticipated results [4].

The aim of this study is to determine the prevalence of work-related upper extremity symptoms and their impact on functional impairment using the DASH (Disabilities of Arm Shoulder and Hand) questionnaire. The DASH questionnaire is one of the most popular patient-report outcomes used to assess shoulder (and upper limb) conditions [5].

2. Review of literature

Tahernejad et al. in 2024 explores the challenging working condition such as prolonged sitting, awkward postures, whole-body vibrations, and physically

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demanding tasks. The findings reveal that 61.75% of truck drivers suffer from MSDs, with the most affected areas being the shoulders (31.5%), neck (25.79%), and lower back (23.46%). Other commonly affected regions include the knees, ankles, wrists, upper back, elbows, and hips. The high prevalence is attributed to long working hours, poor ergonomics, and stressful working conditions. The findings point to an immediate necessity for ergonomic measures, workplace modifications, and routine health assessments to minimize the risks and impacts of MSDs in this occupational group. These preventive measures could improve the health productivity, and overall well-being [6].

Raza et al. in 2024 identifies associated ergonomic risk factors. Utilizing a modified Nordic questionnaire, data were collected from 48 randomly selected drivers. Findings revealed that over the past 12 months, 56% of drivers experienced lower back ache, 43% reported knee pain, and 39% suffered from neck pain. The study's logistic regression analysis indicated significant associations between LBP and factors such as increasing age, poor seat suspension systems, and inadequate body posture. Additionally, both poor suspension systems and the task of lifting heavy weights were significantly linked to Knee pain. These results underscore ergonomic training programs to mitigate the risk of MSDs [1].

Ali et al. in 2024 investigated a significant association between UCS and driving experience, daily driving hours, and body mass index (BMI). The findings indicated that HVDs with over 10 years of driving experience were more susceptible to developing UCS, while those who drove for more than 8 hours a day were also at a higher risk. Additionally, HVDs with a higher BMI were found to be more prone to developing UCS, which can lead to chronic pain and reduced mobility. This study highlights the importance of addressing UCS among HVDs through regular exercise programs, ergonomic adjustments, and health education to prevent and manage the condition, ultimately reducing the risk of long-term health consequences and promoting a healthier work environment [7].

Ithnin et al. in 2024 examined the link in 205 prime mover truck drivers. Using the NMQ-E, researchers found that lower back pain (25.93%), upper back pain (19.88%), and neck pain (16.61%) were the most reported symptoms. WBV exposure, measured in 32 drivers, remained within safety limits (max 1.15 m/s² over 8 hours). Significant correlations were found between work experience and back/hip pain, and shoulder pain. This highlights the despite compliance with WBV exposure limits, musculoskeletal symptoms remain common, suggesting that other factors like

prolonged sitting, posture, and physical condition contribute to MSDs. Researchers recommend interventions such as taking breaks to reduce WBV exposure to mitigate MSD risks among truck drivers [8].

Ahmad et al. in 2024 revealed that 77% of drivers experienced MSP, with the high affected being the neck (30.2%), lower back (22.6%), shoulders (19.1%), upper back (19.6%), and knees (22.6%). Other reported pain sites included hips/thighs (11.5%), ankles/feet (8.1%), wrists (3.0%), and elbows (2.1%). While the pain was common, the relatively mild nature of the severity could be linked to the ergonomic strategies already adopted at the workplace. The study underscores the need for enhanced ergonomic measures and workplace policies to further mitigate MSP. The research highlights the importance of preventive strategies, including posture correction, stretching exercises, and improved seat designs, to promote long-term musculoskeletal health [9].

Study by Rasheed et al. in 2023 found that professional drivers, the most common musculoskeletal symptoms reported were lower back pain and hip/thigh pain, which impacted their work. The findings stress the importance of focusing on MSDs in professional drivers, who face increased risk because of long sitting hours, inadequate posture, and whole-body vibrations. The findings suggest that targeted interventions, such as ergonomic adjustments, regular exercise programs, and health education, are necessary to improve the safety of drivers, reduce musculoskeletal discomfort, and enhance overall well-being and productivity [3].

Pickard et al. (2022) The review found that prolonged driving, poor vehicle ergonomics, whole-body vibrations, and long working hours contribute significantly to MSDs, lower back pain is common disorder followed by neck pain, and shoulder pain. Truck, bus, and taxi drivers are among the most affected due to sustained postures and exposure to mechanical stressors. The study highlights the need for ergonomic interventions, policy changes, and driver health programs to reduce MSD risks in professional driving occupations.

Hanumegowda and Gnanasekaran [2] A total of 400 full-time male bus drivers from BMTC participated in the study, with 92.5% responding to the MNMQ. The study employed random forest, and naïve Bayes classifiers to analyse risk factors influencing WMSDs. Results indicated that 66.75% of participants experienced WMSDs, with decision tree and random forest achieving 100 percent accuracy, while naïve Bayes reached 93.28% accuracy. Key risk factors identified include physical activity involvement, posture changes, exposure to vibration,

seat adaptability issues, ingress and egress difficulties, and inadequate on-duty breaks. The study recommends physical activity, healthy lifestyles, proper driving posture to reduce WMSDs.

Hanumegowda and Gnanasekaran (2022) The study 370 metropolitan bus drivers in Bengaluru, India, focusing on vibration of whole body and hand vibration exposure. Using a questionnaire and real-time vibration testing, the researchers found that 68.7% of drivers reported WMSDs, with lower back ache being the most common complaint. Key risk factors included prolonged sitting, poor seat design, road conditions, and exposure to high vibration levels, especially on rough roads and at higher speeds. Vibration levels frequently exceeded the safety limits set by international standards, increasing the risk of WMSDs. Statistical analysis using Gini impurity identified road type and vibration exposure as the most significant contributors. The study concludes that improved vehicle design, better road maintenance, and ergonomic training for drivers could help mitigate these health risks [4].

In another study Sa-ngiamsak et al. in 2021 found that 88% of the 25 participants, consisting of 15 short-distance and 10 long-distance truck drivers, reported experiencing MSK symptoms in the past 12 months. The lower ache was found to have the highest chances of MSK symptoms (72%), followed by the neck (32%). Long- distance truck drivers were found to have a significantly higher prevalence of neck symptoms and perceived discomfort in the lower back and neck compared to short-distance drivers. The study suggests that prolonged exposure to non-natural working postures, vibration, traffic conditions, and working stress may be contributing factors to MSK symptoms among truck drivers. The researchers recommend implementing integrated interventions with specific measures tailored to short-distance and long-distance truck drivers to minimize the problem [10].

Tobias et al. in 2021 examined the factors contributing to musculoskeletal and postural discomfort among bus drivers, focusing on the impact of prolonged sitting, poor ergonomics, and repetitive forced postures. Conducted over four months in a Brazilian bus company, the research involved 65 drivers and 38 buses, assessing cabin ergonomics, driver anthropometry, and discomfort levels using surveys and body discomfort scales. Results indicate that most drivers are over 50 years old with 6 years' experience, work long shifts, and experience significant lower back pain due to prolonged static postures. The study highlights that poor ergonomic

design of bus cabins contributes to musculoskeletal stress and fatigue. About 26% of drivers reported musculoskeletal pain that could lead to long-term disorders. The findings suggest ergonomic improvements in bus design, along with preventive measures such as encouraging more frequent breaks, to reduce discomfort and enhance driver well- being [11].

In a cross- sectional survey Kasemsan et al. in 2021 observed that of 83 drivers found a MSP, particularly in the neck (81.9%), lower back (80.7%), and shoulders (48.1%). Many drivers also reported mild to moderate disability, with 23.9% experiencing moderate disability due to back pain. The study attributes these issues to prolonged sitting, whole-body vibration, poor seat adjustability, and long working hours (averaging over 50 hours per week). The need for ergonomic interventions, better working conditions, and rehabilitation programs to prevent and manage musculoskeletal pain among bus drivers [12].

Combs et al. in 2021 explores the strenuous nature of their job, the physically demanding nature of their work, truck drivers are at a heightened risk of shoulder injuries because of prolonged driving, repetitive arm movements, heavy lifting, awkward postures, and vibrations from the vehicle. The study utilizes medical records and injury reports to categorize common shoulder conditions, such as rotator cuff tears, tendonitis, bursitis, and strains. The researchers analyse how factors like work experience, job demands, and ergonomic challenges contribute to injury risk. Their findings highlight the significant occupational hazards within the trucking industry, stressing the need for preventive measures such as ergonomic adjustments, strength training, improved workplace policies, and injury prevention programs. The study aims to inform healthcare professionals, employers, and policymakers about the need for targeted interventions to enhance truck drivers' musculoskeletal health and reduce work-related disabilities [13].

Rolander et al. in 2021 investigated the physical workload and movement patterns of warehouse forklift truck operators through measurements and observational methods. Key findings indicate that forklift operators often adopt awkward postures, including excessive neck rotation and forward bending, as they frequently turn their heads and bodies to monitor their surroundings. The study also highlights the operators experience high levels of vibration on body, which can contribute to lower back ache and other musculoskeletal issues. Additionally, prolonged sitting in a constrained position increases the risk of discomfort and long-

term health problems. The article suggests several ergonomic improvements to mitigate these risks. Recommendations include optimizing seat design with better suspension systems to reduce vibration exposure, adjusting work schedules to allow for movement breaks, and implementing training programs focused on posture awareness and safe driving techniques. By addressing these ergonomic concerns, the study aims to improve the conditions and overall health of forklift operators in warehouse environments [14].

Kumar et al. in 2021 investigates the connection between work-related stressor and MSD among Indian heavy vehicle drivers, a group that experiences significant occupational health risks. These drivers are exposed to multiple physical and psychological stressors, including prolonged sitting, awkward postures, whole-body vibrations, irregular work hours, heavy workloads, and limited rest breaks. These factors contribute to MSDs, affecting the lower back, neck, shoulders, and wrists. The study highlights that psychological stressor, such as long working hours, traffic congestion, and tight delivery schedules, physical discomfort and increase the risk of chronic pain and fatigue. The research emphasizes the urgent need for interventions to mitigate these risks. Recommendations include ergonomic modifications and awareness programs to educate drivers about proper sitting posture and physical exercises. Additionally, stress management strategies such as improved scheduling, adequate rest breaks, and mental health support [15].

3. Methodology

Study design: A questionnaire-based study.

Sample size: the target population for this study consisted of heavy vehicle drivers such as trucks, buses and other large transport vehicle drivers who are currently employed and actively driving heavy vehicles. A total of 77 heavy vehicle drivers were approached for participation in the study. But only 51 drivers successfully completed the questionnaire. Eleven drivers refused to participate in the study, Responses from 8 drivers were found to be inaccurate that did not provide sufficient data for analysis, 7 drivers dropped out of the survey midway due to various reason.

Location: Greater Noida.

Selection criteria: Inclusion criteria –

(1) Age between 25 -55 years.

(2) Drivers with at least 5-15 years of continuous driving experience.

(3) Driving at least for a minimum 6-7 hours per day.

(4) included only male participants.

Exclusion criteria –

(1) Drivers with a history of any major injury or surgery in the past year.

(2) Drivers with temporary employment status, under training or with irregular work schedules.

4. Procedure:

Participant were first informed about the purpose and objectives of the study those who met the inclusion criteria and voluntarily agreed to participate were provided with an informed consent form. Once consent was obtained, participants were given a structured questionnaire (DASH questionnaire).

5. Results

A total of 51 participants were included in the study, and data were analysis to assess the relationship between age and upper extremity function, as measured by the Arm, Shoulder and Hand (DASH) Score.

Descriptive Statistics

The descriptive statistics for age and dash score are presented in table 1. The participants ages ranged from 28 to 54 years, with a mean age of 39.37 ± 7.77 years. The dash scores ranged from 5.80 to 36.50, with a mean score of 17.63 ± 7.55 . The standard error of the mean (SEM) was 1.088 for age and 1.057 for the DASH score, indicating a moderate degree of variability in the sample. These statistics suggest that the study population was composed of mid aged adults with a range of mild to moderate disability levels in the upper extremity, as shows by the DASH scoring system.

Variable	Age	DASH Score
No. of values	51	51
Minimum	28.00	5.80
Maximum	54.00	36.50
Range	26.00	30.70
Mean	39.00	17.63
Std. Deviation	± 7.77	± 7.55
Std. Error of mean	1.088	1.057
Table -1 Descriptive Statistics		

Correlation Analysis

A Spearman's rank – order correlation was used to assess the strength and direction of the relationship between age and DASH score. The analysis yielding a spearman correlation coefficient (r) of 0.8657, indicating a strong positive correlation between age and upper extremity disability. the 95% confidence interval for this correlation ranged from 0.7717 to 0.9227, suggesting that this association is both strong and consistent across the sampled population.

The p value associated with this correlation was <0.0001 , which is well below the standard alpha level of 0.05, confirming that the relationship between age and DASH score is statistically significant. This finding implies that as age increases, participants tend to report higher DASH scores, which reflect increased the level of upper extremity dysfunction or disability.

Statistic	Value
spearman (r)	0.8675
95%confidence interval	0.7717 to 0.9227
P value (2 tailed)	<0.0001
Significance (alpha =0.05)	Yes
Number of XY pairs	51

Table. 2 Correlation Analysis

Graphical Representation

Figure 1 illustrates the relationship between age and DASH score. The scatter plot demonstrates a clear upward trend, consistent with the statistical findings, showing that individual with higher ages generally reported higher DASH score. this visual evidence supports the statistical conclusion of a strong and significant positive correlation.

This histogram (fig 2) shows the distribution of DASH scores. This graph shows that most participants had mild to moderate disabilities of the arm, shoulder and hand. The distribution is almost normal with a slight right skew, and the DASH scores cluster mostly between 10 and 30.

XY data: Correlation of Age & DASH Score

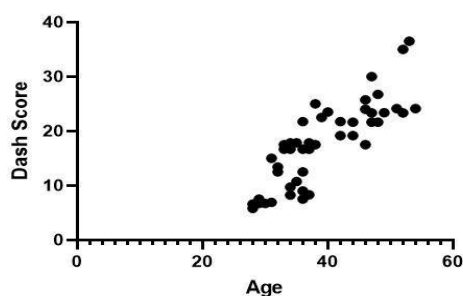


Fig 1: Relationship between age and DASH score

6. Discussion

This study provides important information about the prevalence and functional impact of work-related upper extremity musculoskeletal symptoms among heavy vehicle drivers. The study shows that many heavy vehicle drivers suffer from pain other symptoms in their upper limbs especially in their shoulders, hand, arms, wrist. These symptoms can make it harder for them to do everyday tasks, both at work and at home. Even though driving may not look like a physically demanding job, it puts a lot of stress on the body because drivers sit in the same position for long hours, often with poor posture, and make repeated arm and hand movements while steering or shifting gears.

Tahernejad et al. (2024) reported that over 60% of truck drivers suffer from musculoskeletal disorder especially in the shoulder, neck, upper back and lower back. Prolonged driving hours, repetitive tasks like steering and gear shifting and exposure to whole body vibration. these conditions can lead to increased stress on the musculoskeletal system, particularly affecting spine and shoulder [7]. The prevalence and nature of shoulder injuries among truck drivers who are often subjected to prolonged periods of static posture, repetitive upper limb, and use awkward movements. The most common shoulder issues were rotator cuff injuries, tendinopathies and shoulder impingement syndromes [6]. Raza et al. 2024, also found that many drivers experienced pain in the lower back (56%), neck (39%) and shoulder (25%) and this was linked to poor seating, bad posture, and physical demands of the job [1]. Driving on rough roads increased the risk of work-related musculoskeletal disorders. Extended periods of sitting without adequate breaks and frequent posture changes were associated with higher work-related musculoskeletal disorders prevalence. Lack of adjustable seating contributed to discomfort and musculoskeletal problems [4].

In this study, we used the DASH questionnaire to measure how much these symptoms affect the daily activity of drivers. The questionnaire to measure how much these symptoms affect the daily lives of drivers and helped us understand how arm, shoulder, hand pain can limit simple activities like carrying groceries, opening doors or doing work that require grip strength. Many drivers reported that their pain affected their ability to work efficiently and comfortably. The pain and symptoms are often made worse by design of the vehicles.

Whole body vibration is another major issue. When a vehicle drives over rough roads, vibrations travel through the driver's seat and steering wheel into their body, especially the back and the upper limb.

issue due to repeated exposure over time. According to Pickard et al. (2022) prolonged driving, poor vehicle design and long working hours contribute greatly to pain in the neck, shoulder and back [16].

Our study provides strong evidence of a positive association between age and upper extremity disability, which means that as people get older their DASH scores usually get higher and higher DASH scores mean more disability or trouble using the upper limbs. The result of this study is similar to those found in many previous studies. Pickard et al. (2022) found that older occupational drivers are more prone to musculoskeletal disorders than younger drivers because they have been exposed to whole body vibration for a longer duration [16].

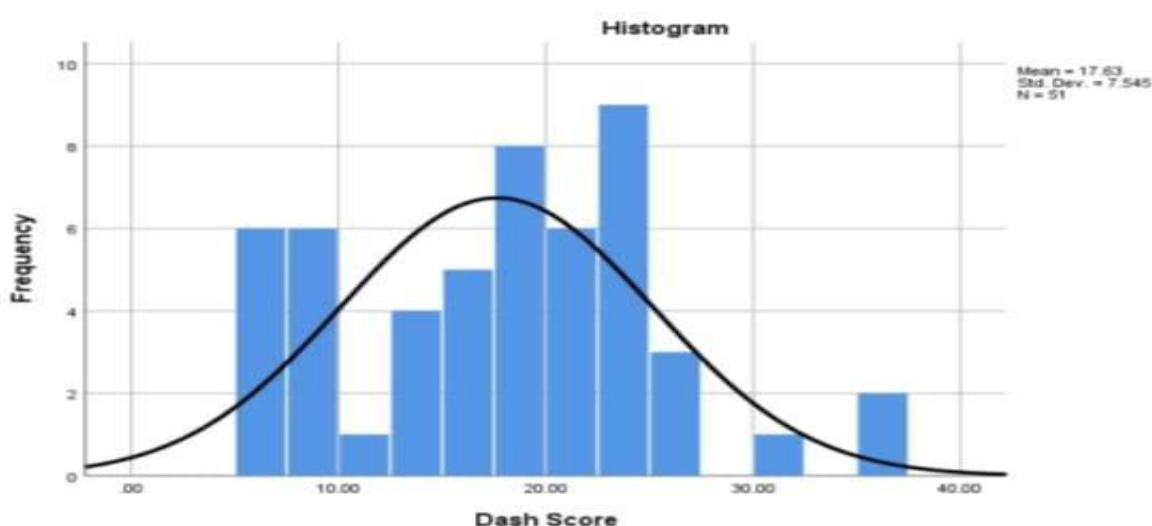


Fig-2 Histogram

Ithnin et al. (2024) Studied 205 truck drivers and found that even when truck vibration levels were within safe limits, drivers still reported a lot of musculoskeletal pain. This show that long term exposure to vibration combined with poor posture can still cause serious problems. Another issue is upper cross syndrome (UCS), which is a muscle imbalance cause by sitting in one position for too long with rounded shoulders and a forward head posture [8]. Ali et al. (2024) found that drivers with over 10 years of experience, those who drive more than 8 hours a day, and those with higher body weight (BMI) more likely to develop UCS. This condition can lead to chronic pain and reduced movement in the upper body [7]. Rasheed et al. (2023) found that many drivers have unhealthy habits such as smoking and consuming soft drinks regularly [3]. These habits, along with poor physical activity, increase the risk of chronic musculoskeletal problems and make recovery slower. Age and year of driving experience are also important factors. Older drivers and those with long work experience are more likely to develop musculoskeletal

7. Conclusion

This study shows that heavy vehicle drivers to drive 7-8 hours daily may experience more problems with arm, shoulder and hand function as they get older. Long driving hours combined with age can lead to increased upper limb discomfort and disability. Regular check-up, exercises and early interventions may help prevent or reduce these issues and support drivers in staying healthy and active at work. The results showed a strong link between age and higher dash scores, which means more difficulty with upper limb movements and daily tasks.

This means that age can affect how well someone's arms work, and it's important to check and support upper limb function as people get older even though work hours and age plays a big role, other factors like job type, health, and physical activity may also affect arm function. More research is needed to understand all the reasons behind this and to find ways to help people keep their arm function as their age.

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