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Association Between Whole-Body Vibration Exposure and Musculoskeletal Symptoms Among University Bus Drivers in Selangor, Malaysia

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Structured Abstract

Background: Whole-body vibration (WBV) is a common occupational exposure among professional drivers, particularly bus drivers who spend long hours seated. Continuous exposure to vibration generated by vehicle engines, road conditions, and driving activities can cause repeated mechanical stress in the body, especially the spine and supporting muscles. Over time, this exposure may contribute to the development of musculoskeletal disorders (MSDs), including low back pain, neck pain, and shoulder discomfort. These conditions can reduce work performance, increase fatigue, and affect overall quality of life. However, limited local studies have examined this association among university bus drivers in Malaysia. Therefore, this study aims to investigate the association between WBV exposure and MSDs symptoms among university bus drivers in Selangor, Malaysia.

Methods: Cross-sectional study was conducted among university bus drivers in Selangor, Malaysia. Whole-body vibration exposure was measured using triaxial seat-type disk accelerometer connected to Human Vibration Meter (SVANTEK SV106D) during normal driving operations on selected routes. Vibration exposure was quantified using Root Mean Square (RMS), daily vibration exposure A(8), and Vibration Dose Value (VDV) in accordance with ISO 2631-1 guidelines. Self-reported musculoskeletal symptoms were assessed using a standardized questionnaire covering symptoms experienced over the past 7 days and 12 months. Statistical analysis was performed to examine the association between WBV exposure and musculoskeletal symptoms.

Results: The findings showed that university bus drivers were exposed to varying levels of WBV, with several measurements exceeding the Health Guidance Caution Zone. Musculoskeletal symptoms were commonly reported, particularly in the lower back, neck, shoulders, and knees. A significant association was observed between higher WBV exposure levels and the prevalence of musculoskeletal symptoms, indicating that prolonged exposure increases the risk of developing MSDs among drivers.

Conclusion: This study highlights that university bus drivers in Selangor are exposed to potentially harmful levels of whole-body vibration, which are significantly associated with musculoskeletal disorder symptoms. The findings emphasize the need for preventive measures such as ergonomic seat improvements, vehicle maintenance, exposure monitoring, and work schedule adjustments to reduce WBV exposure.

Keywords: Whole-body vibration, musculoskeletal disorders, bus drivers, occupational exposure, ergonomics

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