

Assessment of Whole-Body Vibration (WBV) Exposure Among Train Drivers and Its Association with Lower Back Pain (LBP) Symptoms

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Structured Abstract

Background: Train drivers oversee the train's mechanical functioning for long duration, increasing exposure to whole-body vibration (WBV). WBV is transmitted through the seat pan, backrest and platform, contributing to lower back pain (LBP), which affects their mobility. This study aimed to measure the WBV levels exposed to the drivers using SVANTEK SV106D Human Vibration Meter and SV38V Triaxial Seat-Type Disk Accelerometer, determine the prevalence of self-reported LBP symptoms as well as the association.

Methods: The WBV measurements were taken using SVANTEK SV106D Human Vibration Meter and SV38V Triaxial Seat-Type Disk Accelerometer placed under their seats. Six drivers were assessed in x, y and z axes, with three 20-minute measurements. The A(8) and VDV(8) values were compared to Exposure Action Values (EAV) and Exposure Limit Values (ELV) of ISO 2631-1:1997 and EU Directive 2002/44/EC. Besides, the questionnaires covering socio-demographic information, job-related exposure, Standardized Nordic Questionnaires (SNQ) and Oswestry Disability Index (ODI) were distributed to 51 train drivers to assess the prevalence of LBP. Finally, the association between WBV and LBP was analysed using Spearman's Rank Correlation Coefficient.

Results: WBV measurements revealed that Train No.1 had the highest A(8) value ($1.174 \pm 0.129 \text{ m/s}^2$) and Train No.4, No.5, and No.6 had the highest VDV(8) value ($35 \pm 4.7 \text{ m/s}^{1.75}$). All trains exceeded the EAV and ELV for A(8) and VDV(8) of ISO 2631-1:1997. Under the EU Directive 2002/44/EC, all trains exceeded the EAV for A(8) and two trains exceeded the ELV. Additionally, all trains surpassed both the EAV and ELV for VDV(8). As most trains exceeded limits, drivers were exposed to serious musculoskeletal issues. The SNQ results indicated that 78.4% ($n = 40$) of drivers reported LBP, with 45.1% ($n = 23$) experienced moderate restriction in doing daily activities. However, no significant relationships between WBV and LBP were determined.

Conclusion: The findings showed that most train drivers reported LBP, making it a major health concern in this profession. Most trains also exceeded the EAV and ELV, increasing risk of LBP. Lastly, no significant relationship was found between A(8) and VDV(8) with SNQ and ODI.

Keywords: Whole-Body Vibration, Lower Back Pain, Train Drivers, Standardized Nordic Questionnaires, Oswestry Disability Index

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