HEALTH EFFECTS OF HAND AND ARM VIBRATION FROM USING VARIOUS HAND TOOLS

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Background

- Hand-arm vibration(HAV) is an occupational hazard that is transmitted through the workers upper extremities when working with hand power tools.
- Prolonged exposure to hand-arm vibration can lead to Hand-Arm Vibration Syndrome(HAVS). Causing symptoms such as sensorineural(tingling, numbness), vascular(white finger), musculoskeletal(weakness, pain) and functional(gripping)(Gemne et al., 1987; Brammer et al., 1987).
- Less understanding of short term and cumulative effects of vibration.

Objective

- Assess HAV exposure among workers in a concrete distribution facility and compare measured vibration levels to occupational exposure limits.
- Associate both long term and short term symptoms with exposures to vibration through questionnaire.

Methods

- A cross sectional field study was conducted. Vibration readings were taken while workers maintained cement trucks and cleaned inside the cement silos.
- Vibration measurements were taken with the HVM200 vibration meter equipped with a tri-axial accelerometer. It was worn on the workers dominant hand for the time of the task.
- Vibration measurements included root mean square acceleration(aRMS) for the duration of the task and the daily vibration exposure normalized to an 8-hour period, A(8). A(8) was calculated using standard ISO equation.
- The questionnaire was conducted after vibration testing. It consisted of 28 questions looking at demographics, short term(immediate), and long term vibration symptoms(within the year). These symptoms fell into the symptom categories of sensorineural, vascular, musculoskeletal and functional.

Results

- The sample size consisted of 8 workers who regularly use vibrating hand tools.
- All the tools were pneumatic, however the drill was battery operated.

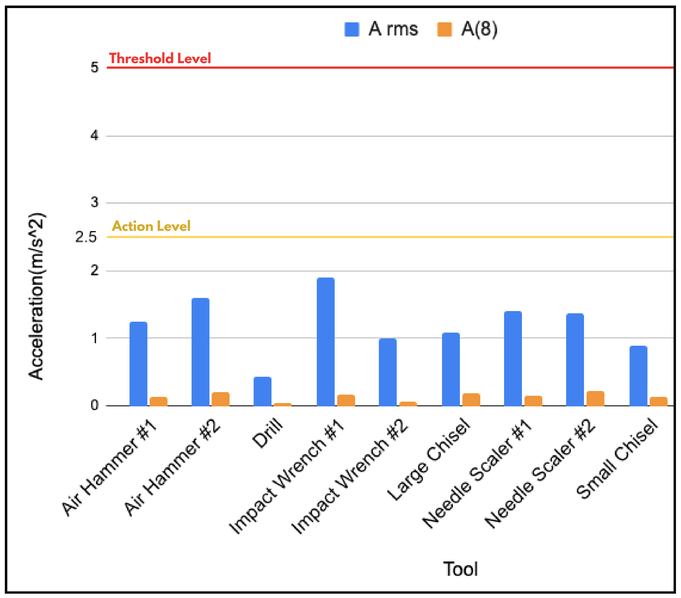


Figure 1. Vibration readings for vibrating tools used.

Regulatory Limits (ACGIH, 2018)
Threshold Level: 5.0 m/s²
Action Level: 2.5 m/s²

- In Figure 1, all tools measured had vibration readings below the legal threshold in red and action level in yellow
- Measured aRMS(blue) ranged from 0.44m/s² to 1.91m/s². The calculated A(8) values(orange) ranged from 0.039m/s² to 0.224m/s².

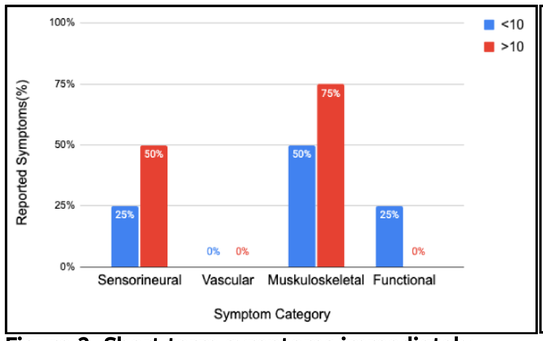


Figure 2. Short term symptoms immediately after tool use. Stratified by under and over 10 years of vibrating tool use.

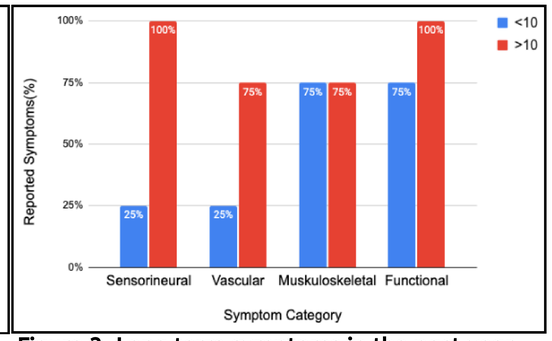


Figure 3. Long term symptoms in the past year. Stratified by under and over 10 years of vibrating tool use.

- Both these figures are stratified by worker years experience with vibrating tools from the demographics of the questionnaire 4 of the workers had under 10 years of experience with vibrating tools and the other 4 had over 10 years of experienced and they were grouped for comparison.
- In Fig.2, symptoms were experiened after tool use even though below regulatory limits
- In Fig 3, workers with >10 years of tool use experienced more symptoms across all categories.

Discussion

- Vibration exposure levels for the tools used were well below current regulatory limits. Although, even with these measurements there were symptoms that were present after the tool use.
- In Figure 3, workers with over 10 years of experience with vibrating tools had greater symptoms experienced across all categories.
- HAV related health effects may accumulate and lead to chronic symptoms related to HAVS.

Limitations

- The study had a small sample size of 8 workers
- Limited measurement duration
- Questionnaire data was self-reported symptoms

Conclusion

- Measured HAV exposure levels were below regulatory limits, however, workers still reported both short and long term symptoms.
- Findings suggest the importance of cumulative exposure. We should still be concerned about HAV despite being below the legal and action limits
- Further research with a larger sample sizes is needed to better understand the relationship between vibration exposure, symptom development, and long term occupational health outcomes.

References

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