

BUMPS IN THE ROAD: CONSIDERATION OF THE EFFECTS OF VIBRATION ON POWER WHEELCHAIR USERS

CATHY CHOI, OT REG. (ONT.)

Outpatient Seating Clinic, Bridgepoint Active Healthcare

KATHY FISHER, BSC.(OT)

Clinical Business Development Manager, Invacare Canada

Whole Body Vibration and Health Risks

The Canadian Institute of Occupational Health and Safety has recommended guidelines for human exposure to vibration.¹ There is evidence that demonstrates the negative effect that Whole-Body Vibration (WBV) has on individuals. Research indicates a correlation between WBV exposure and injury to body organs, muscle fatigue, back injury, neck pain, and disc degeneration.² Ohio State University Wexner Medical Center has also found that the injury process to the back is not only for high load vibration and shock, but also low loads that are repeated and sustained.³ Vibration can also compromise the stability of the spine, making it more vulnerable to injury even during routine tasks.⁴

The International Standards Organization (ISO), standard 2631-1 is an accepted standard for human exposure to WBV in vehicle vibration and demonstrates the importance of understanding the effect of vehicle vibration on health. The ISO recognizes that vibration increases the health risk to the lumbar spine and the connected nervous system, from horizontal displacement and torsion of the vertebral column.⁵ The ISO also recognizes that health changes from WBV exposure develop over several years in healthy individuals.

WBV Measurement, Guidelines, and Assessment Considerations

- WBV considers: X (forward/reverse), Y (lateral), Z (up/down) axes of weighted root mean square acceleration (rms measured in m/s^2)
- ISO guidelines are for healthy individuals seated in vehicles
- The longer the exposure duration, the lower the level of vibration that is acceptable
- For a 4 hr exposure period, a Z-axis weighted rms acceleration $> 0.63 m/s^2$ is in the health caution zone
- What is the potential impact of WBV on people with disabilities in power wheelchairs, whose health is already compromised?

Despite the potential risks from WBV exposure, specific measurement or standards for WBV during power wheelchair use appears to be lacking. Understanding WBV and power wheelchair use is essential to providing clients with objective information to aid in decision making about costly purchases, advancing client care, and potentially reducing WBV related health risks.

WBV and Power Wheelchair Considerations

- Base Wheel Configuration of Front, Mid, and Rear Wheel drives
- Seat placement
- Suspension
- Seating Materials

References

1. Government of Canada, Canadian Centre for Occupational Health and Safety. (April 2015). Vibration - Measurement, Control, and Standards. Retrieved from http://www.ccohs.ca/oshanswers/phys_agents/vibration/vibration_measure.html
2. Pearlman, J., Cooper, R., Duvall, J., & Livingston, R. (2013). Pedestrian Pathway Characteristics and Their Implications on Wheelchair Users. *Assistive Technology: The Official Journal of RESNA*, 25 (4), 230-239. doi:10.1080/10400435.2013.778915
3. DiGiovine, C.P., Metzler, S.A., Darragh, A.R., Berner, T.F., & Tufts, L.E. (2013). Whole Body Measurement System for Power Wheelchairs. Ohio State University Wexner Medical Center (unpublished)
4. Ibid.
5. International Standards Organization (ISO) 2631-1:1997 (reviewed 2014). Mechanical vibration and shock -- Evaluation of human exposure to whole-body vibration -- Part 1: General requirements. Retrieved from http://www.iso.org/iso/catalogue_detail.htm?csnumber=7612

Speaker Bios

Cathy Choi

Cathy Choi is a registered Occupational Therapist and Authorizer with the Assistive Devices Program of Ontario. She has enjoyed working with adult clients with diverse diagnoses in seating and mobility for over 17 years. Cathy is truly enthusiastic about assisting clients to engage in community and in life by improving their seating and mobility, and brings these values to her work in Seating Clinic. She has served in both community and hospital sectors, presented at Invacare Seating Rounds, and is a member of RESNA.

Kathy Fisher

With a background in Occupational Therapy Kathy has worked as an Assistive Technology Supplier and clinical educator and is now Clinical Business Development Manager at Invacare Canada. Kathy has been involved in the provision of high technology rehabilitation equipment with clients in a variety of diagnostic categories including paediatrics. Kathy has presented internationally at a variety of conferences including the Canadian Seating and Mobility Conference, Healthcare Innovations, RESNA, Medtrade, International Seating Symposium and European Seating Symposium.