

ABSTRACT

Deaf individuals are at an increased likelihood of experiencing dizziness and balance concerns. However, no self-report measures of vestibular function are currently available in American Sign Language (ASL). This study aimed to bridge this gap in care by adapting and validating two widely used self-report measures of balance function, the Dizziness Handicap Inventory and the Activity-Specific Balance Confidence scale. Preliminary Variables suggest a high test-retest reliability for each measure and moderate correlation between DHI and ABC scores, consistent with prior literature.

METHODS

DHI and ABC were initially interpreted, separately, by two Certified Deaf Interpreters. The interpreted versions and any noted cultural incompatibilities were then discussed and adjusted to reach a consensus among the research team. The agreed language was then signed in a video-recording studio. This recording was back-translated by an ASL-English interpreter, to ensure consistency with the original English version. Items that significantly changed the meaning were re-recorded, back-translated, and verified. These videos were then constructed into an online survey and piloted to five Deaf ASL users. Based on their feedback, instructions were adjusted accordingly and final versions were constructed in Qualtrics for online computer-based administration.

The final DHI and ABC were administered in a pseudo-randomized, balanced order, to Deaf older adults (aged 50 and older). A subset of the participants repeated the measures. Given the association between chronic dizziness, anxiety, and depression (Graham et al., 2021), we administered the anxiety and depression subscales of PROMIS-Deaf (Kushalnagar et al., 2020), a health measure that was culturally-adapted and validated in 1,717 ASL-using Deaf adults. Timed up-and-go (TUG), a measure of walking speed and agility shown to correlate with DHI and ABC scores (Rolenz & Reneker, 2016; Herssens et al., 2015), was administered to a subset of participants.

Participant characteristics (n= 67):

- Age Range: 51-88
- Gender: 46 women, 22 men
- 11.7% non-White or Hispanic

RESULTS

Test-retest reliability is high for both ABC and DHI.

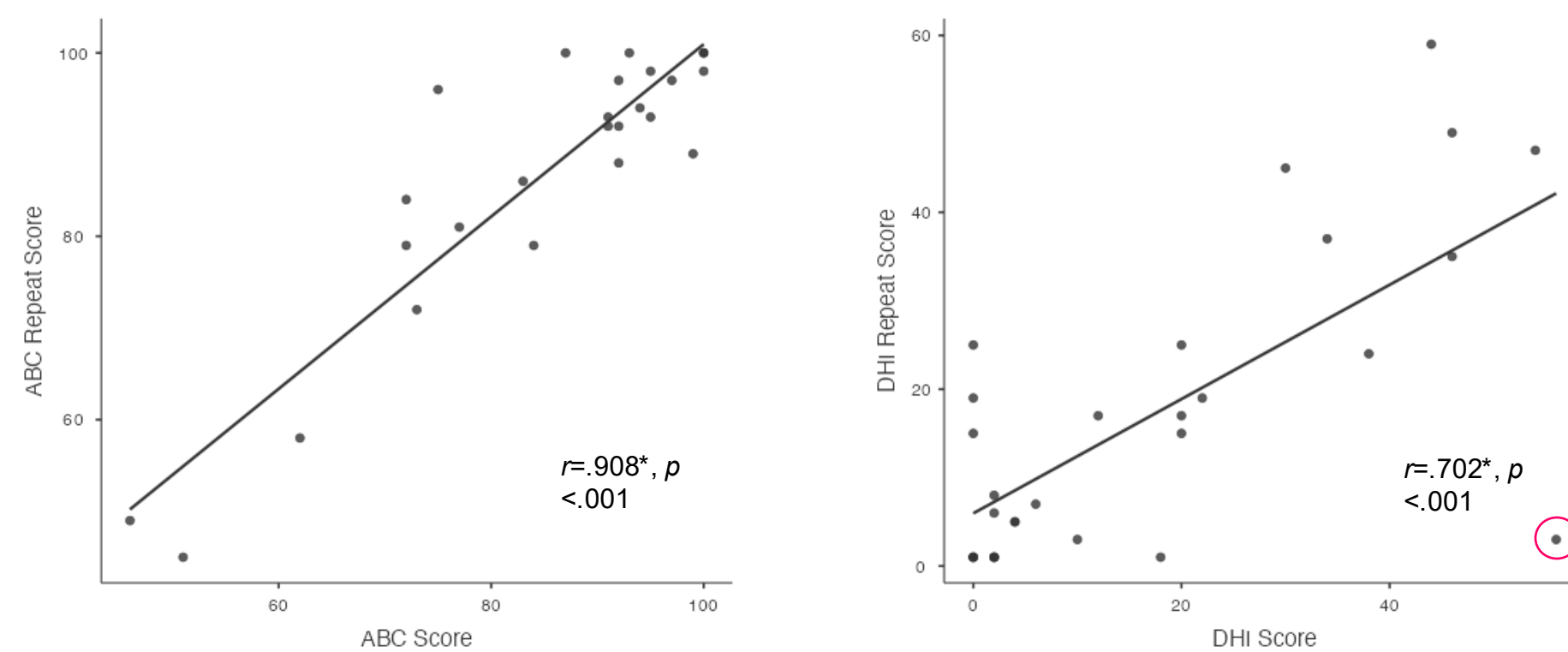


Figure 1. Correlation between the ABC and repeated ABC scores. Very strong, statistically significant correlation between the initial and repeated ABC scores indicate high test-retest reliability.

Figure 2. Correlation between the DHI and repeated DHI scores. Strong, statistically significant correlation between the initial and repeated DHI scores indicate high test-retest reliability.

ABC and
DHI showed
strong,
negative
correlation.

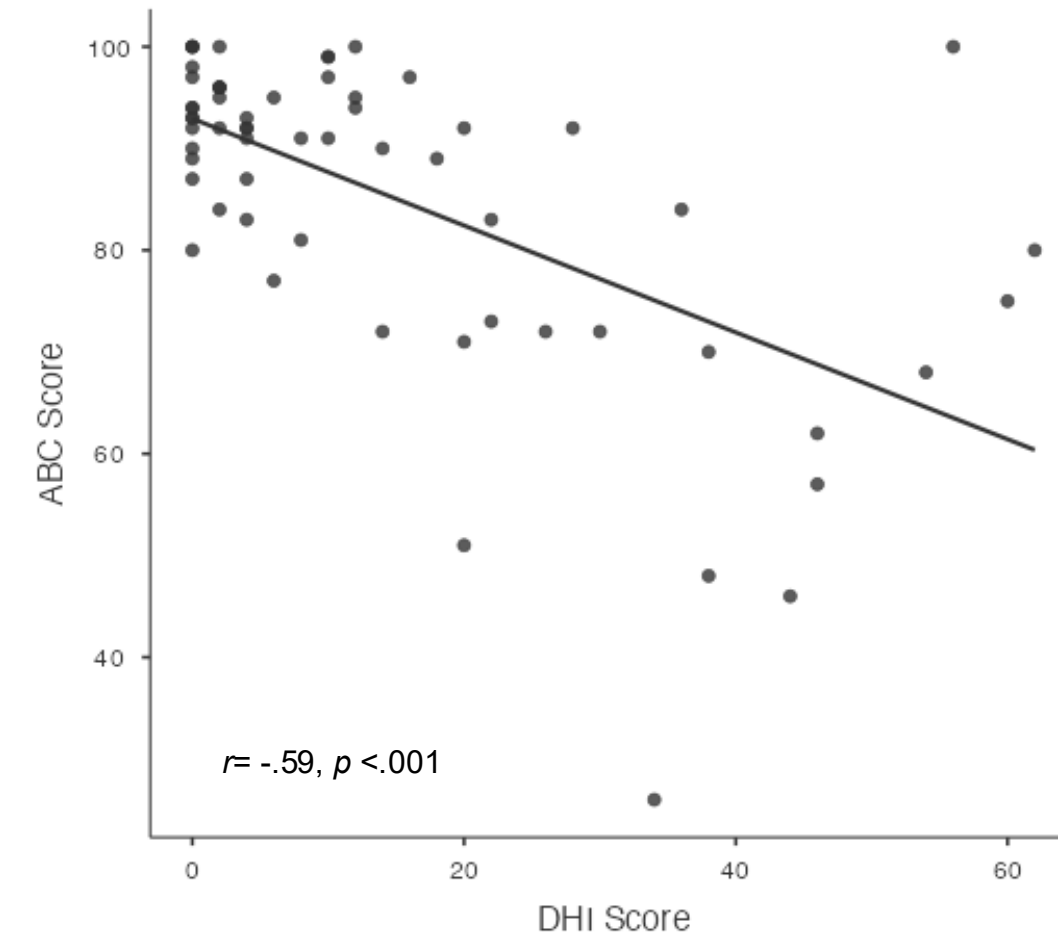


Figure 3. Correlation between the DHI score and ABC scores. Strong negative correlation between DHI and ABC scores ($r = -.59, p < .001$).

Independent Samples T-Test				
		Statistic	df	p
DHI Score	Student's t	-0.196	66.0	0.846
ABC Score	Student's t	1.504	59.0	0.138

Note. $H_0: \mu_1 = \mu_2$

Table 1. Independent Samples T-Test between ASL only and ASL/English versions of the DHI and ABC. No significant difference was found between the ASL Only and ASL+English versions of the DHI and ABC measures.

ABC and DHI in ASL Only and in ASL+English yielded scores that were not statistically different.

ABC is **not** correlated with anxiety or depression.

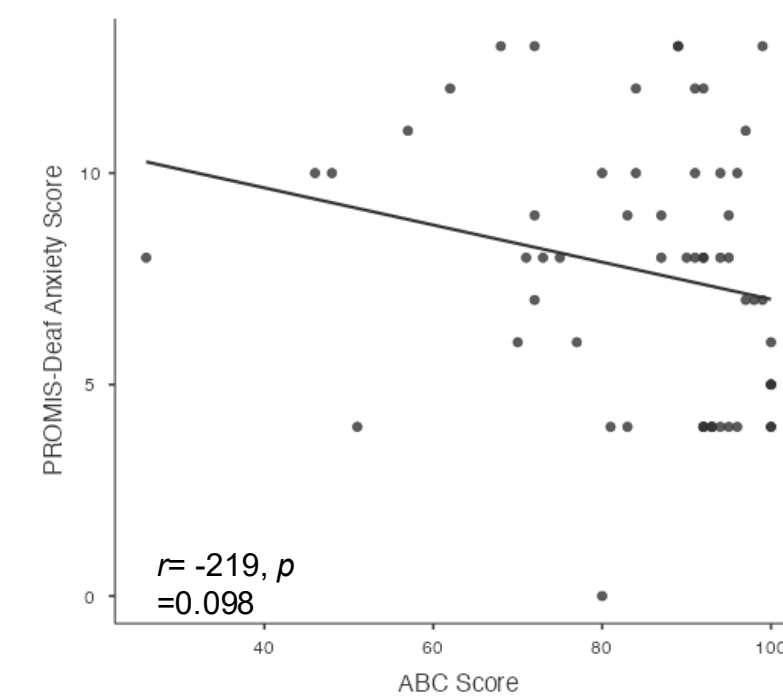


Figure 4. Correlation between the ABC and PROMIS-Deaf Anxiety scores. The trends for weak negative correlation is not statistically significant.

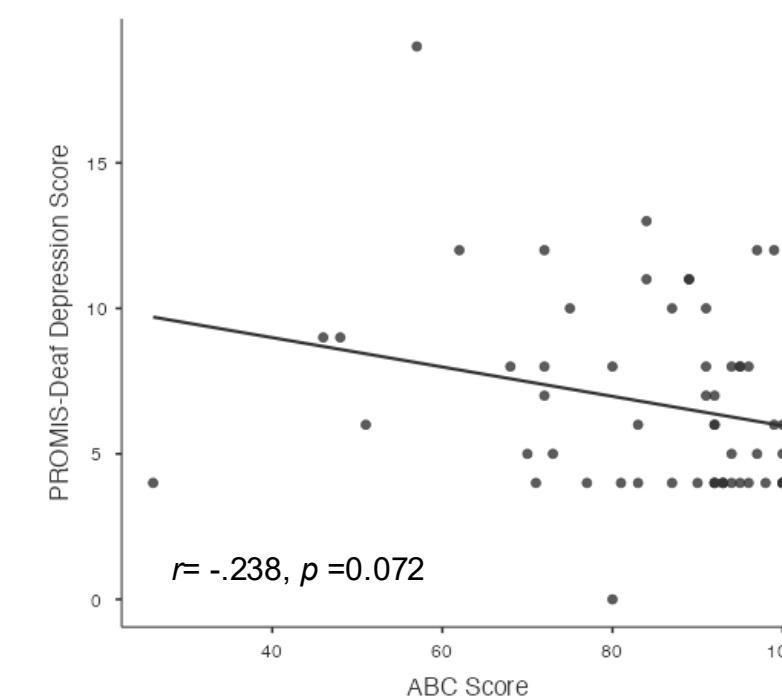


Figure 5. Correlation between the ABC and PROMIS-Deaf Depression scores. The trends for weak negative correlation is not statistically significant.

DHI showed a weak positive correlation with anxiety and depression.

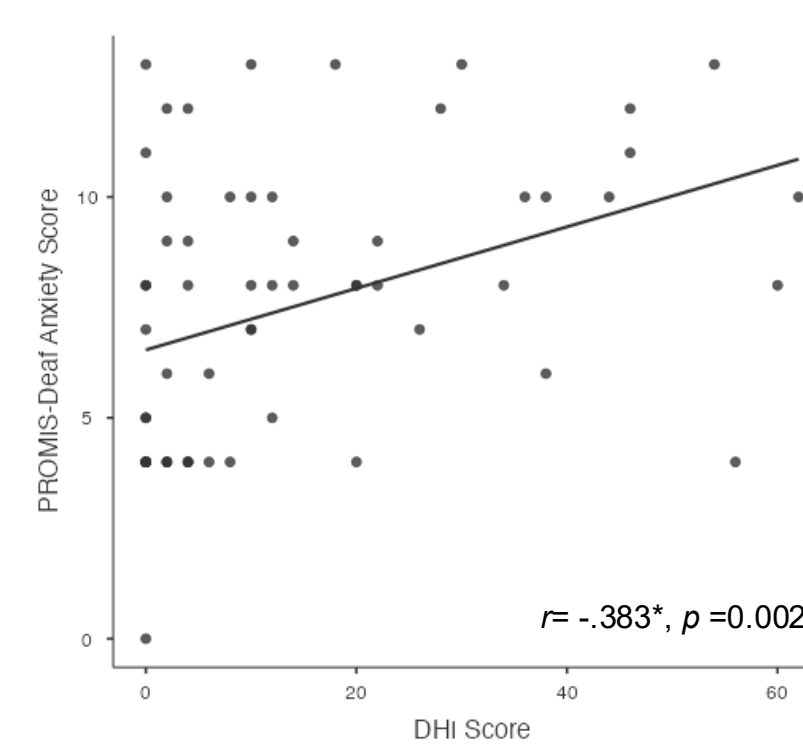


Figure 6. Correlation between the DHI and PROMIS-Deaf Anxiety scores. Weak, statistically significant correlation between DHI and scores and PROMIS-Deaf Anxiety scores is consistent with literature (Van et al., 2023).

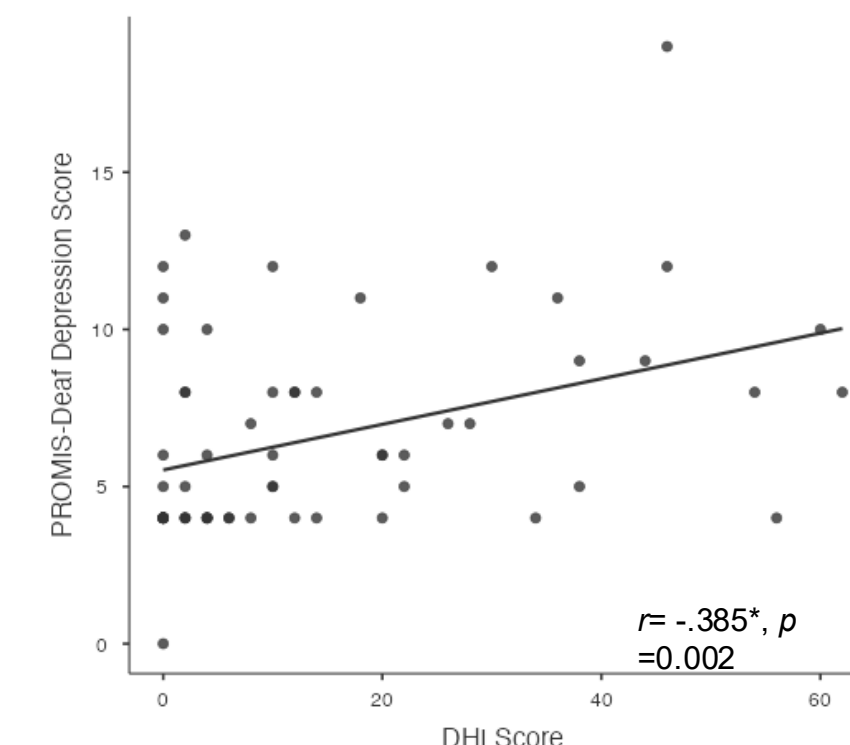


Figure 7. Correlation between the DHI and PROMIS-Deaf Depression scores. Weak, statistically significant correlation between DHI and scores and PROMIS-Deaf Anxiety scores is consistent with literature (Van et al., 2023).

TUG is **not** correlated with ABC or DHI.

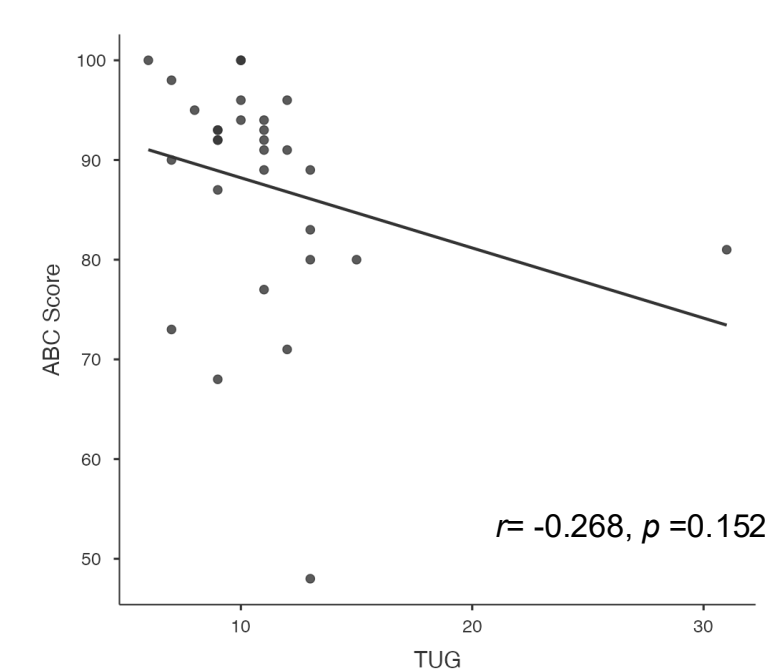


Figure 8. Correlation between the ABC and TUG scores. Significant correlation was not seen between the ABC and TUG scores.

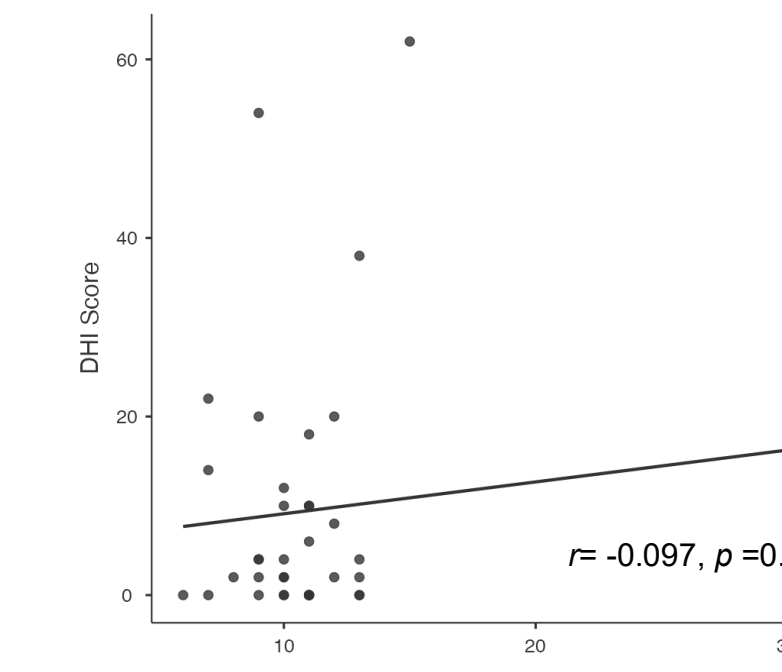


Figure 9. Correlation between the DHI and TUG scores. Significant correlation was not seen between the DHI and TUG scores.

CONCLUSION / DISCUSSION

Preliminary analysis of data suggests validity of both the DHI and ABC measures in ASL.

- Test-reliability is high for both measures. Strong correlation observed between DHI and ABC scores is consistent with literature (Whitney et al., 1999).
- Strong correlation was found between the DHI and PROMIS-Deaf anxiety and depression measures, which is consistent with other literature (Van et al., 2023).
- The scores for ASL only and ASL+English versions were not significantly different for either ABC or DHI, suggesting ASL interpretation is sufficiently equivalent to the original English prompts.
- TUG results did not show a significant correlation to ABC or DHI scores, despite other research's indications (Verdecchia et al., 2020). Differences may be observed due to reduced sample size and younger age inclusion of our study.

Together, it suggests that clinically, both the ASL-interpreted ABC and DHI are valid and equivalent to the original ABC and DHI.

REFERENCES

- E. J. Son, D.-H. Lee, J.-H. Oh, J.-H. Seo and E.-J. Jeon, "Correlation between the dizziness handicap inventory and balance performance during the acute phase of unilateral vestibulopathy," *American Journal of Otolaryngology*, vol. 36, no. 6, pp. 823-827, 2015.
- Jacobson GP, Newman CW: The development of the Dizziness Handicap Inventory. *Arch Otolaryngol Head Neck Surg* 1990;116(4):424-7.
- Kushalnagar, P., Paludnevidene, R., Kallen, M., Atcherson, S., & Cella, D. (2020). PROMIS-deaf profile measure: cultural adaptation and psychometric validation in American sign language. *Journal of patient-reported outcomes*, 4(1), 44. <https://doi.org/10.1186/s41687-020-00208-7>
- M. K. Graham, J. P. Staab, C. M. Lohse and D. L. McCaslin, "A Comparison of Dizziness Handicap Inventory Scores by Categories of Vestibular Diagnoses," *Otology & Neurotology*, vol. 42, no. 1, pp. 129-136, 2021.
- Mutlu, B., & Serbetdoglu, B. (2013). Discussion of the dizziness handicap inventory. *Journal of vestibular research : equilibrium & orientation*, 23(6), 271-277. <https://doi.org/10.3233/VES-130488>
- N. Herssens, E. Swinnen, B. Dobbels, P. Van de Heyning, V. Van Rompaey, A. Hallemaans and L. Vereeck, "The relationship between the Activities-specific Balance Confidence scale and balance performance, self-perceived handicap, and fall status in patients with peripheral dizziness or imbalance," *Otology & Neurotology*, vol. 42, no. 7, pp. 1058-1066, 2021.
- Powell, L. E., & Myers, A. M. (1995). The Activities-specific Balance Confidence (ABC) Scale. *The journals of gerontology. Series A, Biological sciences and medical sciences*, 50A(1), M28-M34. <https://doi.org/10.1093/gerona/50a.1.m28>
- R Core Team (2024). R: A Language and environment for statistical computing. (Version 4.4) [Computer software]. Retrieved from <https://cran.r-project.org>.
- Rolenz, E., & Reneker, J. C. (2016). Validity of the 8-Foot Up and Go, Timed Up and Go, and Activities-Specific Balance Confidence Scale in older adults with and without cognitive impairment. *Journal of rehabilitation research and development*, 53(4), 511-518. <https://doi.org/10.1682/JRRD.2015.03.0042>
- The jamovi project (2024). jamovi. (Version 2.6) [Computer Software]. Retrieved from <https://www.jamovi.org>.
- Van Laer, L., Dunlap, P. M., Vereeck, L., Hendriks, E., Sluydts, M., & Whitney, S. L. (2023). Fear avoidance beliefs, anxiety, and depression in healthy individuals and persons with vestibular disorders across cultures. *Frontiers in neurology*, 14, 1296411. <https://doi.org/10.3389/fneur.2023.1296411>
- Verdecchia, Daniel & Agustina, Monzón & Jaimes, Valentina & Paiva, Laércio & Oliveira, Fernando & T D, Carvalho. (2020). Correlation between timed up and go, usual gait speed and dizziness handicap inventory in elderly with vestibular disorders: a retrospective and analytical study. *Archives of Physiotherapy*. 10. 10.1186/s40945-020-00083-x.
- Whitney, S. L., Hudak, M. T., & Marchetti, G. F. (1999). The activities-specific balance confidence scale and the dizziness handicap inventory: a comparison. *Journal of vestibular research : equilibrium & orientation*, 9(4), 253-259.
- Zamysłowska-Szmytko, E., Politanski, P., & Jozefowicz-Korczynska, M. (2021). Dizziness Handicap Inventory in Clinical Evaluation of Dizzy Patients. *International Journal of Environmental Research and Public Health*, 18(5), 2210. <https://doi.org/10.3390/ijerph18052210>

ACKNOWLEDGEMENT

This project was supported by the Canadian Hearing Services - Global Partnership (#2022-GR3).