

Comparison of muscle activity during level straight walking on treadmill (fixed and self-paced) and overground (indoor and outdoor) among able-bodied and stroke participants

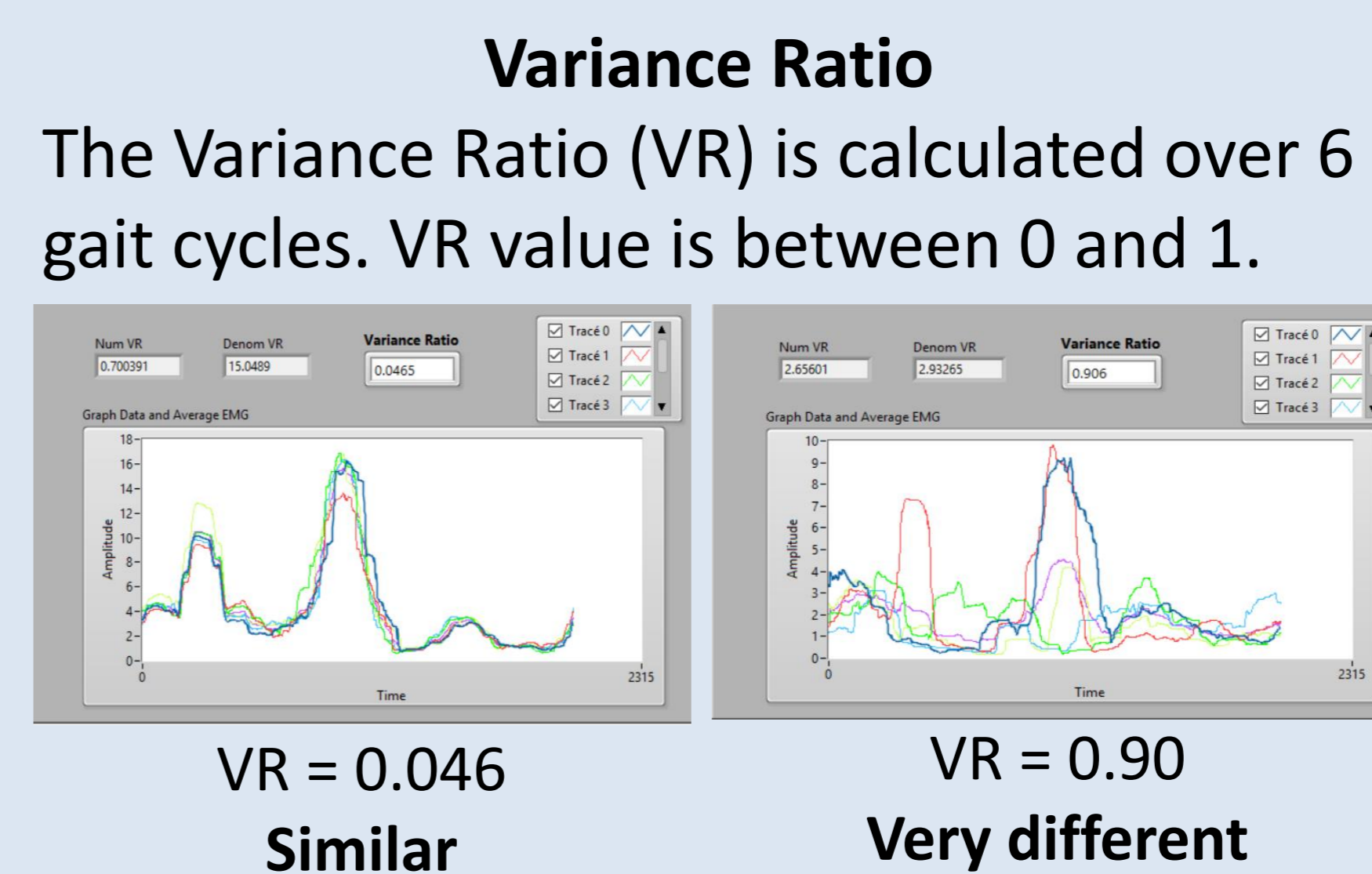
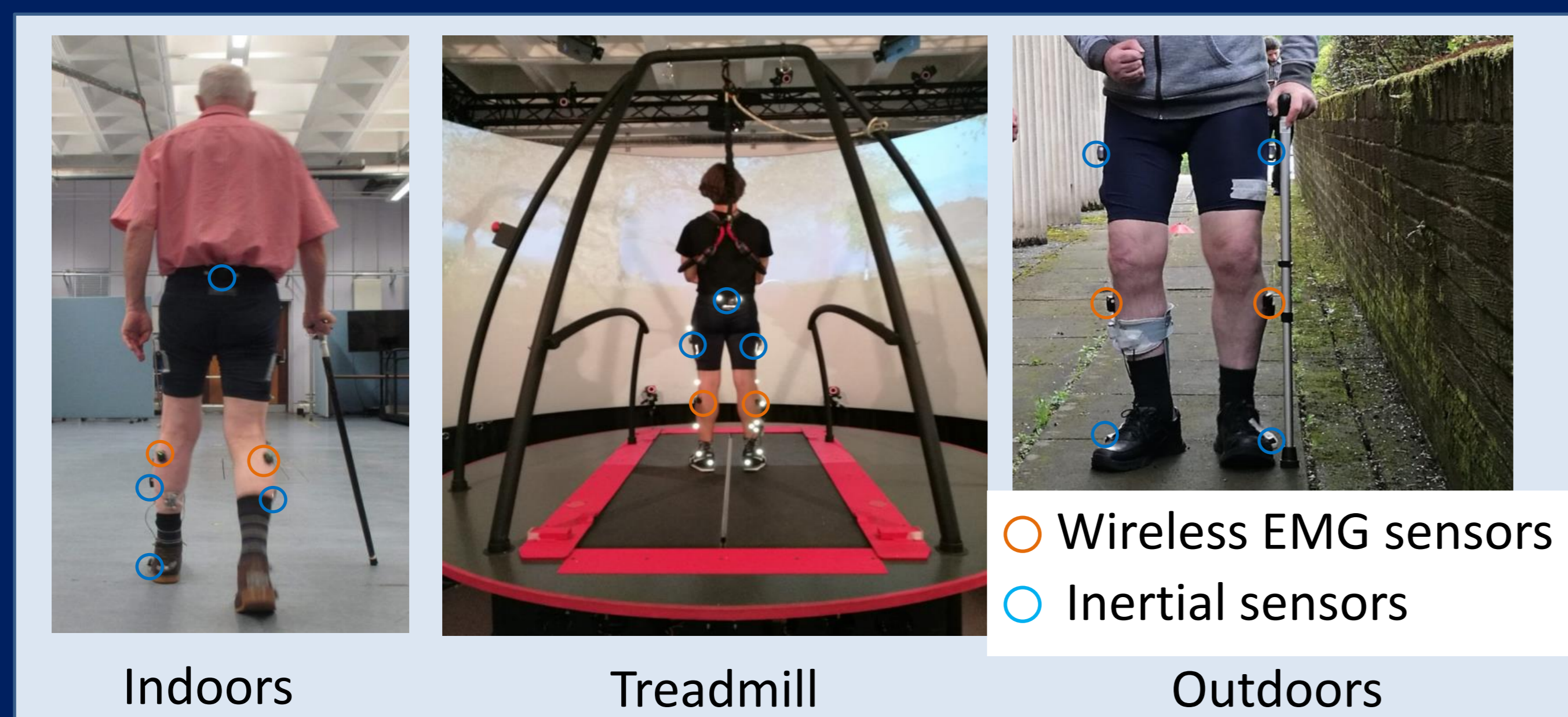
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Background

Self-paced treadmills automatically modify the belt speed according to the user's speed and may, therefore, provide a closer simulation of overground walking. This study aims to test this hypothesis by comparing the muscle activation patterns of treadmill (fixed and self-paced) and overground (indoors and outdoors) walking.

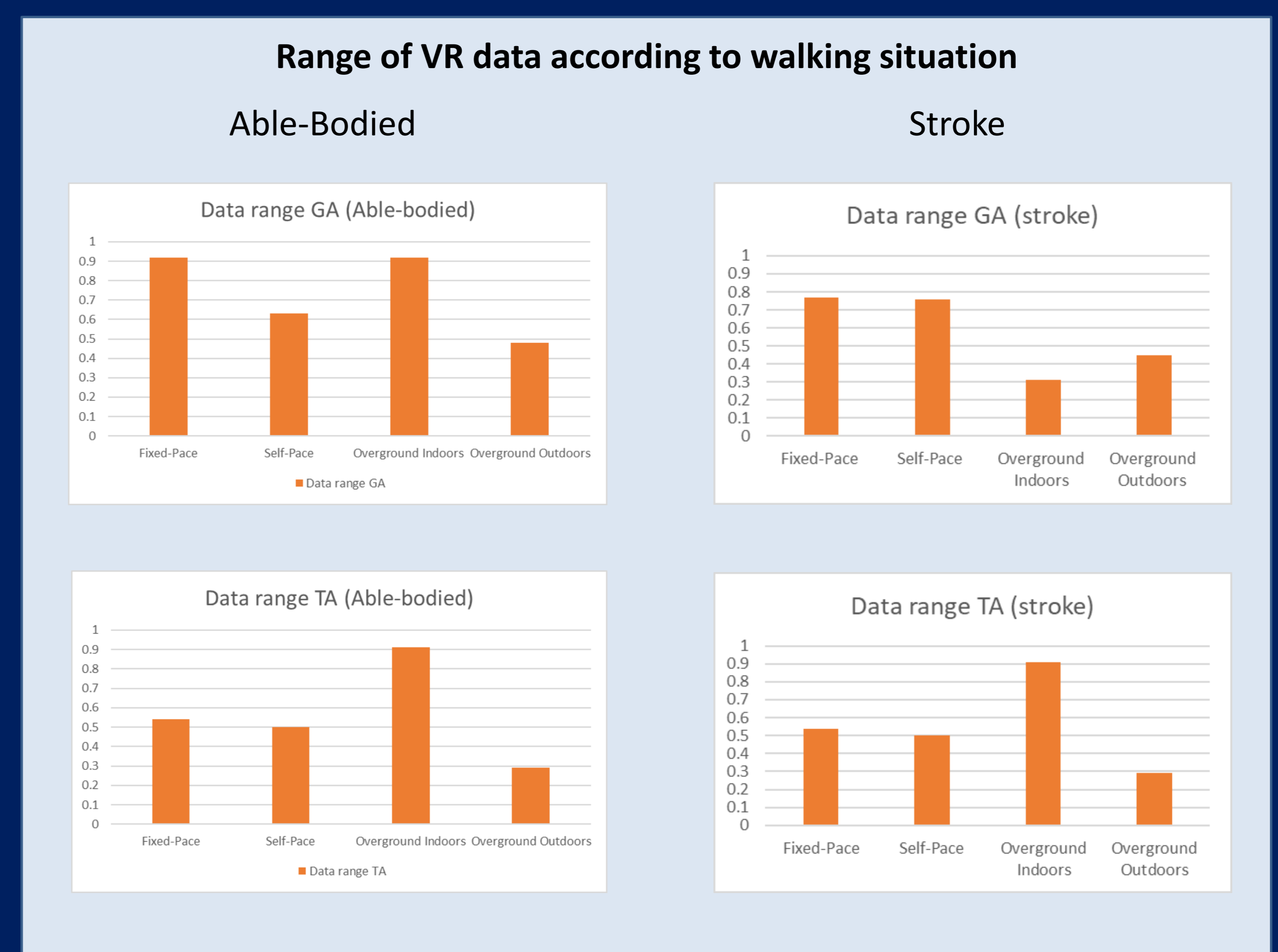
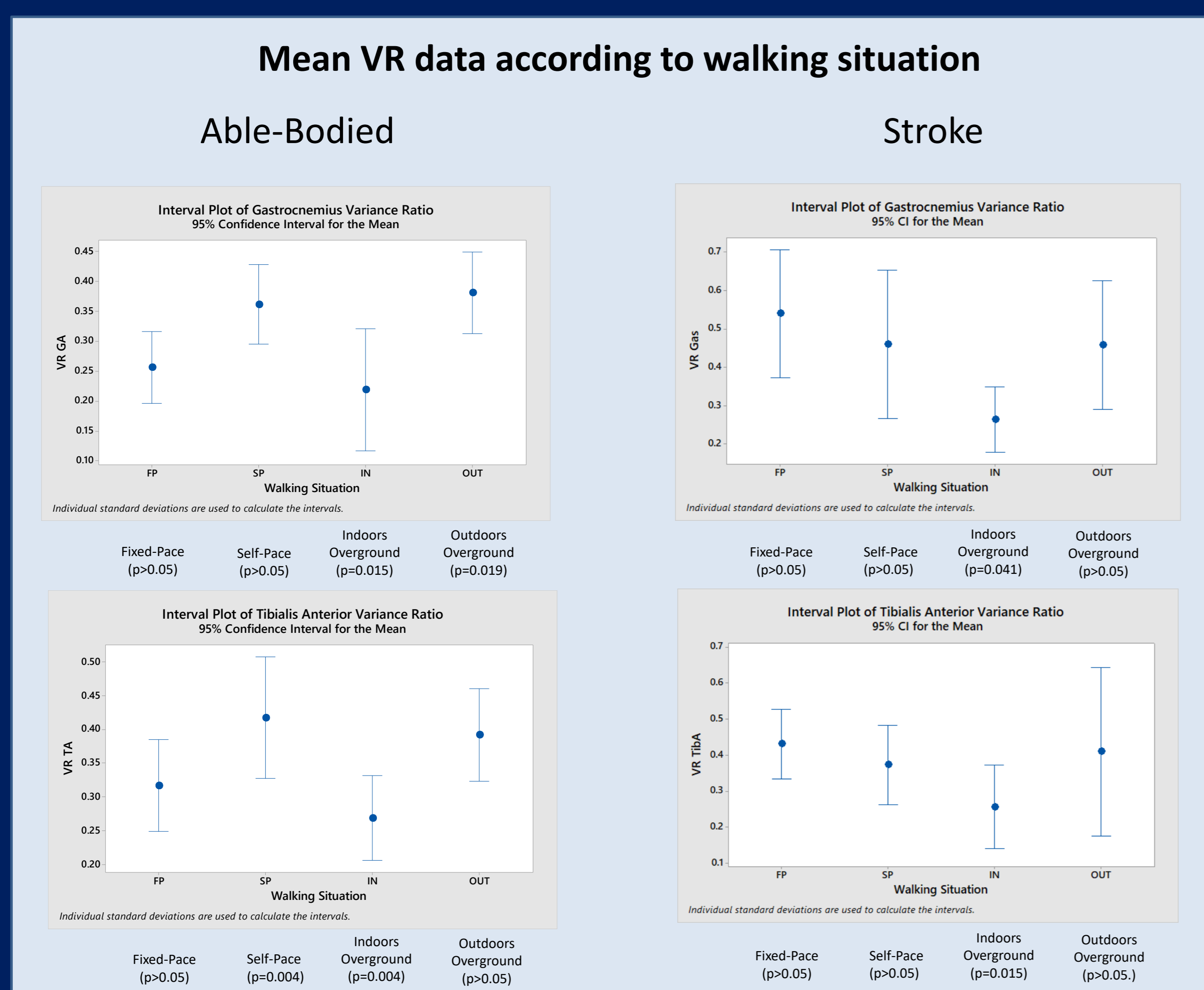
Method

Electromyography (EMG) surface electrodes integrated with inertial sensors (Delsys, Boston, USA) were attached over two lower leg muscle groups (tibialis anterior (TA) and gastrocnemius (GAS)) on both sides. Participants walked at their self-selected speed: outdoors, indoor, on a self-paced and a fixed-paced treadmill. The analysis of EMG pattern variability was done using the variance ratio (VR).



Results

16 able-bodied (7 males) and 8 stroke survivors (2 males) participated. Between 6 (overground) and 72 (treadmill) cycles per person were extracted for the EMG analysis. The pattern of indoor walking appeared to differ from outdoor and fixed-pace treadmill walking for able-bodied people, with a significantly ($p=0.004$) lower variability indoors. The able-bodied participant's TA presented significantly higher VR ($p=0.004$) during self-paced walking. The VR range of stroke participants were more like each other (0.29 to 0.91) than able-bodied (0.23 to 0.92).



Discussion

The differences of pattern in muscle activity (VR values and range) between treadmill and overground walking has implications for rehabilitation and require further testing. The similarity of VR values in the stroke participants suggest a lack of motor flexibility and may explain the lack of significant differences observed across the walk conditions.

Conclusion

This exploratory study has revealed some intriguing differences in muscle activity between the different methods typically used in gait training which should be tested by further exploration with a larger sample size.