METHODS

Design: The study used a test-retest design. All subjects were evaluated with the same protocol twice within a 7-day period.

Participants: Ten manual wheelchair users (MWU) with at least 1 year of wheeling experience were recruited. Wheelchair experience ranged from 1 to 32 years. Fifteen able-bodied individuals (AB) were also included but analyzed separately from MWU. All participants were between 18 and 65 years of age, and able to use a manual wheelchair without pain.

Procedure: MWU used their own wheelchairs for the study, while AB used a fitted elevation™ wheelchair (elevation™, Instinct Mobility, Vancouver, BC). The SmartWheel (SmartWheel™, Three Rivers Holdings, Mesa, AZ) was affixed to the dominant side of the subject’s wheelchair and used to collect data. The SmartWheel software was used to calculate key parameters that are considered clinically relevant: average peak normalized force, average push frequency, average push length, and average velocity. The testing orders of the 3 surfaces were randomized for all subjects and all sessions. Adequate rest was provided at any time during testing sessions to minimize fatigue.

Protocol: Data was collected in accordance with the SmartWheel clinical protocol, however multiple trials were collected for each of the three surfaces (tile, carpet and 5% gradient ramp). Subjects began trials from a stationary position and wheeled at a comfortable, self-selected speed for 10 seconds or 10 meters, whichever occurred first. Data was collected for 5 consecutive trials.

Data Analysis: For each parameter of each surface, the intra-session reliability was calculated using intraclass correlation coefficients: ICC2,1 (singe measures) and ICC2,k (average measures). The inter-session reliability was calculated using ICC2,1 with the first trial of each session. In addition, to ensure that stable intra-session measures were obtained for each wheeling parameter, ICC2,1 was also calculated based on the average of 5 trials for each parameter. ICC values were interpreted according to Munro’s classification of reliability: 0.26-0.49 reflects low correlation; 0.5 to 0.69 reflects moderate correlation; 0.7-0.89 reflects high correlation; 0.9-1.00 indicates very high correlation [2].

RESULTS
Overall, ICC values for MWU show excellent intrasession and intersession reliability for all parameters (ICC ranged from 0.8-0.98 and 0.7-0.97 respectively). Intrasession ICC values for AB parameters ranged from “moderate” to “very high” (ICC from 0.5-0.92). Intersession ICC values indicated “low” to “very high” (ICC from 0.25-0.9) depending on the parameter. For both MWU and AB, using the mean values from 5 trials increased both intrasession and intersession reliability.

DISCUSSION & CONCLUSIONS
Although collecting multiple trials in clinical practice requires more time, it may be justified by increasing the reliability of the SmartWheel clinical protocol. It is critical that clinical interventions or wheelchair prescriptions are based on data that are reliable, and not on measurement error. Therefore, it may be advisable to assess individuals (especially those with minimal wheeling experience) on multiple occasions before deciding on the effectiveness, of an intervention or settling, of a prescribed wheelchair configuration.

The SmartWheel clinical protocol is a reliable method for assessing wheeling parameters in MWU and is appropriate for evaluating changes in wheeling characteristics for MWU. When assessing AB, the SmartWheel clinical protocol showed lower intrasession and intersession reliability compared to MWU. This group would benefit most from taking the mean of repeated measures during their assessments to improve intrasession reliability.

REFERENCES

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