The test-retest agreement for walking speed with a one-week interval in subjects aged 65 to 80 years: a pilot study

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Background

Studies have investigated test-retest reliability of walking speed in adults within one testing session. This has limited application in a clinical setting where patients are seen over an extended period and experience a normal range of variability in performance of a skill that may well exceed that measured in one session. The purpose of this study was to determine the variability of an individual's walking speed from one week to the next. This information is necessary for clinicians to determine score bands (Harvill, 1991) for an individual's walking speed, which indicate the normal fluctuations of an individual's true walking speed.

Subjects

Twenty-one subjects between the ages 65 and 80 years.

Inclusion Criteria

- Live independently without assistance in the performance of functional activities and activities of daily living.
- Ambulate independently 150 feet (45.72 meters) without assistive device.
- Ability to follow instructions

Exclusion Criteria

- Lower extremity joint replacement within the past year
- Lower extremity amputation within the past year
- Parkinsonian gait, and/or stroke with lower extremity involvement within the past year.

TABLE 1. Descriptive statistics for the sample

	Males (n = 9)		Females (n = 12)	
	Mean	SD	Mean	SD
Age (yrs)	72.81	3.29	71.21	4.25
Height (cm)	178.08	8.37	162.03	5.56
Weight (kg)	93.49	19.23	74.28	14.53
BMI (kg/m2)	29.33	4.48	28.25	5.09

Data Collection

Subjects performed the 10-m walk test. Timing device for data collection was Lafayette Instruments Co. Timing Device (Model 54064) with 2 Infrared Sensors (Model 635011R). Three trials were performed on Week 1 and three trials were performed on Week 2 (at least 7 days after initial data collection). Means and 95% confidence intervals (95% CI) were calculated for walking speed factored by gender and measurement interval. Pearson correlations and intraclass correlation coefficients (ICC) calculated to determine within-session and between-session agreement for walking speed. A Bland-Altman plot was constructed to determine agreement of measures between the two sessions. Minimal Detectable Change (MDC) was calculated for z-values of 95% (MDC_{95}) and 90% (MDC_{90}).

Course set up

- Level walking surfaces
- Indoors and Outdoors.
- Straight line 20 meter walking strip
- 1st 5 meters: distance for acceleration
- Last 5 meters: distance for deceleration
- Middle 10 meters for timing
- Sensors at 5 meters and 15 meters

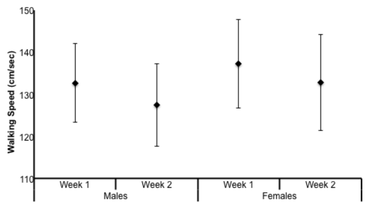

FIGURE 1. Means and 95% Confidence Intervals for walking speed

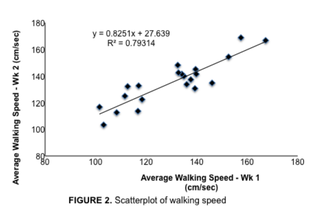

FIGURE 2. Scatterplot of walking speed

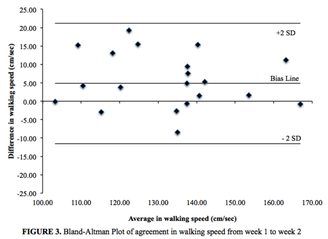

FIGURE 3. Bland-Altman Plot of agreement in walking speed from week 1 to week 2

Results

The overall mean for walking speed was 132.89 cm/sec (SD = 17.89). There were no differences in walking speed between genders or between measurement intervals (weeks). Pearson product-moment correlation between weeks was .89 (95% CI = .74 to .96). Within-session agreement (ICC) for Week 1 was .94 (95% CI = .87 to .97); and within-session agreement (ICC) for Week 2 was .98 (95% CI = .95 to .99); the agreement between sessions was .97 (95% CI = .95 to .99). The Bland-Altman plot showed there was no clinically important bias between the sessions. The MDC_{95} between sessions was 8.59 cm/sec and the MDC_{90} was 7.23 cm/sec.

Discussion

Harvill (1991) described the need for the calculation of score bands (Equation 1) to illustrate normal fluctuations in an individual's test score. A score band around obtained walking speeds can be calculated to estimate the range of the true scores for an individual patient or client, but should include a reasonable time interval between sessions to reflect the true variability of an individual's normal range. A clinician should be aware of this range, because if a subject exhibits walking speed outside of his or her normal range, there may be a change in health status that may require intervention. Minimal detectable change is inadequate to determine the normal fluctuations of test scores.

Equation 1. $[\bar{X} + (ICC)(X - \bar{X})] \pm (1)(sd)(\sqrt{1 - ICC})(\sqrt{ICC})$

Example

For a 72-year-old female whose walking speed was 114 cm/sec at her assessment, her normal range of walking speed using Equation 1 is between 110.91 cm/sec and 117.41 cm/sec for 68% of the time. For 95% of the time, the range of her walking speed is between 106.42 cm/sec and 121.07 cm/sec. These results are assuming the mean walking speed for a female between 70 and 79 years is 105.67 cm/sec with a standard deviation of 21.45 cm/sec.

Reference: Harvill LM. Standard Error of Measurement. Educational Measurement: Issues and Practice. 1991;10(2):181-189.