

Reliable Balance Measures for Individuals with Dementia

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- Older adults with dementia fall **2x** as often as healthy older adults.¹
- Outcome measures that assess balance in healthy adults may not be reliable in those with dementia due to memory issues that lead to difficulty comprehending instructions or repeating a sequence of movements.
- Clinicians should utilize balance tests that have been found to be reliable in this population to ensure accurate assessment of balance ability.

Reliability Assessment

- In total, **36** standardized balance measures were assessed and **10** are recommended based on reliability measures and comprehensiveness of balance components assessed.

Relative Reliability

- Intraclass correlation coefficient (ICC) thresholds were used to interpret inter-rater, intra-rater and test-retest reliability. ICC >0.90 was excellent, 0.80-0.89 was good, 0.70-0.79 was fair and an ICC <0.70 was poor.

Absolute Reliability

- Measured by standard error of measurement (SEM) and minimal detectable change (MDC).

Standard Error of Measurement (SEM)

- Measurement error associated with a single value and is expressed in the same units as the scale. The smaller the SEM, the greater the absolute reliability.

Minimal Detectable Change (MDC)

- Estimate of the smallest change in the score that can be detected beyond measurement error.

	Relative Reliability			Absolute Reliability	
	Inter-rater Reliability	Intra-Rater Reliability	Test-retest	SEM	MDC (95%)
A. COMMUNITY SETTING					
Groningen Meander Walk Test (sec)			0.58-0.97 ²⁶	0.98-3.73 ²⁶	2.71-10.35 ²⁶
mCTSIB			0.91 ²²	0.17 ²²	0.34 ²²
Spatiotemporal Gait Parameters			0.65-0.97 ^{17,21,25}	0.6-3.3 ²⁵	0.03-11.17 ^{17,25,26}
Step Test (reps)			0.87 ²²	1.24 ²²	2.42 ²²
Timed Up & Go Test (sec)	0.98 (0.93-0.99) ²⁸		0.87 ¹⁵ 0.76 ²² 0.72 (0.33-0.90) ²⁸	1.24 ²² 1.24 ²⁸	2.42 ²² 3.44 ²⁸
B. INSTITUTIONAL SETTING					
Berg Balance Scale	1 ²⁹			0.97 ²⁹	1.92 ²⁹
6-meter Walk Test	0.97 ³⁰			0.03 ²⁹	0.06 ²⁹
30 Second Chair Stand	1 ²⁹			0 ²⁹	0 ²⁹
C. MIXED SETTING					
Berg Balance Scale (Korean Version)	0.99 ³⁰		0.99 ³⁰	0.78 ³⁰ (inter-r) 1.36 ³⁰ (t-r)	2.18 ³⁰ (inter-r) 3.78 ³⁰ (t-r)
Groningen Meander Walk Test (Korean Version)					
Seconds	0.99 ³⁰		0.99 ³⁰	1.00 ³⁰ (inter-r) 1.36 ³¹ (t-r)	2.78 ³⁰ (inter-r) 3.78 ³¹ (t-r)
Step Count	0.99 ³⁰		0.99 ³⁰	0.76 ³⁰ (inter-r) 1.49 ³⁰ (t-r)	2.12 ³⁰ (inter-r) 4.13 ³⁰ (t-r)
Timed Up & Go Test					
All Severities			0.94 (0.92-0.97) ²³	2.48 ¹⁸ 2.12 (1.75-2.52) ¹⁵	5.88 ²³
Mild			0.96 (0.92-0.98) ²³	1.43 (1.06-1.79) ²³	3.96 ²³
Mild-Moderate				1.52 ¹⁸	
Moderate			0.94 (0.87-0.97) ²³	2.91 (2.10-3.61) ²³	8.07 ²³
Moderate-Severe				3.03 ¹⁹	
Timed Up & Go Test (Korean Version)	0.99 ³⁰		0.99 ³⁰	0.63 (inter-r) ³⁰ 1.27 (t-r) ³¹	1.75 (inter-r) ³⁰ 3.52 (t-r) ³¹

Assessment of Balance Components

- The Systems Framework for Postural Control (Horak et al. 2006) outlines **9 balance systems** required for the maintenance of postural control.
- Motor systems, anticipatory postural control* and *dynamic stability* were measured in the majority of outcome measures while *verticality* wasn't assessed in any.
- At most, a single outcome measure assessed **6** of the **9** balance components (BBS).

Tool	Anticipatory postural control	Cognitive processing	Dynamic stability	Functional stability limits	Motor system	Reactive postural control	Sensory strategies	Static stability	Verticality/orientation in space	Total components assessed (#)
BBS	✓		✓	✓	✓		✓	✓		6
GMWT	✓		✓		✓					3
Spatiotemporal gait parameters ^{17, 18, 24, 25}	✓		✓		✓					3
Step Test ²²	✓		✓		✓	✓				4
TUG	✓		✓		✓					3
6mWT ^{15, 25, 29}	✓		✓		✓					3
30-Second Chair Stand ²⁹	✓		✓		✓					3

Recommendations

Community Setting

- Spatiotemporal Gait Parameters
- Groningen Meander Walk Test
- TUG
- Step Test
- Modified Clinical Test of Sensory Interaction in Balance

Institutional Setting

- Berg Balance Scale (Korean)
- Groningen Meander Walk Test (Korean)
- TUG (English, Korean)

Mixed Setting

- 6-meter Walk Test
- 30 Second Chair Stand
- Berg Balance Scale

Take Home Messages

- Clinicians should use reliable outcome measures when examining balance in individuals with dementia to accurately measure falls risk.
- Multiple reliable standardized outcome measures may need to be utilized to comprehensively assess balance.