Establishing a Timed 25-Foot Walk Cut-Off Score to Identify Non-Fallers Among Persons with Multiple Sclerosis

Authors: Gianna K. Bracco, SPT1, Nadia L. Filippic, SPT1, Nicole M. Pla, SPT1, Annalisa Termini, SPT1, Laura B. Stella, PT, DPT, NCS2, Jennifer A. Ritz, PT, DPT3, Heather M. DelMastro4

1. Department of Physical Therapy at Quinnipiac University, Hamden, CT, USA
2. Mandell MS Center, Mount Sinai Rehabilitation Hospital, Trinity Health Of New England, Hartford, CT, USA
3. Department of Rehabilitation Medicine, Frank H. Netter MD School of Medicine at Quinnipiac University, North Haven, CT, USA
4. Department of Medical Sciences, Frank H. Netter MD School of Medicine at Quinnipiac University, North Haven, CT, USA

Background

Multiple sclerosis (MS) is a chronic neurodegenerative disease characterized by demyelination and multifocal plaques throughout the central nervous system (CNS) with some common symptoms including fatigue, weakness, impaired balance and coordination, and gait disturbances.1, 2 These impairments can affect the ability for persons with MS (PwMS) to participate in their daily activities, as well as increase their risk for falls.2 Recent studies have shown that over 50% of PwMS have experienced a fall and around 30-50% experience recurrent falls.3 There are many physical and psychological consequences associated with falls, making it critical to establish a measurement that can quickly identify fallers in PwMS. Gait speed has been shown to be a prominent contributing factor to fall risk in various populations including MS.4,5,6 Therefore gait speed may be used to determine PwMS at risk of falling utilizing the Timed 25-Foot Walk (T25FW).

Purpose

The aims of this study were:
1. To determine if the T25FW times are different between PwMS reporting at least one fall in the past 6 months (faller) compared to non-fallers.
2. To determine if the T25FW can detect PwMS at greater risk of falling by developing a quantifiable cut-off score for fall risk.

Hypothesis: the T25FW cut-off score will be a good identifier of PwMS who are at risk of falling

Materials and Methods

Participants:
- A convenience sample (n=173: 39 males, 134 females) of PwMS

Variables Collected:
- Demographics: age, gender, ethnicity, and race
- Disease Characteristics: disease duration and disability (Patient Determined Disease Steps; PDDS)
- Gait speed (T25FW)
- Self-reported faller status (≥ one fall in the past 6 months)

Statistical Analysis
- Comparison between fallers and non-fallers:
  - Age, disease duration, and the T25FW: Mann-Whitney U test
  - Gender: Pearson Chi-Square test
  - PDDS: Median test
- Receiver-operating-characteristic (ROC) curve was performed for the T25FW, to estimate the classification accuracy for fall risk.
  - The sensitivity, specificity, and area under the curve (AUC) were reported.
  - An optimal cut-off score was calculated using the Youden Index.
- Statistics were calculated using SPSS version 26.0.

Results

Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Non-fallers (n=78)</th>
<th>Fallers (n=95)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median (Range)</td>
<td>Median (Range)</td>
<td>p-value</td>
<td></td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>52.00 (21 - 73)</td>
<td>54.00 (23 - 75)</td>
<td>0.364</td>
</tr>
<tr>
<td>Gender (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males: n=19</td>
<td>Females: n=59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males: n=20</td>
<td>Females: n=75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnicity (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic or Latino: n=6</td>
<td>Not Hispanic or Latino: n=72</td>
<td>0.936</td>
<td></td>
</tr>
<tr>
<td>Hispanic or Latino: n=7</td>
<td>Not Hispanic or Latino: n=88</td>
<td>0.936</td>
<td></td>
</tr>
<tr>
<td>Race (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black or African American: n=9</td>
<td>White or Caucasian: n=88</td>
<td>0.555</td>
<td></td>
</tr>
<tr>
<td>American Indian or Alaska Native: n=1</td>
<td>White or Caucasian: n=82</td>
<td>0.555</td>
<td></td>
</tr>
</tbody>
</table>
| Disease Characteristics
| Disease Duration (yrs) | 10.75 (0.33 - 30.00) | 13.42 (1.75 - 40.00) | 0.070 |
| PDDS | 1.00 (0.00 - 6.00) | 3.00 (0.00 - 7.00) | <0.001* |
| Gait Speed | T25FW (seconds) | 5.13 (3.13-15.37) | 6.43 (3.48-70.82) | <0.001* |

*denotes p<0.05

Abbreviations: yrs; years; PDDS: Patient Determined Disease Steps; T25FW: Timed 25-foot walk

Table 2. Characteristics of T25FW cut-off score for predicting fallers

<table>
<thead>
<tr>
<th>Cut-off score (faller if ≥)</th>
<th>AUC</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Youden Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>T25FW</td>
<td>7.2175s</td>
<td>0.743</td>
<td>0.442</td>
<td>0.692</td>
</tr>
</tbody>
</table>

Abbreviations: AUC: Area under the curve; s: seconds; T25FW: Timed 25-foot walk

Discussion

- Fallers had higher level of disability and slower gait speed compared to non-fallers.
- PwMS scoring below the T25FW cut-off score of 7.2175 seconds are at a lower risk of falling.
- The high specificity of the T25FW cut-off score supports its use to identify non-fallers.
- The T25FW cut-off scores can be utilized by clinicians during initial evaluation to identify non-fallers helping to guide individualized goals and plans of care.
- Clinically this cut-off score is useful and relevant, as it is a quick and free test that can be done to rule out fall risk.

Conclusion

The results of this study provide clinicians with a means of utilizing the T25FW as a screen to classify PwMS as non-fallers in order to develop specific interventions to highlight balance impairments in order to ensure patient safety. Our hypothesis that the T25FW test will be a good identifier of fall-risk in PwMS, was rejected. However, in establishing a cut-off score of 7.2175 seconds, it can be determined that PwMS that lie below the established cut-off score can be identified as a non-faller.

Acknowledgements

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References