

Development and Psychometric Validation of a Cognitive–Motor Dual Task Function Scale for Stroke Survivors: A Pilot Study

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ABSTRACT

Introduction: Stroke survivors frequently experience significant cognitive-motor dual-task impairment, whereby simultaneous performance of motor and cognitive activities results in pronounced performance decrements in one or both tasks. This dual-task cost is a critical yet underassessed dimension of post-stroke disability, associated with elevated fall risk, reduced community ambulation, and diminished quality of life. Despite its clinical importance, no psychometrically validated, stroke-specific multi-domain instrument exists to measure cognitive-motor dual-task functional capacity. Existing single-task motor scales and brief cognitive screens fail to capture the attentional resource competition inherent in real-world activities of daily living.

Aim: This pilot study aimed to assess the feasibility, acceptability, and preliminary psychometric properties of a newly developed Cognitive-Motor Dual Task Function Scale (CMDTFS) in a sample of stroke survivors, informing item refinement before a main psychometric validation study.

Materials and Methods: A cross-sectional observational measurement study with a test-retest design was conducted with 20 community-dwelling and inpatient stroke survivors (minimum three months post-onset). The CMDTFS was administered across five functional domains: gait and locomotion, balance and postural control, functional mobility (Timed Up and Go), upper limb activity, and activities of daily living-relevant tasks. Each domain incorporated a single-task motor condition followed by a cognitive-motor dual-task condition using serial subtraction, verbal fluency, or working memory tasks. Outcome metrics included task completion time, Correct Response Rate (CRR), and the Dual Task Effect percentage

(DTE%). Concurrent validity was examined against the Montreal Cognitive Assessment (MoCA), Berg Balance Scale (BBS), and Barthel Index (BI). Test-retest reliability was assessed at 14 days using Intraclass Correlation Coefficients (ICC). Item analysis, internal consistency (Cronbach's alpha), Content Validity Index (CVI), and floor/ceiling effects were evaluated according to COSMIN guidelines.

Results: The CMDTFS demonstrated strong feasibility, with 90% of participants completing all five domains within 35 minutes and high patient acceptability scores (mean 4.2/5.0). Preliminary internal consistency was good (Cronbach's $\alpha=0.81$). Test-retest reliability was good to excellent across domains (ICC=0.76-0.91). The scale-level Content Validity Index was 0.92. Moderate-to-strong concurrent validity was established with MoCA ($r=-0.61$), BBS ($r=-0.58$), and BI ($r=-0.54$). Mean DTE% across domains ranged from 18.4% to 41.2%, indicating substantial dual-task costs. No significant floor effects were observed; minor ceiling effects were noted in two upper limb items requiring revision.

Conclusion: The CMDTFS demonstrated satisfactory feasibility, content validity, internal consistency, and test-retest reliability in this pilot sample of stroke survivors. These findings support the progression to a main psychometric validation study with an adequately powered sample. The CMDTFS offers a novel, clinically feasible instrument to quantify cognitive-motor dual-task functional capacity across multiple domains, with potential utility for fall risk stratification and as an outcome measure in cognitive-motor rehabilitation research.

Keywords: Balance, Dual-task effect, Functional mobility, Gait, Scale development, Stroke rehabilitation.

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