Rasch Analysis of the Wrist and Hand Fugl-Meyer: Dimensionality and Item-Level Characteristics

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BACKGROUND
• Upper extremity (UE) hemiparesis remains one of the most common impairments exhibited by survivors of stroke.1
• Despite weeks of rehabilitation, 50% of survivors of stroke retain some degree of UE weakness2 and up to 70% remain unable to use paretic UE functions in the months after stroke.3
• The UE section of the Fugl-Meyer (UE FM) remains the most well-established and widely-used4 assessment of UE impairment in stroke.5
• The psychometric reliability6-13 and validity14-18 of the UE FM have been shown using classical test theory techniques, findings which support its use in stroke rehabilitative trials6 and in clinical settings.5
• Recent investigations19 also demonstrate the strength of the UE FM items themselves. For example, it is now well established that the majority of UE FM items represent the unidimensional construct of UE motor ability19 and that the UE FM constitutes a useful tool for classifying post-stroke UE motor impairment as mild, moderate, or severe.5
• The proliferation of UE therapies targeting stroke survivors exhibiting minimal UE impairment20-23 has necessitated the continued development and evaluation of assessment tools providing high reliability, validity, and clinical utility.
• Such tools are necessary because (a) clinical time is valuable and (b) recent evidence23,24 demonstrates that the traditional understanding of UE motor recovery (i.e., proximal to distal, reflective then synergistic then isolated) is not absolute.
• To address the need for a quickly administered, rigorous, bedside measure of active UE motor ability the wrist stability, wrist mobility, and hand items of the UE FM (w/UE FM) were administered in a standardized manner to patients with minimal UE impairment.25

OBJECTIVE
To evaluate the item-structure of the wrist stability, wrist mobility, and hand items of the upper extremity Fugl-Meyer (w/UE FM) using Rasch analysis.

METHOD
• Design: Secondary analysis of existing w/UE FM data
• Setting: Psychometric Research Laboratory
• Participants: 150 mildly impaired survivors of stroke (94 men; mean age, 57.1 ± 11.4y; mean time since stroke, 19.5 months)
• Intervention: Not Applicable
• Main Outcome Measure(s): Analyses were conducted using latent parallel analysis, ordinal exploratory factor analysis, and partial credit model Rasch analyses. This procedure enabled psychometric evaluation of w/UE FM dimensionality, factor structure, and item-level characteristics.

INSTRUMENT
• The w/UE FM25 (Table 1) is a 12-item test of wrist and hand motor impairment derived from the larger, full-scale, UE FM.
  • Items are scored using a 3-point ordinal scale (0 = cannot perform; 1 = can partially perform; 2 = can perform fully).
  • Preliminary evidence supports the intrarater reliability, internal consistency, and concurrent validity of the w/UE FM25 when used with mildly impaired survivors of stroke.
  • Standardized directions for administration of the w/UE FM are available for scholarly and clinical use.25

RESULTS
• Latent parallel analysis (Figure 1) and ordinal exploratory factor analysis (Table 1) indicated that all w/UE FM items represent a single unidimensional construct, wrist and hand motor ability.
• Rasch analysis of data from 150 mildly impaired survivors of stroke revealed that participant data was compatible with the Rasch model and consistent with previous research.

DISCUSSION AND CONCLUSIONS
• The w/UE FM performs well when mildly impaired survivors of stroke exhibit the ability perform mass flexion and mass extension movements.
• The full-scale, UE FM may be preferable for survivors of stroke with lower abilities.

REFERENCES
[Please provide a list of references related to the topic of Rasch analysis and its application in the evaluation of UE FM items for survivors of stroke.]