POSTER 76

Title: Meaningful interpretation of Toronto Extremity Salvage Score in people with soft-tissue sarcoma using Rasch analysis

Authors: Kedar K. V. Mate, Robert Turcotte, Jose M. Iturregui, Nancy E. Mayo, Krista Goulding

Abstract:

Purpose: Toronto Extremity Salvage Score (TESS), since its publication in 1996 by Davies et. al., is one of the most widely used self-report measures in people undergoing limb salvage surgery for musculoskeletal tumors. TESS consists of 59 items (29 for upper extremity and 30 for lower extremity) querying difficulty experienced in the last week with tasks or activities. Each item is rated on a 5-point ordinal scale with a score of 1 representing 'impossible to do' and 5 'not at all difficult' with intermediate categories for 'extremely difficult', 'moderately difficult', and 'a little bit difficult' (scored 2, 3, 4, respectively). The summary score is calculated by summing these item scores and converted to percent of 100.

The TESS items were identified by a multidisciplinary team of healthcare providers and tested with people undergoing soft-tissue sarcoma (STS) surgery. The original scale demonstrated acceptable reliability, validity, and responsiveness, psychometric properties that are typically reported in developing a measure using classical test theory. Since its publication methods for developing measures have evolved particularly with respect how total scores are derived. In order to sum the ordinal categories proof of unidimensionality and hierarchical ordering of the items responses is needed. The purpose of this study is to estimate the extent to which items of the TESS fit a unidimensional linear construct, the Rasch model.

Methods: Rasch analysis was used on the data arising from the lower extremity TESS items completed by 162 people with STS prior to surgery. All analyses were done using RUMM 2030 software. Of the 30 lower extremity items, 18 related to activity limitations and 12 related to how these limitations affected participation in usual roles demonstrating multidimensionality and construct dependency. Rasch analysis proceeded through the usual steps needed to demonstrated threshold order, fit to the Rasch model, unidimensionality, lack of item response dependency, lack of differential item functioning (DIF), targeting, and discrimination (Person Separation Index). Rasch analysis coverts ordinal responses to an interval-like scale through a logit transformation. A range of -4 to +4 logits is optimal to reflect the range of the underlying construct and is equivalent to ±4 standard deviations on a standard normal distribution.

Results: 7 of 18 activity items had to be rescored as the categories for 'not at all', 'a little bit', and 'moderately difficult' were used inconsistently by the participants to reflect greater difficulty (disordered thresholds). One item did not fit the Rasch model (kneeling is) and was eliminated. Six items showed dependency: putting on shoes and socks, going up and downstairs, and walking in and outdoors. We chose to include the more challenging item from each of these pairs (shoes, upstairs, outdoors). No items showed DIF by age or sex. The final model included 14

items with a range on the logit scale of -9 to +4. All items fit the model (Chi-square: 34.2; df=28; p=0.19). The PSI was 0.89 indicating excellent suitability for individual discrimination. Approximately 25% of participants achieved the highest score pre-surgery (ceiling effect) and no one achieved the lowest score (floor effect).

Conclusion: The major change to the original lower extremity TESS was to separate activities and participation constructs because participation is at least somewhat dependent on activities. The R-LE-Activity-TESS achieved the same degree of precision with fewer items. The demonstration that the items fit a linear hierarchy can be used to estimate change over time accurately. For clinical use only those items around the current ability level need to be queried to identify change. For research purposes, the Rasch-based total score can be used mathematically to estimate change. There were many more item-thresholds at the low end of the ability hierarchy indicating that in order to comprehensively evaluate disability items of greater difficulty need to be included (e.g., running, jumping, cycling). Additional analyses are underway to evaluate the performance of the R-TESS post-surgery.

Table 1: Rasch lower extremity activity items in comparison to the original TESS

	TESS original	Rasch (Total score)
Total number of people	161	
Pre-surgery: mean (SD)	82.2 (20.5)	39.9 (10.1)
n [%] ceiling	37 [23]	41 [25.5]
n [%] floor	6 [3.7]	1 [0.1]

Table 2: Demographic characteristics of participants with lower extremity STS (n=163)

Variables	**Mean (SD) or n [%]**
Age: Women / Men	58.3 (15.5) / 54.3 (17.7)
Sex: Women / Men	73 [45] / 90 [55]
Side of tumor: left / right	81 [49.7] / 82 [50.3]
Use of walking aids	22 [13.5]
Cancer stage	
Primary M0 - 1	145 [89.0]
Primary M1 - 2	11 [6.7]
LR M0 - 3	5 [3.1]
Metastatic[$]	---
Employment	
Full time	46 [28.2]
Part time	11 [6.7]
Retired	52 [31.9]
Working with modified tasks	20 [12.3]
Other (self-employed, at home, prisoner, volunteer, on-leave without or with pay, student, temporarily laid-off etc.)	22 [13.5]
Comorbidities	
Hypertension	34 [20.9]
Osteoarthritis	11 [6.7]
Diabetes mellitus	16 [9.8]
Other types of Cancer	26 [16.0]
Low back pain	23 [14.1]
COPD*	8 [4.9]
Anemia	8 [4.9]
Other comorbidities[$]	---

* COPD: chronic obstructive pulmonary disease

[$] Cells less than 5 are not reported: metastasis, comorbidities (including renal, liver, ulcer, rheumatoid arthritis, congestive heart failure, myocardial infraction, cardiovascular accident, depression).

Figure 1: Threshold map of 14 final items in the model

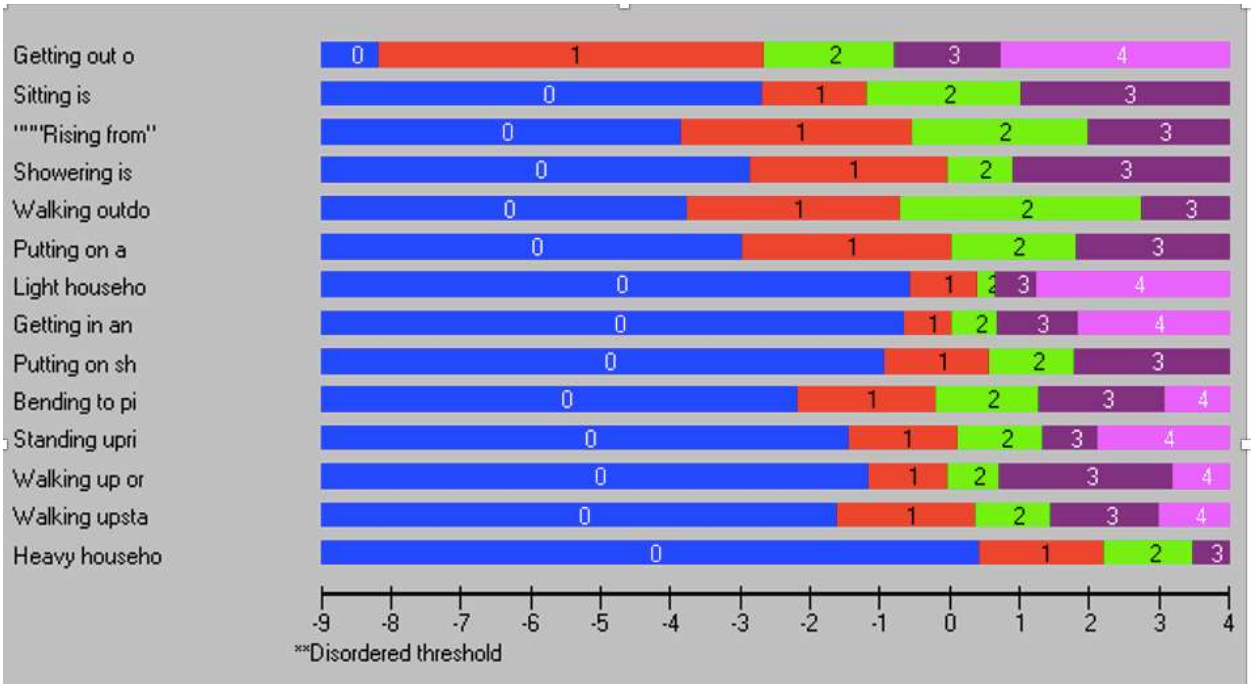

Figure 2: Item map

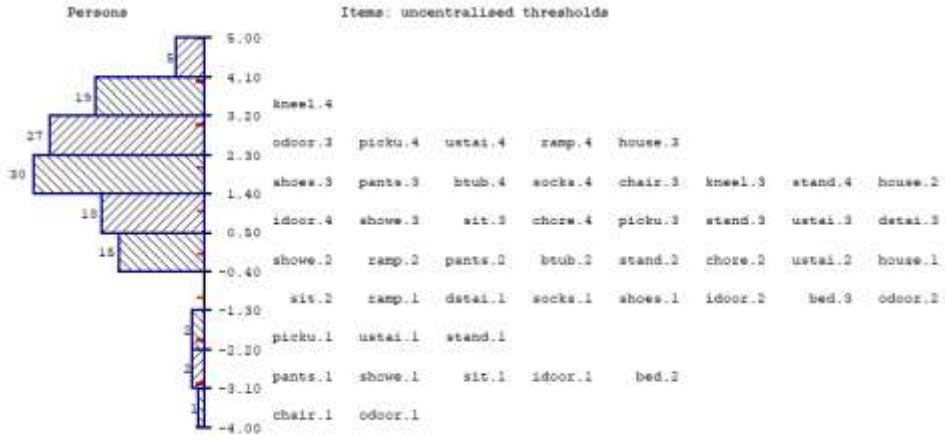

Figure 3: Patient-item distribution