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Construct Validity of the Swedish Version of the Revised Piper Fatigue Scale in an Oncology Sample—A Rasch Analysis

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ABSTRACT

Objectives: Fatigue is a common and distressing symptom in cancer patients due to both the disease and its treatments. The concept of fatigue is multidimensional and includes both physical and mental components. The 22-item Revised Piper Fatigue Scale (RPFS) is a multidimensional instrument developed to assess cancer-related fatigue. This study reports on the construct validity of the Swedish version of the RPFS from the perspective of Rasch measurement. **Methods:** The Swedish version of the RPFS was answered by 196 cancer patients fatigued after 4 to 5 weeks of curative radiation therapy. Data from the scale were fitted to the Rasch measurement model. This involved testing a series of assumptions, including the stochastic ordering of items, local response dependency, and unidimensionality. A series of fit statistics were computed, differential item functioning (DIF) was tested, and local response dependency was accommodated through testlets. **Results:** The Behavioral, Affective and Sensory domains all satisfied the Rasch model expectations. No DIF was observed, and all domains were found to be unidimensional. The Mood/Cognitive scale failed to fit the model, and substantial multidimensionality was found. Splitting the scale between Mood and Cognitive items resolved fit to the Rasch model, and new domains were unidimensional without DIF. **Conclusions:** The current Rasch analyses add to the evidence of measurement properties of the scale and show that the RPFS has good psychometric properties and works well to measure fatigue. The original four-factor structure, however, was not supported.

Keywords: cancer-related fatigue, Rasch analysis, Revised Piper Fatigue Scale.

Introduction

Fatigue is common and can be very distressing in cancer patients due to both the disease and its treatments [1]. The concept of fatigue is multidimensional and includes both physical and mental components and has impact on physical energy levels as well as the patient's social life [2,3]. The Revised Piper Fatigue Scale (RPFS) is a multidimensional instrument developed to assess cancer-related fatigue and is one of the most widely used instruments internationally [4]. The RPFS was developed within a theoretical framework known as the Integrated Fatigue Model. The theory encompasses factors, of subjective and objective character, that are assumed to affect the development and manifestations of fatigue [5].

The RPFS has coverage of fatigue domains in 22 items divided into four subscales: Behavioral/Severity, Affective meaning, Sensory, and Cognitive/Mood [6,7]. It also contains open-ended questions to assess patients' beliefs about what contributes to their fatigue and what they do to alleviate their fatigue. Subscales and total score range from 0 to 10 in the original version, with higher values indicating more intense fatigue. To date, the RPFS has been translated into Chinese [8] and Greek [9] and validated for use in France [10], The Netherlands [11], Brazil [12], and Italy [13,14].

Swedish Version of Piper

In 2007, the RPFS was translated and culturally adapted for use in Sweden [15]; however, no psychometric evaluation was performed at that time. Before initiating later psychometric assessments, the Swedish version was reevaluated in cognitive interviews with 29 cancer patients. Based on comments and suggestions made by patients in the cognitive interviews, some changes were made to earlier item translations, time frame ("now" to "during the past week"), and response scale (0–10 to 1–10). The psychometric evaluation included content and concurrent validity as well as internal consistency including exploratory factor analysis and multitrait scaling analysis. The factor analysis failed to support a four-dimensional model of fatigue as conceptualized in the original RPFS, but rather support was found within a three-factor solution [16]. Validation studies of other language versions of the RPFS have reported similar results [13].

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Table 1 – Demographic characteristics of the study group (n = 196).

Characteristic	n (%)
Sex	
Women	133 (68)
Men	63 (32)
Age (y)	
<60	79 (40)
61–70	74 (38)
>70	43 (22)
Site of radiotherapy	
Breast	109 (56)
Pelvic	56 (28)
Thorax	9 (5)
Head and neck	22 (11)

Furthermore, to justify the use of interval-level scores, further assessments of the construct validity of the RPFS are needed with appropriate techniques. The aim of this study was to examine the internal construct validity of the Swedish version of the RPFS using Rasch analysis.

Methods

Setting and Patients

Data for this analysis were collected from patients undergoing curative radiation therapy, with or without concomitant chemotherapy treatment, within two oncology outpatients' settings. Patients were eligible when they were planned to undergo radiotherapy against breast, pelvic, thorax, or head and neck. The patients answered on their level of fatigue after 4 to 5 weeks of radiotherapy. Within a 3-month period, 300 patients were informed on the study and were sent the questionnaire by mail. Evaluable questionnaires were completed and returned from 65% of the patients (n = 196), as described elsewhere [16]. The Affective meaning subscale had the highest ratings of missed items (n = 14). Characteristics of study participants are shown in Table 1.

Rasch Analysis

Data from the scale were fitted to the Rasch measurement model [17]. This involved testing a series of assumptions, including the stochastic ordering of items, local response dependency, and unidimensionality [18]. Stochastic ordering is evaluated through fit to the model, which reflects a probabilistic Guttman ordering [19]. A series of fit statistics are used to indicate adequacy of fit, and their ideal values are shown at the bottom of the summary fit table (Table 2).

The overall summary statistics (item trait interaction), with standardized mean person and item fit, was evaluated by using χ^2 statistics with nonsignificant χ^2 probability values. A significant χ^2 value indicates that the hierarchical ordering of the items varies across the trait being measured (i.e., fatigue), which comprise the required property of invariance. The standardized mean values of the person and item fit residual by a mean ± SD score of 0.0 ± 1.0 indicates a good fit. Values outside this range indicate problems and render further examination of the individual fit of persons and items residuals. A nonsignificant χ^2 probability value and standardized fit residuals of between −2.5 and +2.5 (99% confidence interval) indicate adequate fit of individual persons and items residuals [20]. A good fit to the Rasch model would expect that for each item of the Piper scale, persons who are severely affected by fatigue would rate higher scores whereas persons who are less affected would rate lower scores. To examine the category function of each item, the threshold ordering was analyzed. A threshold is the point between two categories in which either response is equally probable. When disordered thresholds occur, the items can be rescored by collapsing the categories [21].

The process of Rasch analysis also allows for an investigation of differential item functioning (DIF) [22]; the response to an item (dichotomous or polytomous), given the same level of the trait, should not differ across group membership such as diagnosis. The presence of DIF can be adjusted by "splitting" items in the latter case such that, for example, when there are two diagnostic groups, an item becomes two items, one for each diagnosis, with structural missing values for the excluded diagnosis. A reliability index (Person Separation Index) is also reported.

Local response dependency is where items are linked in some way, for example, two items asking about the distance walked,

Table 2 – Fit of the Revised Piper Fatigue Scale to the Rasch model.

Analysis no.	Name	Item residual*	Person residual*	χ^2		Unidimensionality		
				Value	P	PSI	test %	LCI
1	Behavioral	0.19 ± 2.24	−0.65 ± 1.36	10.20	0.60	0.94	2.6	0.0
2	Affective	−0.09 ± 1.52	−0.59 ± 1.23	12.19	0.07	0.91	7.8	4.4
3	Sensory	0.30 ± 1.89	−0.68 ± 1.38	15.13	0.13	0.93	7.6	4.2
4	Mood/Cognition	0.45 ± 1.23	−0.46 ± 1.31	12.16	0.43	0.90	12.1	9.5
5	Cognition	0.36 ± 0.76	−0.61 ± 1.07	8.36	0.21	0.88	6.1	2.7
6	Mood	0.14 ± 0.98	−0.70 ± 1.20	4.70	0.58	0.86	4.3	1.0
7	Initial 22 items	0.61 ± 2.60	−0.43 ± 2.11	127.10	0.00	0.96	25.9	22.6
8	Rescored	0.48 ± 2.37	−0.48 ± 2.09	121.75	0.00	0.96	25.9	22.6
9	Five testlets	0.37 ± 1.40	−0.46 ± 1.18	8.36	0.59	0.91	6.2	2.8
10	12-item form, four testlet solution	0.26 ± 1.55	−0.44 ± 1.08	7.95	0.44	0.91	8.7	5.3
	Ideal values	0.0 ± <1.4†	0.0 ± <1.4		>0.05‡	>0.85		(LCI <5%)

LCI, lower confidence interval; PSI, Person Separation Index.

* Mean ± SD.

† May be higher when unequal length testlets present.

‡ Bonferroni adjusted.