Support Care Cancer (2010) 18:481–490
DOI 10.1007/s00520-009-0697-0

ORIGINAL ARTICLE

Validation of the Portuguese version of Functional Assessment of Cancer Therapy-Fatigue (FACT-F) in Brazilian cancer patients

Neli Muraki Ishikawa · Luiz Claudio Santos Thuler · Alessandra Grasso Giglio · Clarissa Seródio da Rocha Baldotto · Carlos José Coelho de Andrade · Sophie Françoise Mauricette Derchain

Received: 23 September 2008 / Accepted: 7 July 2009 / Published online: 23 July 2009

Abstract
Goals of work The purpose of this study was to validate the Portuguese version of the Functional Assessment of Cancer Therapy-Fatigue (FACT-F) in order to establish its assessment properties, including validity and reliability in a sample of Brazilian cancer patients.
Materials and methods Two hundred seventy patients with different types of cancer were included for this study; the mean age was 50.5 years. The reliability was assessed by internal consistency and reproducibility. Construct validity was assessed through convergent validity and discriminant validity. Convergent validity was examined by comparing the FACT-F to the SF-36. Discriminant validity of the FACT-F evaluated the ability of the scale to differentiate defined groups, discriminating patients according to Eastern Cooperative Oncology Group Performance Status and different stages of disease.
Main results FACT-F had high internal consistency (Cronbach α coefficient was 0.78 for physical well-being, 0.68 for social/family well-being, 0.75 for emotional well-being, 0.74 for functional well-being, 0.91 for fatigue, and 0.92 for total FACT-F). The range of test–retest intraclass correlation was from 0.72 to 0.91 ($p<0.0001$). The Pearson product correlation revealed good correlations between the total FACT-F and subscales of the SF-36 in most dimensions, ranging from $r=0.51$ to $r=0.76$, except for SF-36 physical ($r=0.31$). The positive correlations between the SF-36 vitality scale and FACT-F total ($r=0.76$) and the fatigue subscale ($r=0.77$) support the convergent validity.
Conclusions The Portuguese version of FACT-F is a reliable and valid instrument to assess quality of life and fatigue, representing a valid tool to screen cancer-related fatigue in Brazilian cancer patients.

Keywords Fatigue · Quality of life · FACT-F · Questionnaire · Cancer

N. M. Ishikawa (✉)
Physical Therapy Department,
Brazilian National Cancer Institute-INCA,
Rua do Rezende, 128,
Centro-Rio de Janeiro, RJ 20231-092, Brazil
e-mail: nelimuraki@gmail.com

L. C. S. Thuler
Federal University of the State of Rio de Janeiro-UNIRIO,
Rua Mariz e Barros, 775,
Maracanã-Rio de Janeiro, RJ 20270-004, Brazil
e-mail: lthuler@gmail.com

A. G. Giglio
Hospital of Cancer II, Brazilian National Cancer Institute-INCA,
Rua Equador, 831,
Santo Cristo-Rio de Janeiro, RJ 20220-410, Brazil
e-mail: laxgiglio@bol.com.br

C. S. d. R. Baldotto · C. J. C. de Andrade
Clinical Oncology Department,
Brazilian National Cancer Institute-INCA,
Praça da Cruz Vermelha, n°23,
Centro-Rio de Janeiro, RJ 20230-130, Brazil

C. S. d. R. Baldotto
e-mail: cbaldotto@gmail.com

C. J. C. de Andrade
e-mail: carlosj@inca.gov.br

S. F. M. Derchain
Department of Obstetrics and Gynecology,
Campinas State University,
Rua Antônio Hossri, 629 Cidade Universitária,
Campinas, São Paulo 13083-370, Brazil
e-mail: derchain@fcm.unicamp.br

Introduction

Fatigue is one the most frequently reported symptoms accompanying cancer and its treatment [1]. In a recent and large study with 462 cancer patients receiving chemotherapy, Yamagishi et al. [2] found fatigue in 23% (severe fatigue 8.2%, moderate 15%). Mota et al. [3] studied fatigue in São Paulo (Brazil) with 584 cancer patients, 184 caregivers, and 189 undergraduate nursing students with the Brazilian Piper Fatigue Scale. Mild, moderate, and severe fatigue in patients were reported by 73 (12.5%), 167 (28.6%), and 83 (14.2%) patients, respectively. The level of fatigue experienced by the Brazilian patients was 4.6; the level of fatigue experienced by the caregivers of cancer patients was 4.2.

Fatigue has a negative effect or impact on health-related quality of life [4] and has a relationship with anxiety and depression [5, 6], pain [7, 8], sleep quality [9], and ability to carry on daily activities [7].

At a research level, the assessment of fatigue is necessary to evaluate treatments. It is also necessary for the design of new approaches and new ways to monitor the effectiveness of interventions, for the improvement of clinicians' knowledge and awareness of patients' needs, and for the development of appropriate strategies for individual patient care [9].

Cancer-related fatigue may be evaluated by specific one-dimensional or multidimensional instruments. In a recent systematic review [10], 14 fatigue-evaluating scales were found; the most common questionnaires were: *Functional Assessment of Cancer Therapy-Fatigue* (FACT-F), *European Organization for Research and Treatment of Cancer Quality of Life Questionnaire* (EORTC QLQ C30; Fatigue subscale) and it *Fatigue Questionnaire* (FQ).

The currently validated questionnaires of fatigue in Brazil are the Chalter Fatigue Questionnaire [11] and Piper Fatigue Scale [3]. The growing number of validated instruments in the country in the last 2 years reflects the importance of this topic.

The Functional Assessment of Chronic Illness Therapy (FACIT) measurement system is a collection of health-related quality of life questionnaires targeted to the management of cancer and other chronic illnesses (http://www.facit.org). The FACIT system [12, 13] includes six scale categories: general measures (e.g., Functional Assessment of Cancer Therapy-General (FACT-G)), cancer-specific measures (e.g., FACT-C, which is a scale specific to patients with colorectal cancer), cancer-specific symptom indices, treatment-specific measures, symptom-specific measures (e.g., FACIT-Fatigue, etc.), and noncancer-specific measures (e.g., Functional Assessment of Human Immunodeficiency Virus Infection, Functional Assessment of Multiple Sclerosis). The FACIT measurement system, under development since 1987, produced its fourth version in November 1997 [14]. The core of the FACIT system is the Functional Assessment of Cancer Therapy-General [15], a 27-item general version of the questionnaire, which serves as a foundation to the questions, with an added scale to address specific problems related to a particular disease site, treatment, or symptom [12]. The first version of the FACT-G had 28 items, while its fourth version dropped the item "Relationship with Doctor." These questionnaires were developed in North America, and many have been translated into almost 45 languages. One of the strengths of this ongoing translation project is its use of input from patients, linguists, psychologists, and physicians internationally to assure that the wording of version 4 is more cross-culturally relevant and more sensitive to measuring the psychosocial impact of illness in cultures outside the USA [13].

FACT-F [16] was specifically developed to measure fatigue associated with anemia in cancer populations. Its Fatigue Subscale was developed between May 1994 and October 1994 and validated in 1997 with American cancer patients. The FACIT-F (version 4) is a 40-item compilation, subdivided into four primary dimensions of quality of life (QOL) domains with the 27-items of FACT-G: physical well-being (seven items), social and family well-being (seven items), emotional well-being (six items), and functional well-being (seven items) and 13 fatigue-related questions. The FACIT-Fatigue Scale has also been validated in the general population [17] and in patients with rheumatoid arthritis [18] and psoriatic arthritis [19]. In patients with cancer, the FACIT-Fatigue scale showed excellent internal consistency and reliability, differentiating patients by hemoglobin level and patient-rated performance status [16].

Accurate assessment of QOL, including the component expressed as fatigue or influenced by fatigue, is important when evaluating comparative treatments, making decisions about future treatments, and in palliative care [16]. The value of accurate QOL assessment is twofold: (a) it allows for an immediate understanding of an individual patient's current status (making it a potentially useful intervention tool); and (b) it allows for measurement of QOL change over time, making it a useful outcome tool [20].

The FACIT translation methodology attempts to attain the five dimensions of equivalence, namely: semantic/linguistic, content, concept, criterion, and technical dimensions, in cross-cultural translation [21].

The FACT-G was originally designed in English and was submitted to a Portuguese translation, which included two forward translations, one reconciled version, a back-translation of the reconciled version, and four independent reviews by bilingual experts. There was an equally balanced representation from Brazil and Portugal, with one forward translator and two reviewers from each

country. A common version in the Portuguese language was developed for use in both Brazil and Portugal [22, 23], which still needs to be validated for the Brazilian population.

This validation study of the FACT-F in the Portuguese language was chosen due to its applicability in several areas. When this study was initiated, there were no publications on any validated instrument to measure fatigue in Brazil. The purpose of this study was to validate the Portuguese version of the FACT-F in Brazil and establish the assessment properties, including validity and reliability, in a sample of Brazilian cancer patients.

Patients and methods

The validity of FACT-F was established by evaluating construct validation (convergent and discriminant validities). The convergent validity was examined by comparing the FACT-F to the MOS 36-Item Short-Form Health Survey SF-36 [24, 25]; both instruments measure health-related QOL. The SF-36 is a known valid and reliable QOL instrument and was validated in Brazil [26]. Discriminant validity of the FACT-F evaluated the ability of the scale to differentiate defined groups, discriminating patients according to Eastern Cooperative Oncology Group (ECOG) Performance Status [27], and different stages of disease. The reliability was assessed by internal consistency and reproducibility.

The minimum sample size suggested to establish the validity of a scale ranges from three to 20 times the number of variables [28]. Thus, the number of participants in the current study (n=270, 6.8 times the 40 variables) falls within the recommended range of minimum sample size for conducting this study.

The reproducibility of the test was evaluated in patients that returned to the Brazilian National Cancer Institute for routine consultations or treatment or to be submitted to further exams in a period of 3 to 14 days, when the retest was performed. A total of 85 patients were included in this study, a number higher than the minimum recommended sample size for test–retest reproducibility, which is at least 50 subjects [29, 30].

This study was approved by the Research Ethics Committee of the Brazilian National Cancer Institute; participation was voluntary, and a written informed consent was obtained before the application of the questionnaires. Eligible oncology patients were asked to participate in an interview designed to elicit a variety of information using a structured interview format pertinent to sociodemographic information. Disease and treatment information was also collected from the patient's medical file. The mode of administration of the FACT-F (self-administration versus read in interview) was registered in 270 cases.

Study patients were selected from the Oncology Department of the Brazilian National Cancer Institute (INCA). Data were collected between September 2005 and June 2006. The inclusion criteria were to be 18 years of age or older and to be in cancer treatment with chemotherapy or hormone therapy. Exclusion criteria included: pregnancy; subjects with more than one diagnosis of cancer; and patients with a psychiatric diagnosis. Depression was not evaluated in these patients, and it is possible that depressive patients were included.

Two hundred seventy-six consecutive patients were enrolled in this study, but six patients refused to participate; reasons for that include lack of time or feeling of illness. The final validation sample consisted of 270 participants, of whom 201 (74.4%) were women, of whom 146 (54.1%) were married. The mean age of the patients was 50.5 years, with a range of 19–82 years; 141 (52.2%) were white, and 164 (60.7%) had attended ≤8 years of formal education. Patients represented a broad spectrum of disease, and the majority had diagnosed breast cancer (50%), had stage III (37.0%), and had performance status 1 (54.8%). All patients were currently undergoing chemotherapy, and 32.2% were in radiotherapy. Demographic and clinical information are available in Table 1. Eighty-five patients were included in reproducibility tests.

Instruments

The validation packet of questionnaires administered to all participants included the FACT-F [16], MOS 36-Item Short-Form Health Survey (SF-36) [24, 25], and Eastern Cooperative Oncology Group Performance Status Rating [27].

FACT-F [16, 20] version 4 consists of a 40-item self-report instrument that includes 40 Likert-type items in four scales that assess quality of life across the domains of physical well-being (seven items), which is the patient's actual physical experience of a disease and/or treatment, including disease symptoms and treatment side effects; social/family well-being (seven items), which encompasses activities with and support from family and friends; emotional well-being (six items), which refers not only to emotional distress but also to positive well-being or life happiness; functional well-being (seven items), which refers to a person's ability to engage in the usual basic activities of daily living; and one scale with 13 items that assess fatigue. Subjects were asked to respond to each item with a score from 0 to 4, where 0 = not at all, 1 = a little bit, 2 = somewhat, 3 = quite a bit, and 4 = very much. The FACT-G first version had 28 items, and its fourth version dropped the item "Relationship with Doctor".

In scoring the FACT-F, the possible range of scores is from 0 to 160. A higher score indicates a higher level of QOL, and high scores in the fatigue subscale correspond to

Table 1 Demographic and clinical characteristics of the validation sample (N=270)

Sample characteristics	Number	Percent
Age		
Mean ± SD (range)	50.5±11.8 (19–82)	
Gender		
Female	201	74.4
Male	69	25.6
Race/ethnicity		
White	141	52.2
Black	51	18.9
Asian	2	0.7
Mulatto	76	28.2
Marital status		
Married	146	54.1
Separated/divorced	33	12.2
Single	56	20.7
Widowed	35	13.0
Educational level		
≤8 years	164	60.7
9–11 years	72	26.7
>11 years	34	12.6
Disease site		
Breast	135	50.0
Colorectal	42	15.5
Lymphoma	33	12.2
Lung	18	6.7
Sarcoma	13	4.8
Stomach	7	2.6
Testicle	5	1.9
Others[a]	17	6.3
Stage		
I	10	3.7
II	74	27.4
III	100	37.0
IV	86	31.9
Performance status		
0 (Fully ambulatory without physical symptoms)	85	31.5
1 (Fully ambulatory with some symptoms)	148	54.8
2 (Requiring <50% awake time to rest)	30	11.1
3 (Requiring >50% awake time to rest)	6	2.2
4 (Bedridden)	1	0.4
Treatment		
Surgery	145	53.7
Chemotherapy	270	100.0
Radiotherapy	87	32.2
Hormone therapy	11	4.1

[a] Others: head and neck (4), myeloma (3), Ewing/primitive neuroectodermal tumors (2), melanoma (3), bladder (3), thymoma (1), pancreas (1)

a lower level of fatigue. The physical well-being, social/family well-being, emotional well-being, functional well-being, fatigue subscales, and the FACT-F total score have 0 as the lowest possible score. The highest possible score is 28 for the physical well-being, social/family well-being, and functional well-being subscales; 24 for the emotional well-being subscale; 52 for the fatigue subscale; and 160 for the FACT-F total score. To achieve this, we reverse the response scores on negatively phrased questions and then add the item responses. In cases where individual questions were skipped, scores were prorated using the average of other answers in the scale. The total FACT-F score was then obtained by adding the subscale scores. For all FACIT scales, the higher score indicates better Quality of Life. The fatigue subscale has 13 items, with 52 as the highest possible score for the fatigue subscale. Eleven items with responses had their scores reversed, and two items had their responses unchanged. Items indicating higher fatigue have their scores reverse, and all items are added so that higher scores correspond to less fatigue.

MOS 36-Item Short-Form Health Survey (SF-36) [24, 25] consists of 36 questions designed to measure health status and QOL domains, designed for use in clinical practice and research, health policy evaluations, and general population surveys. Eight health-related concepts are included in this instrument and are as follows: physical functioning (limitations in physical activities because of health problems); social functioning (limitations in social activities because of physical or emotional problems); role limitations due to physical functioning (limitations in usual role activities because of physical health problems); body pain; general health perceptions; vitality (energy and fatigue); role limitations caused by emotional problems; and mental health (psychological distress and well-being). The SF-36 vitality scale is a four-item measure which asks the respondent to indicate on a six-point frequency scale (1 = all of the time and 6 = none of the time) the extent to which the person feels full of energy versus feeling tired and worn out during the previous 4 weeks. Scores were calculated and transformed to a 0 to 100 scale, with higher scores indicating increased health status.

Eastern Cooperative Oncology Group Performance Status (PS) [27] is a five-point scale ranging scores from 0 (fully ambulatory without physical symptoms), 1 (fully ambulatory with some symptoms), 2 (requiring <50% awake time to rest), 3 (requiring >50% awake time to rest), to 4 (bedridden). It is widely used in cancer patient trials to assess functional capability of patients as they undergo treatment. It is used as an independent prognostic predictor in patients with cancer. The ECOG PS item was included because it is a familiar, somewhat global index.

Questionnaire for Demographic and Disease Information is a demographic information sheet that covers basic patient

information such as age, sex, educational level, and marital status. A disease sheet covers a patient's diagnosis, treatment status, and clinical stage.

Statistical methods/analysis

The validity of FACT-F was established by evaluating construct validation (convergent and discriminant validities). The convergent validity was examined by comparing the FACT-F to the MOS 36-Item Short-Form Health Survey SF-36 [24, 25]; both instruments measure health-related QOL. The SF-36 is a known valid and reliable QOL instrument and has been validated in Brazil [26]. Discriminant validity of the FACT-F evaluated the ability of the scale to differentiate defined groups, discriminating patients according to ECOG Performance Status, and different stages of disease. The reliability was assessed by internal consistency and reproducibility.

Reliability The internal consistency of FACT-F was evaluated by calculating the Cronbach α coefficients for both the subscores and for the total scores of the instruments [31]. The Cronbach α coefficient ranges from 0 to 1; the acceptable Cronbach coefficient was set at approximately 0.70 in accordance with the recommendations of Nunnally and Bernstein [32]. Reproducibility (test–retest) assesses instrument stability over time. This was assessed by intraclass correlation coefficients (ICC) between the first and the second assessments for the same patient. The questionnaire was tested through two evaluations: first at the moment of inclusion in the study and a second evaluation after a period of 3 to 14 days (average 6.5 days±2.84) to compare the results obtained by the same examiner in different times. The interval of 3 to 14 days between assessments was chosen according to Marx et al. [33], with findings that there were no statistically significant differences in the test–retest reproducibility (intraclass correlation coefficient and limits of agreement statistics) for the time interval ranging from 2 days to 2 weeks.

Validity Construct validity was assessed through convergent validity and discriminant validity. The convergent validity was examined by comparing the subscale scores and total scores of FACT-F with those of the SF-36 and inter-scale correlations; and by using Pearson product moment correlation coefficient and SF-36 vitality subscale comparing FACT-F fatigue subscale. It was expected that there would be a relatively high correlation between the FACT-F, fatigue subscale, and SF-36 vitality subscale. The various individual dimensions of the FACT-F and SF-36 had continuous and normal distributions.

Discriminant (known-groups) validity of the FACT-F evaluated the ability of the scale to differentiate defined group discriminating patients according to ECOG PS and different stages of disease. All subscales and total FACT-F samples were divided into three levels (PS=0, 1, and ≥2); due to the small number of occurrences, patients rated "3" or "4" on ECOG PS were combined with individuals rated "≥2." Scheffé post hoc comparisons were tested to show differences in FACT-F total and subscale scores according to ECOG PS and stage of illness. The Scheffé test was used because it is often more conservative than other tests, which means that a larger difference between means is required for significance, and the sample sizes of the groups compared (three groups of PS) were not the same. Better performance status and stage I were expected to be associated with higher QOL.

All analyses were performed using *Statistical Package for the Social Sciences* (SPSS) 13.0. For all tests, a significance level of 0.05 was chosen, and all p were two-tailed.

Results

Although the FACT-F was designed for self-administration, most patients (N=211, 78.1%) in our sample were interviewed due to their low educational level.

Reliability

Internal consistency was evaluated by calculating the Cronbach α coefficient, which was 0.78 for physical well-being, 0.68 for social/family well-being, 0.75 for emotional well-being, 0.74 for functional well-being, 0.91 for fatigue, and 0.92 for total FACT-F, indicating satisfactory internal consistency. Table 2 shows alpha coefficient and mean of FACT-G for the Brazilian Portuguese version.

Test–retest reliability involved administration of 85 retest assessments of the FACT-F within 3–14 days (average 6.5 days±2.84). The test–retest was assessed by intraclass correlation between the first and the second assessments for the same patient; the coefficients were 0.72 (95% CI=0.58–0.82) for physical well-being, 0.91 (0.86–0.94) for social/family well-being, 0.90 (0.86–0.94) for emotional well-being, 0.86 (0.79–0.91) for functional well-being, 0.90 (0.81–0.92) for fatigue, and 0.91 (0.86–0.94) for total FACT-F.

Validity

The Pearson product correlation revealed good correlations between the total FACT-F and subscales of the SF-36 in most dimensions, ranging from r=0.51 to r=0.76, except for SF-36 physical (r=0.31), as shown in Table 3. As expected, the significant positive correlation between the FACT-F total (r=0.76), fatigue subscale (r=0.77), and SF-

Table 2 Internal consistency reliabilities and mean of FACT-F in this study

Subscale (range of scores)	Number of items	Brazilian Portuguese FACT-F (N=270)	
		Mean ± SD	α
Physical (0–28)	7	21.85±4.86	0.78
Social/family(0–28)	7	21.12±3.91	0.68
Emotional (0–24)	6	19.61±4.00	0.75
Functional (0–28)	7	17.87±5.13	0.74
Fatigue subscale (0–52)	13	39.86±9.10	0.91
FACT-F (0–160)	40	120.41±20.95	0.92

FACT-F Functional Assessment of Cancer Therapy-Fatigue Scale

36 vitality scale support the convergent validity, confirming that they are measuring the same domain, fatigue. Intercorrelations among subscales and the total scores of fatigue, means, and standard deviations appear in Table 3. Pearson correlation coefficients were high between the FACT-F total score and its subscale scores, ranging from r=0.50 to r=0.88.

Discriminant validity was examined by ECOG PS and stage of illness in relation to the subscales and total FACT-F. Table 4 shows that subjects who scored higher on the FACT-F had a better PS. Scheffé post hoc comparisons suggests that physical, functional, fatigue subscale, and total FACT-F were able to discriminate between PS=0 versus 1, ≥2 and PS=1 versus ≥2 (p<0.001), social/family well-being was able to discriminate PS=0 versus ≥2 (p<0.018), and emotional well-being was able to discriminate PS=0, 1 versus ≥2 (p<0.001). Scheffé post hoc comparisons suggest that physical, emotional, functional, fatigue subscale, and total FACT-F are able to discriminate between disease stages of I, II, III, versus IV, (p<0.001) reflecting a poorer QOL, but are not able to discriminate social/family well-being, of which the scores were not significant to differentiate between stage differences (p=0.470; Table 4).

Discussion

FACT-F [16, 20] was designed to provide information about fatigue and quality of life. The purpose of this study was to validate the Portuguese version of the FACT-F for use with Brazilian cancer patients.

Although the FACT-F was designed for self-administration, most patients (78.1%) in our sample were interviewed due to their low educational level; most patients preferred the questionnaire to be read out loud by an interviewer instead of filling it out themselves, a fact that also occurred with Uruguayan patients [34] in a related study.

The FACT-G first version had 28 items, and its fourth version dropped the item "Relationship with Doctor" and

Table 3 Pearson correlation between FACT-F and SF-36 subscale scores (vitality scale as an indication of the convergent validity of the FACT-F; N=270)

	Physical FACT-F	Social FACT-F	Emotional FACT-F	Functional FACT-F	Fatigue subscale FACT-F	Total FACT-F
Physical	1.00	0.18**	0.53**	0.52**	0.74**	0.82**
Social FACT-F		1.00	0.33**	0.47**	0.22**	0.50**
Emotional FACT-F			1.00	0.51**	0.49**	0.71**
Functional FACT-F				1.00	0.58**	0.80**
Fatigue subscale FACT-F					1.00	0.88**
SF-36 physical	0.23**	0.14*	0.11****	0.33**	0.30**	0.31**
SF-36 role physical functional	0.48**	0.091***	0.32**	0.44**	0.56**	0.54**
SF-36 body pain	0.57**	0.21**	0.32**	0.43**	0.45**	0.53**
SF-36 general health	0.38**	0.24**	0.38**	0.46**	0.44**	0.51**
SF-36 vitality	0.65**	0.25**	0.56**	0.52**	0.77**	0.76**
SF-36 social functioning	0.52**	0.26**	0.43**	0.47**	0.56**	0.61**
SF-36 role emotional	0.46**	0.24**	0.38**	0.39**	0.52**	0.55**
SF-36 mental health	0.51**	0.28**	0.69**	0.40**	0.52**	0.63**

FACT-F Functional Assessment of Cancer Therapy-Fatigue Scale; *SF-36* MOS Short-Form Health Survey

*p<0.05; **p<0.001; ***p=0.136; ****p=0.61

Table 4 FACT-F differentiation of ECOG performance status and stage of disease

Clinical Condition	Number	Physical FACT-F (mean ± SD)	Social FACT-F (mean ± SD)	Emotional FACT-F (mean ± SD)	Functional FACT-F (mean ± SD)	Fatigue subscale FACT-F (mean ± SD)	Total FACT-F (mean ± SD)
Performance status[a]							
0	85	24.60±2.49	21.95±3.80	20.92±2.80	20.46±4.40	45.65±4.61	133.57±12.15
1	148	21.68±4.24	20.95±3.81	19.79±3.58	17.56±4.74	39.28±8.15	119.26±18.00
≥2	37	16.24±6.19	19.86±4.20	15.86±5.50	13.15±4.55	29.65±10.53	94.77±22.82
Subgroup differences[b]		0>1>2 $p<0.001$	0>2, $p=0.018$	0>2; 1>2 $p<0.001$	0>1>2 $p<0.001$	0>1>2 $p<0.001$	0>1>2 $p<0.001$
Stage of disease							
I	10	23.80±3.74	22.40±2.95	21.00±2.67	20.90±3.48	47.60±4.70	135.70±11.88
II	74	22.82±4.08	21.02±4.01	20.20±2.90	18.68±3.80	40.89±7.81	123.61±16.23
III	100	22.51±4.14	21.40±3.65	20.45±3.24	18.51±5.52	41.30±7.99	124.17±18.81
IV	86	20.03±5.82	20.72±4.19	17.97±5.13	16.07±5.36	36.72±10.62	111.51±24.53
Subgroup differences[b]		I>IV, II>IV, III>IV, $p<0.001$	- $p=0.470$	I>IV, II>IV, III>IV, $p<0.001$	I>IV, II>IV, III>IV, $p<0.001$	I>II, III>IV $p<0.001$	I>IV, II>IV, III>IV, $p<0.001$

FACT-F Functional Assessment of Cancer Therapy-Fatigue Scale

[a] Performance Status: *0* fully ambulatory without physical symptoms; *1* fully ambulatory with some symptoms; *2* requiring <50% awake time to rest; *3* requiring >50% awake time to rest; *4* bedridden

[b] Scheffé comparisons; > symbol separates groups that report significantly higher scores from those with lower scores

has 27 items. The first version of FACT-F had 41 items, and its fourth version had 40 items within five domains: physical well-being (seven items), social/family well-being (seven items), emotional well-being (six items), functional well-being (seven items), and fatigue; the latter was assessed by the same 13 items of the first version [16, 20]. It was not possible to compare the first FACT-F version with the fourth version. The fatigue subscale and anemia subscale were translated into Japanese, and the Psychometric properties have been established [35].

The internal consistencies of FACT-F and fatigue subscale were highly satisfactory. With the exception of reduced social and family well-being, the results indicated good reliability. One possible explanation for the lower Cronbach coefficient ($\alpha=0.68$) noted for social and family well-being was the difference in culture-specific QOL issues.

The findings in the internal consistency of FACT-F in Brazilian (0.92), and Japanese (0.93) [35] samples are very similar. The findings in the internal consistency, using the fatigue subscale, were also very similar; Brazilian samples (0.91) and American samples (0.93) [16] (data were not available for the Japanese study [35]). The results show little differences and might reflect cultural specificities and not a true difference in fatigue experience. Another possible explanation is based on the difference in disease presentation between the samples. Half of the Brazilian sample consisted of women with breast cancer, whereas a quarter of the American sample and the Japanese sample consisted only of lung cancer patients. All patients of this study were outpatients, while those in the Yoshimura et al. study [35] were inpatients.

In the Yellen et al. study [16], the 13-item Fatigue subscale of the FACT-F demonstrated good test–retest reproducibility ($r=0.90$). The Brazilian FACT-F questionnaire in Portuguese language has good test–retest reproducibility (ICC 0.72 to 0.91; 0.90 for Fatigue subscale and 0.91 for Total FACT-F, $p<0.0001$), as seen in 85 retest administrations within 3–14 days (average 6.5 days±2.84). The retest administration was not applied in the same day to all patients because it was applied only in the return to our institution. The majority of patients (75.3%) did the retest in seven days. It is possible that variations in health, learning, reaction, or regression to the mean may yield test–retest data and can under or overestimate reproducibility [36]. Moreover, since in the second assessment the patient already knows the instrument, there may be overestimations of the reproducibility.

Convergent validity of the Brazilian Portuguese version of the total FACT-F and Fatigue Subscale was supported by the significant correlation with the SF-36 ($r=0.31$–0.76, $p<0.001$) and mainly vitality scale ($r=0.76$, $p<0.001$). We observed a weak correlation of SF-36 physical domain and FACT physical well-being (0.23) and total score of the FACIT-F (0.31). A weak correlation was also observed to SF-36 physical functioning and FACIT-F functional well-

being (0.44). SF-36 and FACT-F measure different aspects of QOL, although there is a fair amount of overlap. There are similarities and differences between FACT-F and SF-36, despite their similar names. FACT-F physical well-being covers the patient's actual physical experience of the disease and treatment, including disease symptoms and treatment side effects. The physical well-being incorporates disease symptoms (e.g., pain); pain in SF-36 has a separate domain named "body pain."

FACT-F functional well-being relates to a person's ability to engage in the usual basic activities of daily living; SF-36 physical includes role limitations due to physical functioning (limitations in usual role activities because of physical health problems), and FACT-F functional well-being subscale covers both activity (work) and rest (sleep), as well as the enjoyment of life, aspects that are not necessarily related to physical functioning. For instance, the relationship between scores on the SF-36 physical functioning scale and scores on the FACT physical well-being scale is unclear [37].

The FACT-F has excellent known-group validity, which can accurately discriminate patients with different performance status and fatigue mean scores [17]. A lower fatigue score was associated with a reduction in activity and with increased emotional distress. Patients with high ECOG PS and patients with metastasized cancer reported lower FACT-F scores than patients with low ECOG PS and a localized tumor. Post hoc comparisons (Scheffé test) suggested that all subscales and total scores except social/family well-being were successfully discriminated between PS=0 versus 1 and versus 2. This study suggests that there is an association between QOL and performance status (Table 4) as has been shown in the studies of Yellen et al. [16] and Overcash et al. [38]. In the Yoshimura et al. [35] validation study, a significant negative relation between performance status and the score of the Fatigue subscale was reported. As expected, the scores were significantly lower in stage IV patients compared to those of stage I, II, and III patients.

Although the sample was not probabilistic but intentional, their heterogeneity (the participants belonged to both sexes and to different age groups, had diverse education levels, and differing cancer locations and staging) aimed to ensure the external validity of the results of this research. This attribute has been strengthened by the inclusion of patients pertaining to daily clinical practice. The Brazilian National Cancer Institute is a Public Institution; all patients analyzed were users of the public health system, and there is no reason to believe that the patients included in this study are not representative of the general population, which relates to the external validity of the results. Furthermore, the analysis of a large number of cancer patients and the randomness in its selection also ensure the internal validity of the results.

Fatigue is a multidimensional concept. There are some multidimensional instruments to assess fatigue, such as Multidimensional Fatigue Inventory [39], Schwartz Cancer Fatigue Scale [40], and Piper Fatigue Scale that was validated in Brazil [3]. The Yellen study [16] findings suggest that the Fatigue Subscale could be used as an independent, brief, unidimensional measure of fatigue. As stated by Chandran et al., although the FACT fatigue subscale is also considered to be a unidimensional measure of fatigue, its variables cover a broader concept of fatigue [19]. The fatigue scale used in this study is briefer than the other measures, making it easier to administer and score. Patients do not necessarily have to experience fatigue to be able to answer all the questions of the FACT-F and fatigue subscale. Researchers and health professionals interested only in assessing fatigue as a symptom might choose to use the 13-item Fatigue subscale, whereas those interested in assessing both fatigue and quality of life would use the 40-item FACT-F [16].

With regard to the limitations of this study, we had no control group to differentiate between cancer-related fatigue and noncancer-related fatigue. In addition, FACT was applied only to outpatients. The Brazilian sample included patients at different moments of the treatment process, presumably representing a greater variety of fatigue intensities, which could be reflected in lower average scores. Another limitation was the lack of longitudinal data regarding, for instance, sensitivity to changes induced by therapy (responsiveness). Patient responsiveness should be evaluated in the future, since this instrument will probably be used to detect changes over time in clinical trials and in clinical practice.

As more and more patients survive cancer, it becomes necessary to understand the multidimensional experiences of fatigue associated with cancer, its treatment, and the recovery process. The findings demonstrate that the FACT-F is a measure with strong psychometric properties for use in assessing fatigue and QOL in cancer patients. The FACT-F is the first instrument measuring fatigue in Brazilian cancer patients, and it showed excellent reliability and validity.

Conclusion

The Portuguese version of FACT-F showed high internal consistency, good test–retest reproducibility, as well as convergent validity. FACT-F successfully discriminated patients based on performance status and the clinical stage of the cancer, correlating positively with other measures of fatigue validated for use in Brazilian patients (SF 36 vitality scale). Therefore, the Portuguese version of FACT-F is a reliable and valid instrument to assess QOL and fatigue, representing a valid tool to screen cancer-related fatigue in

Brazilian cancer patients and allowing study results to be compared across different countries.

Acknowledgments The authors are grateful to Mr. Ben Arnold and Ms. Helen Morrow for permission to use the instrument FACT-F in this study and for having provided the questionnaire in Portuguese language. We also thank Mrs. Sirlei Siani Morais for help in statistical review. Finally, we are grateful to all patients who participated in the study.

Authors' disclosures of potential conflicts of interest Authors wish to disclose the absence of financial support and indicated no potential conflicts of interest.

References

1. Winningham ML, Nail LM, Burke MB et al (1994) Fatigue and the cancer experience: the state of the knowledge. Oncol Nurs Forum 21(1):23–36
2. Yamagishi A, Morita T, Miyashita M, Kimura F (2008) Symptom prevalence and longitudinal follow-up in cancer outpatients receiving chemotherapy. J Pain Symptom Manage. doi:10.1016/j.jpainsymman.2008.04.015
3. Mota DD, Pimenta CA, Piper BF (2008) Fatigue in Brazilian cancer patients, caregivers, and nursing students: a psychometric validation study of the Piper Fatigue Scale-Revised. Support Care Cancer. doi:10.1007/s00520-008-0518-x
4. Curt GGA, GA BW et al (2000) Impact of cancer-related fatigue on the lives of patients: new findings from the Fatigue Coalition. Oncologist 5:353–360
5. Bennett B, Goldstein D, Lloyd A et al (2004) Fatigue and psychological distress—exploring the relationship in women treated for breast cancer. Eur J Cancer 40:1689–1695
6. Romito F, Montanaro R, Corvasce C et al (2008) Is cancer-related fatigue more strongly correlated to haematological or to psychological factors in cancer patients? Support Care Cancer 16(8):943–946
7. Haghighat S, Akbari ME, Holakouei K et al (2003) Factors predicting fatigue in breast cancer patients. Support Care Cancer 11(8):533–538
8. Jacobsen PB, Hann DM, Azzarello LM et al (1999) Fatigue in women receiving adjuvant chemotherapy for breast cancer: characteristics, course, and correlate. J Pain Symptom Manage 18(4):233–242
9. Berger AM, VonEssen S, Kuhn BR et al (2003) Adherence, sleep, and fatigue outcomes after adjuvant breast cancer chemotherapy: results of a feasibility intervention study. Oncol Nurs Forum 30 (3):513–522
10. Minton O, Stone P (2008) A systematic review of the scales used for the measurement of cancer-related fatigue (CRF). Ann Oncol. doi:10.1093/annonc/mdn537
11. Cho HJ, Costa E, Menezes PR, Chalder T, Bhugra D, Wessely S (2007) Cross-cultural validation of the Chalder Fatigue Questionnaire in Brazilian primary care. J Psychosom Res 62(3):301–304
12. Lent L, Hahn E, Vehemence S et al (1999) Using cross-cultural input to adapt the Functional Assessment of Chronic Illness Therapy (FACIT) scales. Acta Oncol 38(6):695–702
13. Webster K, Cella D, Yost K (2003) The Functional Assessment of Chronic Illness Therapy (FACIT) measurement system: properties, applications, and interpretation. Health Quality Life Outcomes 1:79. doi:10.1186/1477-7525-1-79
14. Webster K, Odom L, Peterman A et al (1999) The Functional Assessment of Chronic Illness Therapy (FACIT) measurement system: validation of version 4 of the core questionnaire. Qual Life Res 8(7):604
15. Cella DF, Tulsky DS, Gray G et al (1993) The Functional Assessment of Cancer Therapy (FACT) scale: development and validation of the general measure. J Clin Oncol 11(3):570–579
16. Yellen SB, Cella DF, Webster K et al (1997) Measuring fatigue and other anemia-related symptoms with the Functional Assessment of Cancer Therapy (FACT) measurement system. J Pain Symptom Manage 13(2):63–74
17. Cella D, Lai JS, Chang CH, Peterman A, Slavin M (2002) Fatigue in cancer patients compared with fatigue in the general United States population. Cancer 94:528–538
18. Cella D, Yount S, Sorensen M, Chartash E, Sengupta N, Grober J (2005) Validation of the Functional Assessment of Chronic Illness Therapy fatigue scale relative to other instrumentation in patients with rheumatoid arthritis. J Rheumatol 32:811–819
19. Chandran V, Bhella S, Schentag C, Gladman DD (2007) Functional assessment of chronic illness therapy-fatigue scale is valid in patients with psoriatic arthritis. Ann Rheum Dis 66 (7):936–939
20. Cella D (1997) The FACT-anemia scale. A new tool for the assessment of outcomes in cancer anemia and fatigue. Semin Hematol 34(3):13–19
21. Eremenco SL, Cella D, Arnold BJ (2005) A comprehensive method for the translation and cross-cultural validation of health status questionnaires. Eval Health Prof 28(2):212–232
22. Arnold BJ, Eremenco E, Chang CH et al (2000) Development of a single Portuguese language version of the functional assessment of cancer therapy general (FACT G) scale. Qual Life Res 9(3):316
23. Arnold BJ, Eremenco E, Chang CH et al (2001) How much is "very much"? Developing a rating scale for Portuguese speaking countries. Qual Life Res 10(3):2644
24. Ware JE, Sherbourne CD (1992) The MOS 36-item short-form health survey (SF-36) I: conceptual framework and item selection. Med Care 30(6):473–483
25. McHorney CA, Ware JE, Raczek AE (1993) The MOS 36-item short-form health survey (SF-36) II: psychometric and clinical tests of validity in measuring physical and mental health constructs. Med Care 31(3):247–263
26. Ciconelli RM, Ferraz MB, Santos W et al (1999) Tradução para a língua portuguesa e validação do questionário genérico de avaliação de qualidade de vida SF-36 (Brasil SF-36). Rev Bras Reumatol 39(3):143–150
27. Zubrod CG, Schneiderman M, Frei E III et al (1960) Appraisal of methods for the study of chemotherapy of cancer in man: comparative therapeutic trial of nitrogen mustard and thiophosphoramide. J Chronic Dis 11:7–33
28. Mundfrom DJ, Shaw DG, Ke TL (2005) Minimum sample size recommendations for conducting factor analyses. International Journal Testing 5:159–168
29. Hopkins WG (2000) Measures of reliability in sports medicine and science. Sports Med 30(1):1–15
30. Atkinson G, Nevill A (2000) Typical error versus limits of agreement. Sports Med 30(5):375–381
31. Cronbach LJ (1951) Coefficient alpha and the internal structure of tests. Psychometrika 16(3):297–334
32. Nunnally JM, Bernstein IH (1994) Psychometric theory, 3rd edn. McGraw-Hill, New York
33. Marx RG, Menezes A, Horovitz L, Jones EC, Warren RF (2003) A comparison of two time intervals for test–retest reliability of health status instruments. J Clin Epidemiol 56:730–735
34. Dapueto JJ, Francolino C, Servente L, Chang CH, Gotta I, Levin R, Abreu MC (2003) Evaluation of the Functional Assessment of Cancer Therapy-General (FACT-G) Spanish version 4 in South America: classic psychometric and item response theory analyses. Health Qual Life Outcomes 1:32. doi:10.1186/1477-7525-1-32

35. Yoshimura A, Kobayashi K, Fumimoto H et al (2004) Cross-cultural validation of the Japanese Functional Assessment of Cancer Therapy-Anemia (FACT-An). J Nippon Med Sch 71 (5):314–322
36. Aaronson N, Alonso J, Burnam A, Lohr KN, Patrick DL, Perrin E, Stein REK, Scientific Advisory Committee of the Medical Outcomes Trust (2002) Assessing health status and quality-of-life instruments: attributes and review criteria. Qual Life Res 11:193–205
37. Cella D, Nowinski CJ (2002) Measuring quality of life in chronic illness: the functional assessment of chronic illness therapy measurement system. Arch Phys Med Rehabil 83(Suppl 2):s10–s17
38. Overcash J, Extermann M, Parr J et al (2001) Validity and reliability of the FACT-G scale for use in the older person with cancer. Am J Clin Oncol 24(6):591–596
39. Smets E, Garssen B, Bonke B, Haes JD (1995) The multidimensional fatigue inventory: psychometric qualities of an instrument to assess fatigue. J Psychosom Res 39:315–329
40. Schwartz A, Meek P (1999) Additional construct validity of the Schwartz Cancer Fatigue Scale. J Nurs Meas 7(1):35–45