



Development and validation of the daily fatigue cancer scale (DFCS): Single-item questions for clinical practice



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ABSTRACT

Purpose: Cancer-Related Fatigue (CRF), subjective symptom, is considered the most prevalent and disabling in cancer. To help caregivers better understand it, we developed and evaluated the psychometric properties of a visual analog scale to assess daily CRF.

Method: In our qualitative study, we conducted interviews with caregivers, patients and scientists (N = 30) to generate items and select the scale's format. We then administered the final scale to a sample of 104 patients hospitalized for cancer surgery. In our quantitative study, we evaluated psychometric items with standardized questionnaires to compare and identify the construct validity of our fatigue scale. Because clinicians need a cutoff to diagnose fatigue in daily care, we also analyzed the scale's sensitivity.

Results: Correlations evidenced good construct validity for our scale, with $r = 0.886$ ($p > 0.01$), confirming that both physical fatigue and psychological fatigue ($r = 0.768$) were effectively measured. The Receiver Operating Curve (ROC) showed good sensitivity and specificity (>0.80), giving clinicians a threshold to identify tired patients, with only a 3% chance of misdiagnosis.

Conclusion: The Daily Fatigue Cancer Scale is a good tool to detect patient fatigue and improve patient care.

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1. Introduction

Cancer-Related Fatigue (CRF) is a subjective symptom of fatigue, which differs from ordinary fatigue. Several authors have proposed various definitions of cancer-related fatigue. In 2007, the National Comprehensive Cancer Network [NCCN] proposed that CRF was a «distressing persistent subjective sense of physical, emotional, and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and that interferes with usual functioning» (National Comprehensive Cancer Network, 2007), which seems accepted as a consensus. CRF is the most frequent and specific symptom in cancer, but also the most disabling (Glaus et al., 1996; Lawrence et al., 2004; Richardson, 1995). Up to 80–90% of cancer patients (Irvine et al., 1991; Ream and Richardson, 1996) frequently mention this symptom, and report that it prevents them from leading a normal life – more so

than nausea or pain (Curt, 2000). In 2006, Prue et al. conducted a review of the literature to determine the forms and prevalence of CRF (Prue et al., 2006). They showed that a majority of studies reported an increase in fatigue at the beginning of anticancer therapy, with a prevalence of 39–90%. Unlike other types of fatigue, and while it is characterized by its intensity, CRF cannot be alleviated by resting. It has been shown to start at diagnosis and to consistently increase with the evolution of the disease, to continue beyond treatments, even in patients in remission (Cella et al., 2002), thereby resulting in a significant decrease in patients' quality of life (Holzner et al., 2003; Payne et al., 2003). This impact on quality of life is arguably a major issue. Researchers and caregivers should therefore work to improve CRF management.

Glaus et al. studied the concept of CRF by conducting patient interviews (Glaus et al., 1996). These authors highlighted three different aspects of CRF: They showed that patients experience physical, cognitive and affective sensations. Indeed, cancer patients use these 3 sensations in 59%, 12% and 29% of the cases, respectively, to describe their fatigue. Diseases such as cancer are physically exhausting because of the treatments, but also quite trying emotionally and

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psychologically. A strong association between fatigue and depression has frequently been reported (Brown and Kroenke, 2009). A meta-analysis in 2011 estimated the prevalence of depression in cancer patients at 16.3% (Mitchell et al., 2011). Hamama-Raz et al. (2007) examined the relative contribution of psychosocial factors to psychological adjustment. The authors evaluated objective illness-related factors and subjective factors of psychological adjustment. They found that subjective factors were more strongly associated with adjustment than some medical factors (Hamama-Raz et al., 2007).

The basis for this research is the pressing need to provide a reliable assessment tool for nurses. Though their healthcare routine does not allow sufficient time for it, nurses are expected to quickly and accurately assess fatigue symptoms in patients. In fact, nurses report that collecting and assessing such information in order to manage patient fatigue is difficult because, in part, exhausted patients are less autonomous. These professionals therefore need a quick and user-friendly tool that can provide a useful criterion for healthcare decisions. Our aim was thusly to provide a solution for this assessment in light of the limited length of time to make it. We first conducted a literature review of all fatigue questionnaires to find an adequate tool. In our review, 23 questionnaires were examined, including 5 in French. These fatigue questionnaires were found unsuitable to daily nursing practice because they were either too long, or required prior training or additional time for scoring. In addition, those tools were not suitable for repeated measures. Indeed, psychological questionnaires are too long (about 20 items) and ill-suited to repeated measures because of learning bias. Nurses need a tool that can be used once –or many times–daily. In light of their overloaded routine (care-giving, pain management and emergency treatment), the use of a long questionnaire –however adapted– may lead to oversights in the evaluation of patient fatigue. Instead, a well-designed tool would aim to facilitate the work of the nurses, and thereby help improve patient care. We thus chose to design and develop a more adequate tool to measure daily CRF.

The single-item response is considered the most patient-friendly form (a visual analogic scale is recommended by the NCCN for CRF diagnosis). The visual aspect of these scales has been shown to have some influence on the result (Paul-Dauphin et al., 1999), and “a good tool is not the one that is the most efficient but the most suited to the situation” as Lesage aptly concluded in his thesis (Lesage, 2012). A visual analogic scale (VAS) thus seemed to be the most suitable tool for our study. A VAS consists of a 10-cm line (3.94 inches) with no gradation, and which ends are labeled so as to define the range of possible answers, usually “not at all” (left) and “extremely” (right). These scales provide a quick and simple assessment tool. They are commonly used by caregivers (e.g., the VAS for pain). Indeed, its simplicity makes it user-friendly, a feature patients widely appreciate. Those advantages allow its systematic use, thereby facilitating open dialogue and improving patient-caregiver relationships.

The aim of our study was to create the Daily Fatigue Cancer Scale (DFCS), a simple and patient-friendly tool adapted to daily nursing practice. We examined psychometric properties, focusing on the construct validity of the DFCS using correlations with another fatigue-assessment tool, the Multi-dimensional Fatigue Inventory (MFI). We also performed correlations with a tool evaluating depression; indeed, in cancer patients, CRF and depression have been shown to be tightly associated.

2. Methods

2.1. Stage I: development of the DFCS

2.1.1. Exploratory interviews

In the first step of the study, we conducted discussions with a small group of surgery nurses (one healthcare manager and seven

caregivers). All were females, aged 35 to 55, and employed at the time in the same facility. The nurses confirmed their preference for the VAS form: As seen above, it was considered the most suitable. The DFCS was then debated in greater detail. The nurses suggested the integration of smileys at both ends to add expressiveness and originality to the tool. Visual scales or other tools with faces have already been presented in the literature (Castel et al., 2005; Dunham and Herman, 1975; Gynther et al., 1979; McKinley et al., 2004). This idea was accepted.

In an attempt to gauge their understanding of cancer-related fatigue, we asked the nurses for a definition of patient fatigue. Producing a clear definition was difficult for them: They invoked individual patient differences and behaviors, e.g., patients “who are tired of ablutions but not of going out for walks”. These statements highlighted the difficulty of understanding and managing such a subjective symptom, and prompted the organization of interviews with the patients themselves to obtain their own representation of fatigue.

Audio-recorded interviews were conducted with 16 patients (nine women and seven men). In these interviews, the patients were asked three questions: First, “How, from your own point of view, would you define fatigue?”; second, “Do you think there are different types of fatigue?”; and third, “How would you measure fatigue on a daily basis?” The interviews were transcribed and analyzed.

These interviews helped us understand fatigue from the patients' perspective. Content analysis revealed that patients defined fatigue as a two-dimensional concept. The mental and cognitive dimensions of fatigue do not seem to stand out. However, all patients distinguished physical fatigue and emotional fatigue. In the interviews, a majority of patients used the French term “lassitude”, which can be understood as weariness, and many evoked depressive symptoms. Thus, items covering *general fatigue*, *physical fatigue* and *weariness* (lassitude in French) were selected to develop our VAS.

2.1.2. Scale items and design

The selection of the items composing the scale was a delicate process. It was important to ensure that these items be understandable by a majority of patients, and that they simply and clearly solicit the given symptom.

For the item describing general fatigue, we used an item from the “FACIT-F questionnaire” (Cella et al., 2010). For physical fatigue, the explicit term “lack of energy” was chosen. For the patients we interviewed and for the general population, the term “energy” refers to a significant and objective idea correlated to a physical state. The choice of this term was also motivated by the fact that the FACIT questionnaire also uses it (Cella et al., 2002). For the item related to emotional fatigue, we selected the term “to feel weary” (“lassitude” in French), which patients mentioned repeatedly in the interviews.

To design the format of the scale, we tested four different scales on 24 patients (fifteen women and nine men): The first scale consisted in a simple VAS with a single line with a smiley at both ends; the second scale was horizontal triangle showing the strength of the response from tip to base, with extremities labeled “not at all” and “extremely”; the third scale showed a red gradient representing the severity of the fatigue and also included smileys at both ends; the fourth design combined aspects of the three previous models, the triangle and the red gradient, to illustrate fatigue intensity, and smileys at both ends. To prevent methodological bias, these four scales were presented to the patients in different orders.

In summary, the interviews with the nurses and the caregivers allowed us to choose the most adapted form, while the interviews with the patients and the subsequent thematic analysis afforded us a method to select the most adapted items. Finally, discussions with

several researchers helped us develop an optimal final version of our tool. As evidenced by our methodology, this research project was rooted in medical practice and favored a multidisciplinary approach.

2.1.3. The daily fatigue cancer scale (DFCS)

The results of the pretests were analyzed: Ten patients chose the fourth scale (i.e., the combination of triangle, gradient and smileys (Fig. A1)). Several patients were sensitive to the color gradient, whereas several others liked the originality of the smileys; these results were in line with the proven impact of the visual aspect of a VAS (Paul-Dauphin et al., 1999). Additionally, the DFCS is adapted to the needs of caregivers, and may also be offered in research with children or to compensate for illiteracy.

2.2. Stage II: validation of the daily fatigue cancer scale

2.2.1. Participants

The validation sample comprised 104 hospitalized patients who had undergone cancer surgery at the Montpellier Cancer Institute (France). The patients were informed of the purpose of the study and about the tasks they would be required to perform. All the patients who were invited to participate in the study answered positively. The inclusion criteria were as follows: cancer patients hospitalized for cancer surgery, or who had undergone a surgical intervention in the previous days; willing to participate in the study, and able to speak and read French.

2.2.2. Materials

The caregivers presented the DFCS to the patients with the following instructions: “This scale is used to assess fatigue (present VAS with the pointer on the 0 position). This end (0) corresponds to the total absence of fatigue; the other end (10) corresponds to extreme fatigue”.

The caregivers repositioned the pointer to 0 before asking the three following questions:

- 1) Please move the red pointer to indicate “how tired you are” right now.
- 2) Please move the red pointer to indicate “how much you are lacking energy” right now.
- 3) Please move the red pointer to indicate “how weary you feel” right now.

The scores obtained are given and interpreted in the empirical section below.

To measure the depressive symptoms, the CES-D scale was used. This self-administered questionnaire was elaborated by Radloff in 1977 (Radloff, 1977), improved by Radloff and Locke in 1986 (Radloff and Locke, 1986), and validated in French by Fuhrer and Rouillon in 1999 (Fuhrer and Rouillon, 1989). This questionnaire comprises twenty items and evaluates various aspects of depressive symptomatology. For each question, Respondents must refer to the week preceding the treatment to provide their answer. Each response is rated from 0 (never, rarely, less than a day) to 3 (often, all the time, 5–7 days). The interpretation of the questionnaire's score is performed on the basis of a threshold to discriminate between depressed and non-depressed subjects, with a cutoff of 17 for men and 23 for women.

Among the many tools assessing fatigue, the MFI appears to be widely used in international studies. It provides a profile of the fatigue experienced by the subjects. Originally developed by a Dutch team, the MFI was later translated into English and validated (Smets et al., 1995). Subsequently, a French team translated and validated the scale which comprises only four dimensions of

fatigue, (general fatigue, mental fatigue, lack of motivation and reduced activities; Gentile et al., 2003). This MFI is a self-administered questionnaire comprising twenty items. Responses are rated from 1 (strongly disagree) to 5 (strongly agree). Respondents are instructed to rate the intensity of their feelings (feel or do not feel) about the truth of assertions relating to their experiences in the preceding days.

2.2.3. Procedure

This study received an investigation approval by the Ethics Committee of the Montpellier Cancer Institute. Data collection for the DFCS tests was completed between April 14th and April 29th, 2014 at the Montpellier Cancer Institute (France). Patients were first presented with the CES-D and second with the MFI. Both instruments are fairly simple and generally well understood. Last, patients evaluated their fatigue with the DFCS. They were asked to move the pointer to indicate their level of fatigue, and caregivers wrote the scores on the back of the scale. The interviews lasted between ten and fifteen minutes.

2.2.4. Statistical analyses

Prior to performing statistical analysis, a Kolmogorov-Smirnov test was conducted to evaluate the distribution of our sample across our different variables. We performed a Student's *t*-test for independent samples on controlled variables. We first computed Pearson and Spearman correlations between the two gold standards (MFI and CES-D) and our three items. In behavioral sciences (Cohen, 1992), correlations of 0.10, 0.30, and 0.50 are usually considered to reflect small, medium, and large effect sizes, respectively. The following statistics were used to establish diagnostic accuracy: sensitivity (Se), specificity (Sp), Positive Predictive Value (PPV) and Negative Predictive Value (NPV). ROC curves were used to establish initial cut-offs. The AUC is a measure of overall effectiveness of the scale. It is considered adequate if its value is greater than 0.8.

3. Results

3.1. Patient characteristics

The patients' socio-demographic characteristics are presented in Table 1. Among the 104 patients, 66% were women, with a mean age of 60 years.

The effect of gender on all variables was monitored performing a Student's *t*-test for independent samples. A trend effect ($t = 1.914$, $p = 0.059$) was found on the depression scale, in which women seemed to be more depressed than men, with mean scores equal to 17.6 (SD = 12.7) against 13.2 (SD = 10.4) for men. However, other results for the sex variable indicated that scores reported on the other scales for men or women did not differ significantly. We also reported the date of surgery, as it was expected to be correlated with patient fatigue (Table 2). The Levene's test was used to reject the null hypothesis of equal variances for the item “I'm tired” ($F = 7.642$, $p = 0.007$). The hypothesis H_0 ($t = 2.004$, $p = 0.049$) was rejected; the mean score for the item “I'm tired” was higher in patients who underwent surgery in the previous week.

3.2. Construct validity

All correlations between the three items of the DFCS and the MFI were statistically significant ($p < 0.01$; Table 3). The item which reported the best correlation with the physical dimension of the MFI questionnaire was “I lack energy” ($r = 0.866$), which characterized the physical item. However, the item “I feel weary” was more significantly correlated with the mental dimension than with the physical dimension of the MFI questionnaire. Correlations with

Table 1
Patient characteristics.

		Number of patients	(n = 104) %
Sex	Male	38	36.5
	Female	66	63.5
Age	<50 years old	19	18.3
	50–70 years old	59	56.7
	>70 years old	26	25
Marital status	Married	64	61.5
	Widower	2	1.9
Current occupational status	Not employed/Retired	48	46.1
	Employed	56	53.8
Cancer type	Breast	31	29.8
	Lung	2	1.9
	Colorectal	26	25
	Gastric	3	2.9
	Oesophagus	5	4.8
	Pancreas	5	4.8
	Liver	3	2.9
	Gynaecologic	24	23.1
	Others	5	4.8
	Years since diagnosis	<2 years	66
2–5 years		21	20.2
>5 years		17	16.3
Primary treatment	SU only	4	3.8
	SU + CT	13	12.5
	RT + CT	9	8.6
	SU + RT + CT	23	22.1
	CT only	22	21.1
	None	33	31.7
Recurrence	Yes	19	18.3
	No	85	81.7
Metastasis	Yes	32	30.8
	No	72	69.2
Treatment at time of the survey	SU only	85	81.7
	HIPEC	8	7.7
	SU + HT	6	5.8
	SU + CT	5	4.8

SU: surgery; CT: chemotherapy; RT: radiotherapy; HIPEC: hyperthermic intraperitoneal chemotherapy; HT: HormonoTherapy.

Table 2
Mean, standard deviation and min/max scores on questionnaires (sub-dimension) according to date of surgery.

Variables	n	surgery	mean	SD	Min/Max
VAS	104				
General	76	≤7 days	4.5	2.8	0/10
« I'm tired »	28	>7 days	3.5	1.9	0/8.5
Physical	76	≤7 days	4.8	3.1	0/10
« I lack energy »	28	>7 days	3.9	2.5	0/8.6
Emotional	76	≤7 days	3.9	3.1	0/10
« I feel weary »	28	>7 days	3.8	2.6	0/8.9
MFI	104				
Physical	76	≤7 days	29.9	10.7	9/45
	28	>7 days	27.7	9.3	11/45
Mental	76	≤7 days	15.9	7.1	6/30
	28	>7 days	15.9	6.4	6/28
CES-D	104				
	76	≤7 days	16.4	12.9	0/45
	28	>7 days	14.9	9.5	0/45

VAS: Visual Analog Scale; MFI: Multidimensional Fatigue Inventory; Center for Epidemiologic Studies–Depression scale.

the CES-D questionnaire were also all significant ($p < 0.01$); the item “I feel weary” was the most correlated to the CES-D dimensions. These results supported the notion of fatigue multidimensionality and confirmed that the different dimensions of fatigue overlap depressive symptoms.

3.3. Sensitivity

The AUC value for the physical item “I lack energy” was the

highest, 0.970. For the items “I'm tired” and “I feel weary”, the AUC values were 0.933 and 0.857, respectively, confirming that the physical item “I lack energy” has good diagnostic value. A threshold of 5.5 cm on the DFCS scale gave the best sensitivity/specificity ratio (0.968 and 0.890, respectively) for the “I lack energy” item (Fig. A2). These results corroborated those obtained with our correlations (Table 3) and confirmed that the physical item “I lack energy” was the most reliable and the most sensitive.

3.4. Specificity and interpretation

The DFCS scale comprises an emotional fatigue item (i.e., “I feel weary”). To distance the DFCS from sensitive diagnostic tests, we looked for a specific threshold on the item “I feel weary”, which would alert the medical team about depressive symptoms in patients and foster appropriate care. When compared to the gold-standard scales, the AUC value was 0.933 compared for the CES-D, and 0.856 for the MFI. A 7-cm threshold provided the best sensitivity/specificity ratio (0.630 and 0.922, respectively) for the item “I feel weary”.

4. Discussion

We developed a scale to evaluate daily fatigue and their psychometric items in cancer patients. First, we conducted a qualitative investigation to explore the dimensions of fatigue. We generate the scale's items, and chose the most optimal format. Results showed that caregivers believe patients should “act” their responses. This method is considered the best way to obtain reliable

Table 3
Index values of the correlations between MFI (mental and physical), CES-D and DFCS items.

Variables		General VAS «I'm tired»	Physical VAS «I lack energy»	Emotional VAS «I feel weary»
<i>Index correlation</i>				
MFI Physical	<i>r Pearson</i>	0.779**	0.866**	0.703**
MFI mental	<i>r Pearson</i>	0.564**	0.654**	0.768**
CES-D	<i>Rho Spearman</i>	0.526**	0.620**	0.678**

Note: ** $p < 0.01$.

answers (Stone and Minton, 2008). The analysis of the interviews conducted with cancer patients showed, that, in addition to physical fatigue, “weariness” (lassitude in French) was frequently reported by patients. This was also highlighted by Garnier, Villard and Comandini in 2005 (Garnier et al., 2005). Moreover, our results confirmed the multiple dimensions of fatigue first described by Glaus et al., in 1996 (Glaus et al., 1996). Following discussions with scientists and researchers, we concluded that the best way to investigate the different dimensions of fatigue was to present subjects with items on a measuring scale. The format of the scale was also discussed (Lesage, 2012; Paul-Dauphin et al., 1999). This led to the development of an original VAS containing smileys. Our multidisciplinary approach allowed us to combine the experience of multiple healthcare professionals and to place the patient at the center of a global vision of care.

Second, we performed quantitative analyses to validate the construct, sensitivity and diagnostic quality of the DFCS. The construct validity was confirmed by high correlations between the MFI scores and the three items of the DFCS, which justified our choice of items and the concept of multidimensional fatigue. The sensitivity and diagnostic quality of the DFCS were evidenced by ROC curves, which confirmed it as a good diagnostic test and highlighted the fact that the best item is “I lack energy”. Caregivers had only a 3% chance of misdiagnosing fatigue when the physical item “I lack energy” (VAS) was greater than 5.5 cm (2.16 inches). Additionally, a high VAS did not necessarily correspond to a state of intense fatigue, whereas a less than 5.5 cm (2.16 inches) VAS excluded a state of fatigue at the time of evaluation. We thus showed that our scale, and especially the physical fatigue item (i.e., “I lack energy”), is a reliable instrument to detect and measure patient fatigue. By detecting fatigue, caregivers may become more attentive to patients, develop a more open dialogue with them, thereby creating the conditions for improvement in the management of fatigue.

In our study, it was important to distinguish fatigue from depression. Indeed, fatigue is a common depressive symptom. The correlation between fatigue and depression was shown to be quite strong (Mitchell et al., 2011; Okuyama et al., 2000). Though based on fatigue, our psychometric validation led us to consider that the DFCS may also be an indicator of depressive symptomatology. The correlations between the CES-D and our scale were significant: the three items of the DFCS were correlated with the depression scores in most patients. The emotional item was strongly linked with the CES-D. Using the ROC curves, we determined a threshold value which may help alert medical teams to the occurrence of depression symptoms in patients. An optimal specific threshold (false positives limited) was selected: for example, a caregiver may estimate a patient to be at a 7% “risk of depression” if that patient obtains a score greater than 7 cm (2.76 inches) for the item “I feel weary”. High scores for this item would likely alert the medical staff of possible psychological distress. These data suggest that our items may be useful to distinguish between patients with physical fatigue and those with emotional fatigue. Furthermore, our results also suggest that patients with emotional fatigue may be detected in clinical practice with a simple screening instrument. In 2009, Strasser and al. concluded that “future research must address the

development of a generalizable instrument that is currently validated and the testing of the hypothesis that fatigue-domain screening can reliably guide fatigue domain-specific treatments in clinical practice, facilitate interdisciplinary management, and improve fatigue-related outcomes” (Strasser et al., 2009). This was precisely the aim of our study.

Our study did suffer from several limitations. One of those limitations is that we did not screen for the cognitive dimension of fatigue. Our sample consisted of patients who were confined to bed in a surgery unit, which may explain why none of them mentioned a lack of attention or concentration. Another limitation stems from the subjective nature of fatigue, and the fact that it generally is an internalized social representation. Accordingly, the feeling of fatigue, like the perception of pain, is different from one individual to another. In 2004, Sophia Rosman highlighted this idea by reporting that fatigue is indeed experienced differently by cancer patients (Rosman, 2004). In her study, the author opposed standard fatigue to “positive fatigue” or “immersion fatigue”. Standard fatigue was described by patients as an expected, “non-preventable” side effect; positive fatigue was considered to provide benefits, among which that of being a useful indicator of their health; finally, immersion fatigue described a central feeling in their daily lives. These three types of fatigue suggest that different patients may obtain different scores on fatigue scales, and therefore highlight the strong subjectivity of this symptom. This lies the main challenge for researchers investigating subjective latent variables. In our specific case, understanding fatigue symptoms is a complex process, caregivers need simple and accurate ways to complete it.

4.1. Implications for nursing

This study answers the fundamental need of nurses to understand a subjective state. Fatigue, like pain, can be a crippling experience for patients – but it also negatively impacts the nursing practice. Improving our understanding of fatigue will empower nurses with the ability to optimize patient autonomy in the context of daily caregiving. The DFCS provides a simple form to work with and thereby facilitates communication. In the first step of our study, qualitative interviews allowed us to better understand this complex symptom. As a result of our analysis, we opted to include three assessment items. Our decision was motivated by the results of our Cronbach's alpha analyses, in which we found the following: between general fatigue and physical fatigue 0.902; between general fatigue and psychological fatigue 0.874; and between physical fatigue and psychological fatigue 0.841. These results led to the question of whether the general fatigue item should be kept or removed. Furthermore, we reasoned that reducing our VAS to two questions would render it even more practical and adapted to the routine of nurses. Therefore, contrary to the expectations of caregivers, we propose a two-item VAS: one item will assess the physical dimension of fatigue, and the other its psychological dimension. We contend that those two items are sufficient, and prefer this option to that of proposing a third item for the assessment of general fatigue. Proposing two distinct items also helps prevent the potential misuse of a general item. We believe that the

psychological state should be assessed by itself.

Improving patient care means improving medical care, but also – and in equal measure – improving quality of life throughout all treatment and follow-up periods. Identifying the determinants of the evolution of fatigue would allow for better prevention, early diagnosis and the implementation of various actions to control diseases. This project brought together researchers and hospital practitioners who place patient care at the center of their research work and implementation processes. Together we conclude that the optimal way to deal with fatigue implies a better understanding of this complex symptom.

5. Conclusion

The practical implications of our work may encourage clinicians to use and explore simple symptom assessment instruments, such as the DFCS, in their daily practices to help guide treatments and

care decisions. Our results represent a first step towards a valid measurement tool for daily fatigue in French cancer patients. This concise and user-friendly tool is shorter and more practical than long-scale instruments such the MFI, and offers a useful alternative for both clinicians and caregivers in their daily clinical practice. Future studies with larger samples should attempt to establish its construct validity.

Conflict of interest

The authors report no conflict of interest.

Note: The DFCS was developed in French and translated into English for the purpose of this manuscript.

APPENDIX

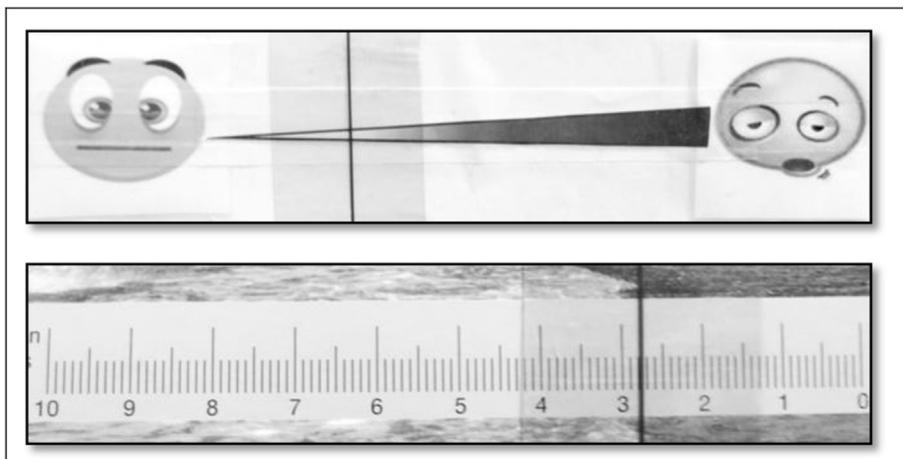


Fig. A1. The Daily Fatigue Cancer Scale (top: front view = patients' view; bottom: back of the scale = practitioner's view).

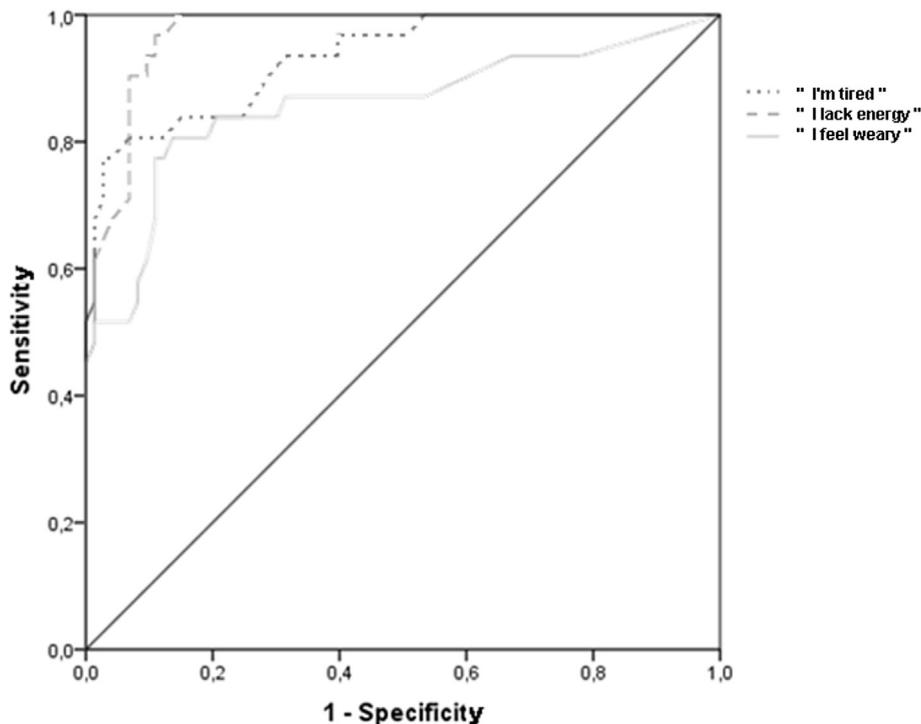


Fig. A2. ROC curve analysis comparing 3 DFCS item scores with established MFI cutoff score.

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