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Hedlund, Lena; Lundvik Gyllensten, Amanda; Hansson, Lars

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A psychometric study of the Multidimensional Fatigue Inventory to assess fatigue in patients with schizophrenia spectrum disorders

Authors:

Lena Hedlund, RPT, MSc[a]*, Amanda Lundvik Gyllensten, RPT, Ass Prof.[b], Lars Hansson, Prof.[c]

Address:

[abc] Departement of Health Science Centre, Faculty of Medicine at Lund University, P.O. Box 157, 221 00 Lund, Sweden

[a]* Corresponding author. Tel: 046 46 222 00 00.

E-mail adress: lena.hedlund@med.lu.se. Fax: 046 46 222 1808

[b] E-mail adress: Amanda.lundvik_gyllensten@med.lu.se.

[c] E-mail adress: lars.hansson@med.lu.se.

ABSTRACT

Fatigue is frequently reported by patients with mental illness. The multidimensional fatigue inventory (MFI-20) is a self-assessment instrument with 20 items including five dimensions of fatigue. The purpose of this study was to examine the test-retest reliability, internal consistency, convergent construct validity and feasibility of using MFI-20 in patients with schizophrenia spectrum disorders. Patients completed two self-assessment instruments, MFI-20 (n=93) and Visual Analogue Scale (n=79), twice within one week ± 2 days. Fifty-three patients also rated the feasibility of responding to the MFI-20 with a Likert scale. The test-retest reliability and validity were analysed by using Spearman´s correlations and internal consistency by calculating Cronbach´s α. The test-retest showed a correlation between .66-.91 for all subscales of MFI. The internal consistency was .92. The analysis of convergent construct validity showed a correlation of .68 (time 1) and .77 (time 2). No item was systematically identified as being difficult to answer.

Key words: Rehabilitation, motivation, anhedonia, feasibility, psychometric

Introduction

Fatigue can be a normal everyday experience or a symptom that indicates a disease including both somatic and psychiatric pathological conditions (Alsén, Brink, Brändström, Karlsson, & Persson, 2010; Harrington, 2012; Targum, Hassman, Pinho, & Fava, 2012). Depression and sleep disturbances have in particular been associated with fatigue (Palmese et al., 2011; Schneider, 1998; Stepnowsky, Palau, Zamora, Ancoli-Israel, & Loredo, 2011), which may also appear as a side effect of some medications (for example antipsychotic medication) (Targum et al., 2012). There is no consensus concerning a definition of fatigue which is an individual experience that affects each person's daily activity differently, and that may have multiple aetiology with individual physical, emotional and mental signs (Harrington, 2012). Normal fatigue is described as an experience of tiredness after an exertion where energy is restored after rest, while pathological fatigue is seldom reduced after rest (Harrington, 2012). The opposite experience of fatigue can be termed as strength, vitality or alertness, which are positive emotions linked to health, motivation and engagement (Hunter, Marshall, Corcoran, Leeder, & Phelps, 2013; Nix, Ryan, Manly, & Deci, 1999).

Patients with schizophrenia spectrum disorders often report fatigue. Many have sleep disturbances (Palmese et al., 2011) and negative symptoms including lack of energy, anhedonia and reduced activity. Problems concerning fatigue are also often overlooked due to its complexity (Targum et al., 2012). Fatigue in its different manifestations is sometimes a symptom and sometimes a condition mainly communicated by the affected person, and with an impact on quality of life, productivity and interpersonal relations (Targum et al., 2012). Clinically, when it comes to activating interventions such as vocational rehabilitation or physical exercise, the question of fatigue is often an issue that needs to be addressed. For this reason it is relevant to include a self- assessment consisting of different aspect of fatigue before starting an intervention.

There is no golden standard for the assessment of fatigue in patients with schizophrenia spectrum disorders, although a simple way is by using of a Visual Analogue Scale (VAS) (Lee, Hicks, & Nino-Murcie, 1990; Smets, Garssen, Bonke, & Haes, 1995). It consists of a 100 mm horizontal line with two endpoints, best possible or worst possible regarding different experiences like fatigue, or more commonly pain. A new application of the Clinical Global Impression Scale for the assessment of fatigue in patients with major depression, bipolar disorder or schizophrenia has recently been psychometrically tested by Targum et al. (2012). This consists of both a patient-rated and clinical-rated global impression scale. The patient-rated questionnaire consists of a single question about the severity of experienced fatigue within the past week. The scale has shown good reliability and validity (Targum et al. 2012).

Another scale commonly used within somatic care and science is the Multidimensional Fatigue Inventory (MFI-20). MFI-20 is a self-rating questionnaire with 20 items developed by Smets and colleagues (1995) and translated into Swedish by Fürst and Åhsberg (2001). The scale has shown good psychometric properties for several diagnostic groups, such as Chronic Fatigue Disorder, Parkinson´s disease, Cancer, Chronic widespread pain and Fibromyalgia

(Elbers, van Wegen, Verhoef, & Kwakkel, 2012; Ericsson & Mannerkorpi, 2007; Lundh Hagelin, Wengström, Runesdotter & Fürst, 2007; Smets et al. 1995). MFI-20 has also been compared to assessments of depression, anxiety, personality disorders, cognitive impairments, health status (SF-36) and different physiological variables such as vital capacity (Alsén et al. 2010; Breukink et al. 1998; Bol, Duits, Hupperts, Verlinden, & Verhey, 2010; Lin et al. 2009; Nater et al. 2010). The MFI-20 has been shown to have an overlapping variance with scores for depression, anxiety but also seems to reflect fatigue as a unique experience, as the opposite to vitality (Lin et al. 2009; Schneider, 1998; Stepnowsky et al. 2011). The MFI-20 has so far not been evaluated and used in studies of patients with schizophrenia spectrum disorders where fatigue is a commonly reported symptom. Reliable and valid assessments of fatigue would therefore be of clinical value, both in order to assess the levels of fatigue and to evaluate interventions that affect the experience of fatigue.

Aims of the Study

The aim of this study is to examine the test-retest reliability, convergent construct validity and feasibility of MFI-20 in patients with schizophrenia spectrum disorder. Furthermore, the scale's sensitivity to identify differences between various diagnostic groups and the general population will be investigated as well as differences within subgroups of patients with schizophrenia spectrum disorders.

Method

Participants and procedures

Patients were recruited from six out-patient mental health services in the south of Sweden. A pilot study of test-retest reliability was initially conducted in 2008, in order to evaluate the clinical usefulness of MFI-20. Both staff and patients reported the questions to be meaningful and to clarify different aspects of fatigue that otherwise would not have been revealed. A statistical analysis of test-retest reliability showed satisfying results. The main study of MFI-20 was conducted during 2010-2012.

Patients were assessed at two points of time with a span of 7±2 days between the assessments and asked to respond to the MFI-20 and a VAS-scale assessing general fatigue. Questions were also asked about the wording of items and the feasibility of assessments in a subgroup of the sample. Staffs were present if needed to support the patient by answering questions about responding to the questionnaire.

The inclusion criteria were: patients diagnosed with schizophrenia spectrum disorders (F 20.0-F 29 according to ICD-10 (295.10- 295.40, 295,70, 295.90, 297.1 according to DSM-IV)) visiting their out-patient unit on a regular basis, and able to read and speak the Swedish language. The patients received both verbal and written information about the study and gave informed consent to participate. No explicit exclusion criteria were applied.

A power calculation based on sample size required for the test retest part of study was performed. Assuming expected r=.7 and a 95% CI of .57-.80 for r, a sample size of 80 participants would be sufficient (Hertzog 2008).

One-hundred and three patients (20 in the pilot study and 83 in the main study) participated in the test-retest study and 79 patients from the main study participated in the validity study. A subsample of 53 patients was used to examine feasibility. Ten patients were excluded due to not completing the questionnaire correctly, mainly due to an invalid timespan between test-retest. The analysis of the reliability thus included 93 patients, the validity study 79 patients and the feasibility study 53 patients.

Measures

The MFI-20 consists of 20 statements, worded in a positive or negative direction. The scale is stipulated to reflect five dimensions of fatigue; general fatigue, physical fatigue, mental fatigue, reduced motivation and reduced activity. Each dimension is represented by four questions (Table 1). The creator of the MFI-20 does not recommend the use of the total score of MFI-20 for statistical analysis, but instead the total score for the subscale General Fatigue (Smets et al. 1995).

Table 1
The MFI-20 subscales, number of item and wording of statement

MFI-20 subscales	Item no and statements
General Fatigue	1. I feel fit. 5. I feel tired. 12. I am rested. 16. I tire easily.
Physical Fatigue	2. Physically I feel only able to do a little. 8. Physically I can take on a lot. 14. Physically I feel I am in a bad condition. 20. Physically I feel I am in an excellent condition.
Mental Fatigue	7. When I am doing something, I can keep my thoughts on it. 11. I can concentrate well. 13. It takes a lot of effort to concentrate on things. 19. My thoughts easily wander.
Reduced Activity	3. I feel very active. 6. I think I do a lot in a day. 10. I think I do very little in a day. 17. I get little done.
Reduced Motivation	4. I feel like doing all sorts of nice things. 9. I dread having to do things. 15. I have a lot of plans.18. I don’t feel like doing anything.

The Visual Analogue Scale consisted of a 100 mm horizontal line (Krupp, Alvarez, Larocca, & Scheinberg 1998; Smets et al. 1995). The patients were instructed to mark with a cross how tired they felt on an ordinary day. The endpoints represented "not at all" and "very much".

The feasibility was examined with a 5 point Likert scale, from easy (1) to difficult (5). The patients were instructed to answer how difficult it was to answer the questions in the MFI-20 scale, and to also write down the item numbers of questions that were particularly difficult to answer.

Statistical analysis

The IBM SPSS statistical software version 20.0 was used to carry out the statistical analyses for examining the test-retest reliability, the internal consistency and the convergent construct validity. All statistical analyses were 2-tailed and used a significance level of $p<0.05$, *(*if not noted otherwise).

Mean and standard deviations are described for the outcomes of the MFI-20 scale at time 1 and 2. The scores of Time 1 were compared to investigations of MFI-20 in three medical conditions (data from other studies).

The internal consistency was examined for both time 1 and time 2, using Cronbach´s α. An α-value of ≥ .70 was accepted as satisfactory (Björkqvist, 2012). The corrected item-total correlations (CITC), and alpha if item deleted were also calculated. A CITC value of >.20 was set as a satisfactory association between an item and the total scale (Streiner & Norman, 2002).

Spearman´s correlation was used to evaluate test-retest reliability between time 1 and time 2, both regarding each item and the subscales. Correlations were defined as not existing or small in the range 0.00-0.25, fair for 0.26-0.50, moderate or good for 0.51-0.75 and strong for > .75 (Ericsson & Mannerkorpi, 2007).

Convergent construct validity was evaluated by using Spearman´s correlations of the ratings on the VAS and the general fatigue subscale of MFI-20, for both time 1 and time 2.

ANOVA was used to identify differences in fatigue scores of each subscale and between diagnostic subgroups. Student´s *t*-test were used to compare means between different the actual group of patients, other diagnosis and a general population.

Ethics

This study is part of a larger study investigating Basic Body Awareness Therapy for patients with schizophrenia. Ethical approval was obtained from Regional Ethical Review Board, Lund University, Sweden (Dnr 208/2008).

Results

Background characteristics of the participants are shown in Table 2. There were 22 female and 42 male participants with a primary diagnosis of schizophrenia (F 20.0-F 20.9). For the other diagnoses there were 17 female and 12 male.

Table 2
Background characteristics of participants (N=93)

Characteristic	N	%
Gender		
Male	54	58.1
Female	39	41.9
Primary diagnosis		
Schizophrenia F20	64	68.8
Schizoaffective disorder F25	23	24.7
Persistent delusional disorders F22	4	4.3
Unspecified non organic psychosis	2	2.2
Medication		
Antipsychotic	90	96.8
Antidepressant	38 (F20, n=28)	40.9 (F20 74%)
Sedative	36 (F20, n=26)	38.7 (F20 72%)
Other (mood stabilizer, heart and blood pressure medication, vitamins)	45 (F20, n=25)	48.3 (F20 55%)
Age		
Mean	43.54	
±SD years	±10.59	
Range	49	
Min-Max	22-71	

The internal missing data were very low, generally in the range of 0-1%. The MFI-20 demonstrated a satisfactory internal consistency. At time 1 the Cronbach´s α = .92 and at time 2, Cronbach's α = .92. The CITC values varied between .32 and .70 and were all above the limit of .20. Deletion of single items only marginally changed the alpha value.

The analyses of test-retest reliability showed good to strong correlations (.66-.91) between the two assessments for all subscales (table 3). Two items (item no 11 and 19) showed a strong correlation (.77-.82), item no 3, 5 and 9 showed a fair correlation (.32 -.50) and the remaining fifteen items showed a good correlation.

Table 3
Test-Retest reliability for each subscale.

MFI-20	**Spearman´s correlation *****
General fatigue	.74
Physical fatigue	.82
Reduced activity	.71
Reduced motivation	.66
Mental fatigue	.91

*** Correlations are significant at the p<0.001 level

The analysis of convergent construct validity showed that the total score of the subscale general fatigue and VAS-F were significantly correlated at both time 1 (.68; p<.001) and time 2 (.77; p<.001).

The investigation of feasibility showed that the items of MFI-20 were generally understandable and easy to answer (m= 2.36 and SD 1.16). Eight patients identified item no 1 as difficult, four identified item no 9 as difficult to answer, and three item no 15 and 19 as difficult to answer. Fourteen of the totals of 20 items were stated as being difficult to answer by at least one person. No patient gave further explanations on why they found the respective item difficult to answer.

The ratings of MFI-20 at time 1 are presented in table 4 and compared with the assessments of a general population sample, samples of patients after a myocardial infarct (Alsén et al. 2010), and patients with fibromyalgia and chronic widespread pain (Ericsson & Mannerkorpi, 2007).

Table 4
MFI scores at time 1 and time 2 for patients with schizophrenia spectrum disorders compared with the general population, patients with MI (Alsén et al. 2010), Fibromyalgia and chronic widespread pain (Ericsson & Mannerkorpi. 2007).

MFI-20 scale	General population (GP) (n=139) Mean age (SD) 46 (16)	Patients with schizophrenia disorders (SD), Time 1 and time 2 (n=93) Mean age (SD) 43 (10.5)	Patients 4 months after Myocardial infarct (MI) (n=204) Mean age (SD) 64 (10)	Patients with fibromyalgia and Chronic widespread pain (FCP) (n=166) Mean age (SD) 46 (8.8)
General fatigue (GF) 4 item	9.9 (5.2) [a]	13.4 (3.9) 13.4 (3.8)	12.3 (4.3)	16.0 (3.2)[c]
Physical fatigue (PF) 4 item	8.8 (4.9) [a]	12,6 (4.2) 13.1 (4.0)	11.9 (4.7)	15.9 (3.6)[c]
Reduced activity (RA) 4 item	8.7 (4.6) [a]	12.3 (4.2) 12.4 (3.9)	12.1 (4.5)	14.4 (4.3)[c]
Reduced motivation(RM) 4 item	8.2 (4.0) [a]	10.3 (3.6) 10.5 (3.7)	8.9 (3.5)[b]	9.9 (3.8)[c]
Mental fatigue (MF) 4 item	8.3 (4.8) [a]	12.6 (4.4) 12.8 (4.5)	10.2 (3.8)[b]	14.1 (3.8)[d]

Comparisons with patients with schizophrenia: [a] = p<.001; [b] = p<.001; [c] = p<.001; [d] = p<.01

Patients with schizophrenia spectrum disorders reported significantly (p= 0.001) higher scores for fatigue in all five subscales compared to the general population. Furthermore, patients with schizophrenia spectrum disorders had significantly higher scores for fatigue in the reduced motivation and mental fatigue subscales (p=0.001) than patients with myocardial infarct. On the other hand, patients with fibromyalgia and chronic widespread pain had significantly higher scores for fatigue in the subscales general fatigue, physical fatigue, reduced activity (P= 0.001) and mental fatigue (p=0.004) compared to patients with schizophrenia spectrum disorder.

Subgroup analyses were conducted to identify differences in levels of fatigue in relation to age, gender, type of medication and diagnosis. Those who stated that they were taking antidepressants had significantly higher scores on mental fatigue (p=0.011). Patients with schizophrenia (F. 20.0- F 20.9) had significantly higher scores on physical fatigue (p=0.015) and reduced motivation (p=0.009) than the remaining diagnostic subgroups.

Discussion

The internal consistency at both times of assessment was satisfactory as well as CITC and alpha if item deleted, indicating that MFI-20 has adequate scale properties and that each item is correlated to the construct of fatigue. There were high correlations between the subscale general fatigue and with the subscales physical and mental fatigue all thought not as high as reported in earlier studies (.72-.88).

Furthermore, the test-retest reliability was also satisfactory, with mainly good correlations between the two points of assessment. Three items within three different subscales showed fair correlations. Two of them (item no 3 and 5) were close to the limit for good correlation, whereas item no 9 had the lowest item level correlation, although only four patients identified it as a difficult item in the feasible study. However, this item consists of a Swedish word for dread (fasar), which is seldom used in common Swedish language today and young people or people originating from other countries might not understand its purport and therefore be more uncertain when evaluating themselves. A preliminary conclusion is thus that this item needs further investigation, and the wording might need to be changed. The Swedish word for dread can be replaced with the more common and synonymous "strong fear". However, when using the total score for each subscale, the higher correlation of the other items (item no 4, 15 and 18) within reduced motivation compensates for the lower correlation of item no 9.

The convergent construct validity between the total score in the subscale general fatigue and VAS was also shown to be satisfactory, with significant correlations at both points of assessments. When the present study was performed, no other instrument for the assessment of fatigue in patients with schizophrenia spectrum disorder was available for use. Testing validity by comparisons with the newly published Clinical Global Impression Scale (Targum et al. 2012) would be relevant and interesting in future studies. However, one advantage with testing the validity by comparing with the VAS for fatigue is that it has been used in other studies including other pathological conditions (Ericsson & Mannerkorpi, 2007; Smets et al. 1995). This circumstance enables comparisons and in fact the present study showed similar levels of correlation, indicating that the actual pathological condition had no influence or relevance for the convergent construct validity.

The feasibility of the MFI-20 was satisfactory. The mean value of the Likert scale was below the neutral responding option used in assessing feasibility, and there was no consensus about a specific item that was difficult to answer. At the most eight of the 53 participants stated a single item (item no 1) as being difficult and 14 of the 20 items were reported only by one patient as being difficult, indicating no systematic difficulties with any single item.

The MFI-20 showed sensitivity in differentiating between patients with schizophrenia disorders compared to the general population and several other pathological conditions, and also between subgroups of patients with schizophrenia disorder. The present study indicates that patients with schizophrenia spectrum disorder overall have a high and evenly distributed multidimensional level of fatigue compared to the general population and also other

pathological conditions. This overall increased level of fatigue is also in line with the results of the study done by Targum et al. (2012). Interestingly, patients using antidepressants had a significantly higher level of mental fatigue, and people with schizophrenia (F 20.0- F 20.9) had significantly higher levels of reduced motivation and physical fatigue. People with depression are known to experience fatigue as one of the most prominent symptoms (Alsén et al. 2010; Harrington, 2012; Visser & Smets, 1998), which might explain the higher level of mental fatigue shown in the present study. Furthermore, the reduced motivation among patients with schizophrenia might be an expression of negative symptoms like anhedonia connected to the disease, as well as the higher scores on physical fatigue might be connected to worse physical condition. If not noticed before, the individual profile of MFI-20 might indicate a need of further estimation of depression or prominent negative symptoms of schizophrenia. Since almost all of the participants reported that they used antipsychotic medication there were no possibilities for comparing levels of fatigue with participants not taking antipsychotic medication, which is also known to increase fatigue (Targum et al. 2012). Another circumstance contributing to fatigue is insomnia, and it has been found in a recently performed study, that as many as 44% of 175 patients with schizophrenia met the criteria for insomnia (Palmese et al. 2011).

Compared to the Clinical Global Impression Scale, the MFI-20 only assesses the patients´ experience of fatigue but at the same time provides a more specific and differentiated profile due to the five dimensions of fatigue. These subscales thus give an individual profile that provides relevant clinical information that can be followed up after different interventions. The scientific value of the MFI-20 is that it may enable further studies of different kinds of fatigue and their interrelationship and coexistence with other symptoms, such as negative symptoms, depression and anxiety, which also may have relevance for clinical interventions.

One limitation of this study is that the total number of patients invited to participate in the study is unknown, and that no information was gathered for those who chose to decline participation. We thus had no possibilities of investigating the representativeness of the participants in comparison with the total number of patients eligible for the study. However, the population in our study varies in age, gender and diagnosis, which might indicate representativeness. Together with the results of Targum et al. (2012) our study indicate that fatigue might be a common feature among patients with schizophrenia spectrum disorders, in need to be clinically highlighted and followed up.

Conflict of interest

None of the authors declare any conflict of interests. All authors certify responsibility.

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