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Short communication

Short fatigue questionnaire: Screening for severe fatigue.

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ABSTRACT

Objective. To determine psychometric properties, a cut-off score for severe fatigue and normative data for the 4-item Short Fatigue Questionnaire (SFQ) derived from the multi-dimensional fatigue questionnaire Checklist Individual Strength (CIS).

Methods. Data of previous studies investigating the prevalence of fatigue in ten chronic conditions (n = 2985) and the general population (n = 2288) was used to determine the internal consistency (Cronbach's alpha) of the SFQ, its relation with other fatigue measures (EORTC QLQ-30 fatigue subscale and digital fatigue diary), a cut-off score for severe fatigue (ROC analysis) and to examine whether the four SFQ items truly measure the same construct. Norms were calculated for ten patient groups and the Dutch general population.

Results. Cronbach's alpha of the SFQ were excellent in almost all groups. Pearson's correlations between the SFQ and the EORTC-QLQ-C30 fatigue subscale and a fatigue diary were respectively 0.76 and 0.68. ROC analysis showed an area under the curve of 0.982 (95% CI: 0.979–0.985) and cut-off score of 18 was suggested which showed a good sensitivity (0.984) and specificity (0.826) as well as excellent values for the positive and negative prediction values within all groups using the CIS as golden standard. Factor analysis showed a one factor solution (Eigenvalue: 3.095) with factor loadings of all items on the factor being greater than 0.87.

Conclusion. The SFQ is an easy to use, reliable and valid instrument to screen for severe fatigue in clinical routine and research.

1. Introduction

Fatigue, defined as a sense of tiredness, lack of energy or feeling of exhaustion, is a common symptom in several clinical conditions [1]. Persistent severely fatigued persons, indicated as such by a cut-off score on a validated fatigue questionnaire, are limited in their daily functioning, visit their physician more often and have an increased risk for developing other diagnoses [2,3]. It is important to identify and monitor the severity of fatigue and provide proper care to patients who are affected by it. Being a multidimensional, subjective experience, fatigue is best measured by the use of a questionnaire consisting of several subscales with multiple dimensions. The Checklist Individual Strength (CIS) [4] is an example of a reliable fatigue questionnaire containing multiple subscales assessing different dimensions of fatigue.

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This 20-item instrument is well validated and used in various patient groups [4–7]. However, the CIS, but also other instruments like the Multidimensional Fatigue Instrument (MFI) [8] or the Chalder Fatigue Scale (CFQ) [9], are relatively long. In clinical routine it is desirable to have a screening instrument that measures fatigue swiftly and is easy to administer. The Shortened Fatigue Questionnaire (SFQ), a 4-item version of the CIS, is such a questionnaire [10,11]. The four items of the SFQ have, being part of the CIS, been translated into English, German, Spanish, Swedish, French, Portuguese, Turkish, Italian, Polish, and Japanese. For its use in clinical routing, it is essential to have a validated cut-off score to indicate the presence of severe fatigue. Most fatigue scales lack such a cut-off score making them less suitable for the management of fatigue in clinical practice. An example of a short fatigue questionnaire with a validated cut-off score is the Fatigue Severity Scale (FSS) [12]. However, next to having more than twice as much items compared to the SFQ, to calculate a total score of the 9 FFS items several calculations need to be carried out which make its use as a screening instrument less optimal. The availability of a short, easy to administer fatigue questionnaire with a validated cut-off score can aid assessment of clinical relevant levels of fatigue. The aim of the current study is to determine psychometric properties of the SFQ, a cut-off score indicating severe fatigue and to present normative data of a wide range of chronic conditions and the general population.

2. Methods

2.1. Participants

SFQ data were derived from the CIS, gathered in previous studies for the following participants: A sample of the general Dutch population (n = 2288), derived from CentERdata [13], a research institute at Tilburg University in the Netherlands with access to data of a large panel reflecting the distribution of the Dutch population in age, sex, education level, and social and economic status; Patients with chronic fatigue syndrome (CFS, n = 1407) [14] meeting the revised 2003 US Centers for Disease Control and Prevention criteria for CFS [15,16]; Patients with Diabetes type 1 (n = 214) [17], Rheumatoid Arthritis (RA, n = 228) [18], advanced cancer (n = 135) [19], Facioscapulohumeral Muscular Dystrophy (FSHD, n = 137) [20], Myotonic Dystrophy (MD, n = 320) [20], Hereditary Motor and Sensory Neuropathy type 1 (HMSN, n = 136) [20], Chronic Obstructive Pulmonary Disease (COPD, n = 160) [21], breast cancer survivors (n = 150) [22] and cancer survivors treated with stem cell transplantation (SCT, n = 98) [23].

2.2. Additional participants.

Extracting SFQ from CIS: Although identical, the four items of the SFQ may be answered differently when being part of a more extensive questionnaire (CIS). To investigate this possible difference, the SFQ and CIS were completed by patients who were consecutively referred to a tertiary treatment center for chronic fatigue (Fatigued group 1 (FG1), n = 127).

Cut-off score: People referred to a tertiary treatment center for chronic fatigue between 2000 and 2016 were included. This group consisted of patients with medically unexplained fatigue, possibly meeting CDC criteria for CFS, as well as patients with a chronic medical condition and patients who were successfully treated for cancer but reported fatigue (Fatigued group 2 (FG2), n = 4854). SFQ total scores were derived from the CIS which they completed as part of their assessment.

A description of all participants is given in Table 1 in appendix A.

SFQ

The Shortened Fatigue Questionnaire (SFQ) [10] consists of four items ('I feel tired', 'I tire easily', 'I feel fit' and 'I feel physically exhausted'; see appendix B). Each item is scored on a 7-point Likert Scale, ranging from 1 'yes, that is true' to 7 'no, that is not true'. Scores of items 1, 2 and 4 are reversed and then all item scores are added up which results in a total score varying from 4 to 28. Higher scores reflect a higher level of fatigue.

Other fatigue measures.

The EORTC-QLQ-C30 [24], a questionnaire to assess quality of life containing 15 subscales (one assessing fatigue), was completed by the participating cancer survivors (n = 247, one participant had missing data) [22,23].

An electronic fatigue diary (EFD) was completed to assess fatigue in 68 of the Diabetes type 1 participants [17]. At the day of assessment, these participants were asked to indicate their fatigue status at that particular moment on a visual analog scale. They scored their level of fatigue six times during that day with the mean score representing their fatigue severity.

Statistical analyses.

IBM SPSS (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp) was used for all statistical analyses.

Extracting SFQ from CIS: Total mean scores of the SFQ and corresponding CIS items completed by FG1 were compared using a paired samples t-test.

Factor analysis: To investigate if the items of the SFQ indeed measure one underlying variable, we conducted a confirmatory factor analysis (CFA) in the general Dutch population cohort (n = 2288) by means of a principal component analysis including all four items. We expected to find one factor, representing fatigue severity. Item correlation matrix, Kaiser-Meyer-Oklin (KMO) test and Bartlett's test of sphericity were calculated to test adequacy of the data for CFA. Model fit was examined using the Root Mean Square Error of Approximation (RMSEA), with a value < 0.06 as a cut-off value to indicate good model fit [25]. A Scree plot was calculated to examine the possibility of a 2- or more factor solution.

Psychometric properties: Cronbach's alpha was calculated for all groups to determine the internal consistency. To gain insight in the construct validity, Pearson's correlations were calculated between the SFQ and the EORTC-QLQ-C30 fatigue subscale and between the SFQ and the EFD.

Cut-off score: Receiver Operating Characteristic (ROC) analysis was performed. FG2 was labeled severely fatigued. A healthy subgroup of the general Dutch population who reported no sick days in the past month (n = 1906) was thought to not experience clinically relevant levels of fatigue (mean total SFQ score: 11.4, SD: 5.8) and was labeled not severely fatigued. In addition, for all plausible cut-off scores (determined by the ROC analyses) the positive prediction value (PPV; probability that a person is truly severely fatigued when indicated so by the total SFQ score) and negative prediction value (NPV; probability that a person is truly not severely fatigued when indicated so by the total SFQ score) were calculated using the validated cut-off score ($\geq$ 35) of the CIS fatigue subscale (CIS-fatigue) [14] to indicate true 'cases' and 'non-cases'.

Normative data: Mean total scores and quartile scores of the SFQ were calculated for all groups.

An overview of the analyses that were conducted in each participant group is given in Table 1 in appendix A.

3. Results

3.1. Extracting SFQ from CIS.

Mean total score of the SFQ and of the same four items being part of the CIS showed no significant difference (-0.19; 95% CI -0.52-0.15; p-value = 0.27).

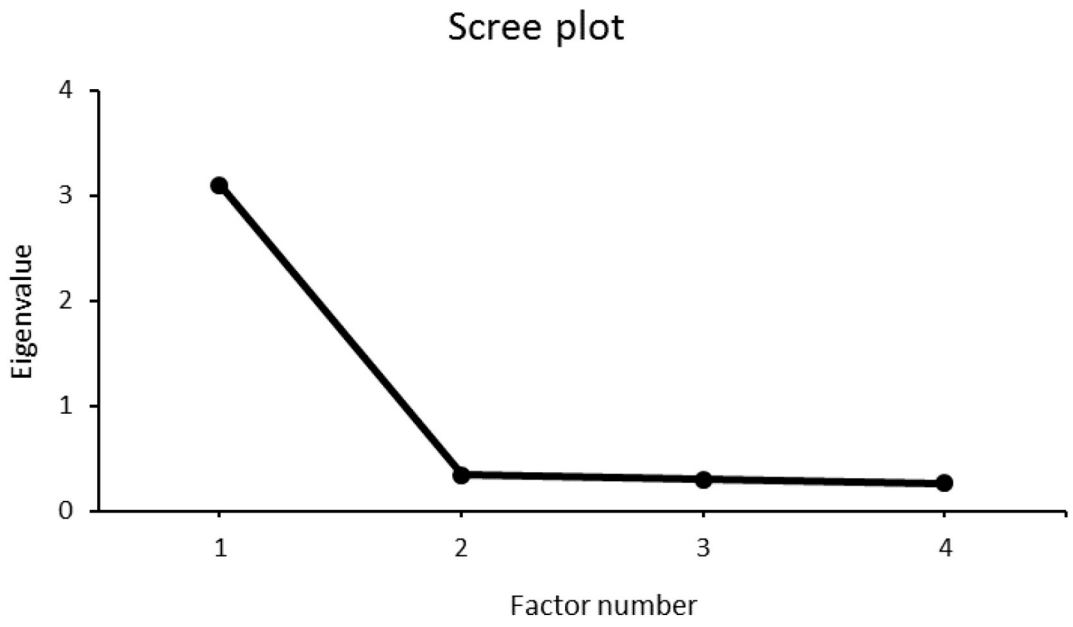

Fig. 1. Scree plot showing the Eigenvalues of different factor solutions.

3.2. Factor analysis.

The data was adequate to perform CFA: Item correlation matrix showed all coefficients ≥0.75, KMO value was 0.85 and Bartlett's test of sphericity was significant ($p < 0.001$). CFA showed a one factor solution (Eigenvalue: 3.095) explaining 77.4% of the variance with factor loadings of all items on the factor greater than 0.87. A two-, three- or four factor solution resulted in Eigenvalues smaller than 1, confirming a one-factor solution (Fig. 1). RMSEA had a value of 0.0012 which supports a good model fit.

3.3. Psychometric properties of the SFQ.

Cronbach's alpha is presented for all groups in Table 3 in appendix A and, except for the CFS patients (0.57), showed acceptable to excellent values (0.72–0.92). Pearson's correlation between SFQ total score and the EORTC-QLQ-C30 subscale fatigue score was 0.76 and between the SFQ and the EFD 0.68.

3.4. Cut-off score.

ROC analysis showed an area under the curve of 0.983 (95% CI: 0.980–0.986). Table 1 shows the sensitivity and specificity of several possible cut-off points for the SFQ. A cut-ff score of 22 resulted in the highest combined sensitivity and specificity. A cut-off score of 18 showed a high sensitivity (0.986) and specificity (0.826) and resulted in an excellent combined PPV and NPV for all groups. Table 2 in appendix A shows the PPV and NPV of these two plausible cut-off scores for all groups.

Table 1
Sensitivity and Specificity for best fitting cut-off points of the SFQ.

Cut-off point (equal or higher = Severe Fatigue)*	Sensitivity (%)	Specificity (%)
17	99.1	78.4
18	98.6	82.6
19	98.1	86.0
20	97.1	88.3
21	96.0	91.9
22	94.1	94.3
23	89.6	95.5
24	85.6	97.3

* A range of possible cut-off points is shown.

3.5. Normative data.

Population norms of all groups are presented in Table 3 in appendix A.

4. Discussion

Psychometric characteristics of the SFQ were shown to be adequate. Cronbach's alpha was high for almost all study populations, except for the CFS population. A plausible explanation for the latter could be the fact that the CFS group scored extremely high on the SFQ decreasing the variance of the item- and total scores. The reason why this group scored this high on the SFQ is explained by the fact that one of the criteria to meet the case definition of CFS is scoring above the cut-off score of 35 on the CIS fatigue severity subscale. As the SFQ is derived from the CIS, this will lead to a restricted range of scores. This suggests that the internal consistency itself was not necessarily lower in the CFS population. The relation between the SFQ and other fatigue measures showed the construct validity to be satisfying.

A cut-off score to indicate the presence of severe fatigue was presented. From a clinical perspective we believe a cut-off score of 18 to best match the purpose of the SFQ as a screening tool. Next to a good sensitivity and specificity, it shows an excellent NPV, a value which was stressed to be of great importance for screening tools [26], for all groups. The higher the NPV, the higher the chance that a person is truly not fatigued when indicated as such by the SFQ. A high NPV is essential since it ensures that persons who are truly severe fatigued will not be overlooked. Severely fatigued persons as indicated by the SFQ will undergo more extensive fatigue assessment, including clinical history-taking and a multidimensional fatigue questionnaire. Persons wrongly identified as severely fatigued (a low PPV increases the chance of doing so) are thus filtered out. Therefore, we suggest a cut-off score of 18 (with excellent NPV's and good PPV's for all groups) to screen for severe fatigue. Screening needs to be followed by a more detailed assessment including a multi-dimensional fatigue questionnaire. In this way, the persistence, the person's functional impairment and other somatic or psychological factors which might be related to the fatigue symptoms can be determined.

To conclude, with good psychometric properties, a cut-off score for severe fatigue and population norms presented, the SFQ can be used as screening instrument to identify severe fatigue in the clinic as well as for medical research purposes.

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Declarations of interest

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychores.2020.110229.

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