



## The assessment of fatigue: Psychometric qualities and norms for the Checklist individual strength

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### ABSTRACT

**Objective:** The Checklist Individual Strength (CIS) measures four dimensions of fatigue: Fatigue severity, concentration problems, reduced motivation and activity. On the fatigue severity subscale, a cut-off score of 35 is used. This study 1) investigated the psychometric qualities of the CIS; 2) validated the cut-off score for severe fatigue and 3) provided norms.

**Methods:** Representatives of the Dutch general population ( $n = 2288$ ) completed the CIS. The factor structure was investigated using an exploratory factor analysis. Internal consistency and test-retest reliability were determined. Concurrent validity was assessed in two additional samples by correlating the CIS with other fatigue scales (Chalder Fatigue Questionnaire, MOS Short form-36 Vitality subscale, EORTC QLQ-C30 fatigue subscale).

To validate the fatigue severity cut-off score, a Receiver Operating Characteristics analysis was performed with patients referred to a chronic fatigue treatment centre ( $n = 5243$ ) and a healthy group ( $n = 1906$ ). Norm scores for CIS subscales were calculated for the general population, patients with chronic fatigue syndrome (CFS;  $n = 1407$ ) and eight groups with other medical conditions ( $n = 1411$ ).

**Results:** The original four-factor structure of the CIS was replicated. Internal consistency ( $\alpha = 0.84\text{--}0.95$ ) and test-retest reliability ( $r = 0.74\text{--}0.86$ ) of the subscales were high. Correlations with other fatigue scales were moderate to high. The 35 points cut-off score for severe fatigue is appropriate, but, given the 17% false positive rate, should be adjusted to 40 for research in CFS.

**Conclusion:** The CIS is a valid and reliable tool for the assessment of fatigue, with a validated cut-off score for severe fatigue that can be used in clinical practice.

### 1. Introduction

Fatigue is a subjective phenomenon that can be defined as an overwhelming sense of tiredness, lack of energy and feeling of exhaustion. It is different to more everyday experiences as tiredness or sleepiness and is also different from muscle weakness [1]. When severe, fatigue can lead to limitations in daily functioning. Fatigue is common in many (chronic) clinical conditions, for example during and after cancer treatment [2–5], in type I diabetes [6], in rheumatoid arthritis (RA) [7], stroke [8], traumatic brain injury [9], Multiple Sclerosis (MS)

and neuromuscular disease [1,10]. In addition, fatigue is a central feature of chronic fatigue syndrome (CFS) [11]. Fatigue is regarded to be a multi-dimensional symptom. Among the relevant dimensions are experienced fatigue, concentration problems or mental fatigue, reduced motivation, and reduced (physical) activity.

There are no objective markers of fatigue. Therefore, fatigue is usually assessed with self-report scales. There is no consensus on the definition of fatigue, which is reflected in the wide variety of instruments developed to assess it. Data on validity, reliability and cut-off scores that identify patients with clinically relevant levels of fatigue are

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often not available for these instruments, or only for the population for which the scale was developed [12].

An often-used fatigue scale is the Checklist Individual Strength (CIS) [13]. It was developed as a self-reported multidimensional instrument to assess four qualitatively different and relevant aspects of fatigue: fatigue severity (subjective experience of fatigue); concentration problems; reduced motivation and reduced activity level. The items were developed with the intention to measure these dimensions of fatigue. The intention was not to assess all aspects of fatigue. During its construction, it was tested in a large group of patients with Chronic Fatigue Syndrome (CFS). Principal component analysis and reliability analysis lead to a 20 item questionnaire (see Appendix A). It was found to indeed measure the above mentioned four distinct dimensions of fatigue, which together explained about two third of the variance in item scores.

The CIS was found to be reliable, the internal consistency was high for the total scale as well as for the subscales. The CIS was able to distinguish between different patient groups and between patients and healthy people [14–16]. Modest to large correlations existed between the CIS subscales and other scales that were expected to measure similar constructs [14,15,17,18]. The CIS has since then been translated into English [19], German, Spanish, Swedish, French, Portuguese [20], Turkish [21], Italian, Polish [22] and Japanese [23]. The Portuguese, Turkish, Japanese and Polish versions were validated. The subscale Fatigue Severity was used to identify patients with severe fatigue and was often used as an outcome measure in intervention studies [12,24–28].

In some cases severe and persistent fatigue can be treated effectively. Research has shown that severe fatigue can be treated effectively in CFS [29]; in cancer survivors [27,30]; and in several chronic diseases: neuromuscular disorders [31]; MS [32] and RA [33]. To investigate the efficacy of interventions, it is important to have a valid and reliable tool to assess fatigue, that is able to detect change and can determine whether fatigue has returned to healthy levels. For assessment in clinical practice it is important to have an instrument that, besides a clinical interview, can help identify those patients that have clinically relevant levels of fatigue and could potentially profit from an intervention aimed at fatigue. A cut-off score of 35 of the CIS subscale Fatigue Severity is often used, as this score is within two standard deviations above the mean fatigue score of healthy people [34]. This cut-off score is, however, based on data of a small group of healthy controls ( $n = 53$ ), collected more than twenty years ago [14,15]. Furthermore, the CIS was never validated in a large sample from the general population or in other patient groups than CFS. Also, no data exists on the test-retest reliability and norm data on the clinical populations in which the CIS has been applied are limited to a few groups and were only published in Dutch, approximately 15 years ago [14].

The first objective of this study was to investigate the psychometric characteristics of the CIS in a sample from the general population. Concurrent validity was tested in a group of CFS patients and in a group of cancer survivors. The second objective was to determine the cut-off score that distinguishes between severe and non-severe fatigue, using data from the general population and from patients with severe fatigue. The third objective was to present CIS norms for various clinical groups.

## 2. Methods

### 2.1. Participants

#### 2.1.1. Psychometric properties of the CIS

To determine psychometric qualities of the CIS the following samples were used:

1. A large sample ( $n = 2288$ ) from the general Dutch population derived from CentERdata, a research institute at Tilburg

University in the Netherlands [35]. CentERdata has access to a large panel used for surveys which reflects the distribution of the Dutch population in age, sex, education level, and social and economical status.

2. Cancer survivors from three studies ( $n = 320$ ) [3,36,37]. All patients had completed cancer treatment with curative intent and had mixed tumor diagnoses. Further details on the characteristics of this group are presented in Appendix B.
3. Patients meeting CDC criteria for CFS ( $n = 1407$ ) [11,38] consecutively referred to a tertiary treatment center for chronic fatigue at the Radboud University Medical Center between 2007 and 2013.

In both clinical samples the relationship between the CIS and other fatigue measures was determined (see also Measures).

#### 2.1.2. Cut-off score for severe fatigue

To determine the cut-off score for CIS Fatigue Severity subscale we used the following groups:

1. People referred between 2000 and 2016 to a tertiary treatment center for chronic fatigue at the Radboud University Medical Center for being severely fatigued ( $n = 5243$ ). All completed the CIS as part of a routine screening at the start of their diagnostic process.
2. A healthy subgroup of the aforementioned sample from the general population, who reported no sick days in the past month, with people younger than 18 years ( $n = 17$ ) excluded (total  $n = 1906$ ). The latter was done to match the data with the first group, that only contains adults.

#### 2.1.3. Population norms

Norms were derived from the aforementioned CFS group, the general population sample and from existing data on eight additional samples of patient groups ( $n = 1411$ ), in which fatigue was assessed. These groups were patients with Type 1 diabetes [6]; patients with RA [7]; breast cancer survivors [39]; haematological cancer survivors, mixed diagnoses [3]; patients with advanced solid tumors [2]; patients with Facioscapulohumeral Dystrophy; patients with Myotonic Dystrophy and patients with Hereditary Motor and Sensory Neuropathy type I [10]. Patients were not selected on their level of fatigue. For details on the populations see Appendix B. In all samples used, patients who did not complete the entire CIS were excluded from analyses.

## 2.2. Measures

### 2.2.1. Checklist individual strength

The Checklist Individual Strength was used (CIS; Appendix A). The questionnaire consists of 20 items with a 7-point Likert scale scoring. A total score is derived by summation of the item scores. There are four subscales; Fatigue Severity, measuring the subjective experience of fatigue (8 items); Concentration, measuring concentration problems (5 items); Motivation, measuring reduced motivation (4 items) and Activity, measuring the reduction of activities (3 items). Reversed scoring is applied to some items (see Appendix A).

### 2.2.2. Other fatigue measures

In CFS patients fatigue was also assessed with the MOS Short form-36 (SF-36) subscale Vitality [41] and the Chalder Fatigue Questionnaire (CFQ) [42]. The SF-36 subscale Vitality consists of four questions concerning fatigue and energy, that can be answered on a 6-point scale ranging from zero to five. Scores were transformed to obtain a total score ranging from zero to 100. Lower score indicates less vitality. Cronbach's alpha for the Dutch version was 0.82 [43]. The CFQ is a widely used, reliable and valid fatigue questionnaire [44,45], consisting of eleven items. Seven measure physical fatigue and four measure mental fatigue. There are four response options, each scored from zero to three, total score range zero to 33. A Dutch version was validated and

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