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Measuring fatigue in sarcoidosis: The Fatigue Assessment Scale (FAS)

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Fatigue is a major problem in a wide range of diseases including sarcoidosis. However, there is no standard measure for assessing fatigue. Therefore, the aim of the present study was to evaluate the usefulness of the Fatigue Assessment Scale (FAS) in two samples of sarcoidosis patients. Sample 1 included 1046 members of the Dutch Sarcoidosis Society and Sample 2 consisted of 80 sarcoidosis patients of the outpatient clinic of the Sarcoidosis Management Centre Maastricht, the Netherlands. All patients completed the FAS as well as the 'energy and fatigue' subscale of the WHOQOL-100. Additionally, the participants of Sample 1 filled in the Beck Depression Inventory (BDI). In addition, 241 patients of Sample 1 completed the FAS for the second time after a one-week interval. The FAS appeared to be a unidimensional scale. The content validity, construct validity and internal consistency of the FAS were good. The test–retest reliability was .89. Four FAS items appeared to have a gender bias: three items were uniformly biased and one item non-uniformly biased. Correction for gender bias in the calculation of the FAS total score is not indicated. In conclusion, the FAS is a promising measure for assessing fatigue in sarcoidosis patients.

Fatigue is a common complaint in the general population (e.g. Loge, Ekeberg, & Kaasa, 1998) as well as in general practice (e.g. Bensing, Hulsman, & Schreurs, 1996). In addition, it is a symptom of many diseases such as an Epstein-Bar virus infection, rheumatoid arthritis, cancer and fibromyalgia (e.g. Lewis & Wessely, 1992). Recent studies have shown that fatigue is also a major problem in sarcoidosis (Drent *et al.*, 1998; Sharma, 1999; Wirnsberger, De Vries, Breteler *et al.*, 1998; Wirnsberger, De Vries, Woulters, & Drent, 1998). After asthma, sarcoidosis is the second most common respiratory disease in young adults. It is a disseminated granulomatous disease of unknown origin in which practically every organ can be involved (Hunninghake *et al.*, 1999). Beside the lungs, most frequently engaged are lymph nodes, the skin, eyes, muscles, heart and joints. Symptoms can vary considerably depending on the specific

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organs involved and the severity of the granulomatous inflammation (Wirnsberger, De Vries, Woulters, & Drent, 1998). Fatigue, measured with a single yes/no question, appeared to be related to inflammation as indicated by an acute phase response (Drent *et al.*, 1999).

Fatigue as an objective state is not necessarily related to the subjective experience of fatigue (e.g. Aldasheva, Chernook, Glushkova, & Kurmanalieva, 1992; Chalder *et al.*, 1993). Fatigue can be measured objectively using, for instance, types of performance decrement (Gander, Nguyen, Rosekind, & Connell, 1993; Veldhuizen, Gaillard, & De Vries, 2003). A common way of assessing perceived fatigue is by means of questionnaires. Within the tradition of questionnaire studies, it appears that fatigue is assumed to be multidimensional. However, convincing empirical evidence for this assumption is still lacking (Michielsen, De Vries, Van Heck, Van de Vijver, & Sijtsma, 2004). Recently, however, two studies have shown that fatigue is best conceived of as a unidimensional construct (Michielsen *et al.*, 2004; Studts, De Leeuw, & Carlson, 2001). In the Michielsen *et al.* study, a new instrument, the Fatigue Assessment Scale (FAS), was proposed. This scale was developed initially in a large representative sample of the Dutch working population (Michielsen *et al.*, 2004). Validation studies have been conducted in (i) a representative sample of the Dutch population, and (ii) a working population. These studies have demonstrated that the FAS is a reliable and valid unidimensional fatigue questionnaire (Michielsen, De Vries, & Van Heck, 2003; Michielsen *et al.*, 2004).

Previous studies on sarcoidosis have shown that patients suffer from fatigue and sleeping problems (Wirnsberger, De Vries, Breteler *et al.*, 1998). Fatigue and sleep disorders are also the classic symptoms of depression. Therefore, any attempt to measure fatigue in sarcoidosis patients should be done with a questionnaire that has no substantial overlap with depression measures. In another study, the FAS has shown to measure fatigue independently from depression (Michielsen, De Vries, & Van Heck, 2003). However, that study was performed among a working sample. It is interesting to examine whether the same result is found in sarcoidosis patients.

This article reports the evaluation of the usefulness of the FAS to measure fatigue in sarcoidosis patients. Furthermore, it was attempted to examine the generalizability of the findings by studying two samples of sarcoidosis patients with different backgrounds and ways of recruitment. The internal consistency of the FAS was predicted to be high and the scale was expected to be unidimensional. It was anticipated that the FAS would have strong associations with a related fatigue measure, even when controlling for overlap in items (convergent validity). Concerning divergent validity, fatigue and depression were expected to be two different constructs (examined in Sample 1). In addition, demographic differences in fatigue were examined. Finally, gender item bias was explored (only in Sample 1).

Methods

Participants

Sample 1

All members of the Dutch Sarcoidosis Society (DSS) suffering from sarcoidosis ($N = 2\,352$) were sent a test booklet together with a covering letter in which they were asked to participate in a study on fatigue. In all, 1 046 (44.5%) patients completed the questionnaires. This sample comprised 390 (37.3%) male and 617 (59.0%) female

patients. Gender was unknown for 39 (3.7%) patients. The participants' median age range was 45–49 years (see Table 1 in the Results section, below).

A randomly selected quarter of the participants was asked to complete the FAS once again after one week. Of these, 241 patients returned a usable questionnaire, yielding a response rate of 41%. This final group comprised 83 (34.4%) male and 137 (56.9%) female patients. Gender was unknown for 21 (8.7%) patients. The median age range was 50–59 years.

Sample 2

Eighty outpatients suffering from sarcoidosis, who attended the Sarcoidosis Management Centre Maastricht, the Netherlands, were studied. The diagnosis of sarcoidosis was based on consistent clinical features, together with biopsy-proven noncaseating epitheloid cell granulomas according to the international guidelines (Hunninghake *et al.*, 1999). The clinical symptoms of the respective patients varied from none (sarcoidosis detected on routine chest radiography) to more or less severe respiratory symptoms or erythema nodosum and arthralgia (i.e. Löfgren's syndrome). Patients with significant comorbidity were excluded. This population consisted of 36 (45%) male and 44 (55%) female patients. The mean age was 41.3 years ($SD = 10.3$) with a range of 17–68 years.

Measures

All respondents completed the following questionnaires: the Fatigue Assessment Scale (FAS; Michielsen *et al.*, 2004) and the energy and fatigue subscale from the World Health Organization Quality of Life assessment questionnaire (WHOQOL-100; WHOQOL Group 1994, 1995; Dutch version by De Vries & Van Heck, 1995). In addition, respondents in Sample 1 completed the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961).

The FAS is a fatigue questionnaire consisting of 10 items: five questions reflecting physical fatigue and five questions for mental fatigue. Although these two aspects of fatigue are represented in the questionnaire, the FAS appeared to be unidimensional in a Dutch working population as well as a representative sample of the general population (Michielsen *et al.*, 2003; Michielsen *et al.*, 2004). The response scale is a 5-point scale (1 = never to 5 = always). Scores on the FAS can range from 10 to 50. The psychometric properties are good (Michielsen *et al.*, 2003; Michielsen *et al.*, 2004). The FAS is presented in the Appendix.

The WHOQOL-100 is a cross-culturally developed generic multidimensional quality of life measure that consists of a general evaluative facet of four questions and 96 questions assessing 24 facets of quality of life within six domains (WHOQOL Group, 1995). Each facet is represented by four items with 5-point Likert-type response scales. Scores on each facet and domain can range from 4 to 20. The reliability and validity of the instrument, which have also been tested in groups of individuals with sarcoidosis, are good (De Vries, Drent, Van Heck, & Woulters, 1998; De Vries & Van Heck, 1997). The test–retest reliability is satisfactory (De Vries, 1996). In the present study, only the subscale energy and fatigue was used. Higher scores on this facet indicate more energy.

The BDI consists of statements that are arranged in 21 groups of four possible responses. Patients have to select that statement from each group that best describes their feelings in the past week. Each answer is scored on a 4-point Likert-type scale ranging from 0 to 3. A summation of the ratings in the 21 groups indicates the severity of

depression (possible range 0–63). Depression scale scores for clinically diagnosed patients correlated highly with clinicians' ratings of depth of depression and the scale significantly differentiated between groups of non-depressed, mildly depressed and severely depressed patients (Beck *et al.*, 1961).

Statistical procedure

Frequencies were used to present the demographic and psychological data of the patients. Mann–Whitney *U* tests and Pearson correlations were performed to examine the relationship between the demographic data (smoking, illness duration and prednison use) and fatigue. In Sample 1, a Kruskal–Wallis test was used to examine the relationship between age and fatigue, while a Pearson correlation coefficient was calculated in Sample 2. The content validity of the FAS was studied by exploratory factor analyses and subsequently Mokken scale analyses (Mokken & Lewis, 1982; Sijtsma, 1998; Sijtsma & Molenaar, 2002). Factor analysis uses the correlations or covariances among items and is vulnerable to the influence of differences in the items' frequency distributions. This may produce artifactual 'difficulty factors' (Nunnally, 1978). Mokken scale analysis is based on the scalability coefficient H (Molenaar, 1997). This coefficient equals the ratio of the items' covariance and their maximum covariance given the items' univariate frequency distributions. In this way, the effect of different frequency distributions is eliminated. Thus, Mokken scale analysis does not produce artifacts due to differences in frequency distributions.

The scree plot (Cattell, 1966) of the exploratory factor analysis was examined to detect the dimensionality of the FAS because the criterion of eigenvalues greater than one is known to overestimate dimensionality and causes factors to split into bloated specifics (e.g. Kline, 1987; Rummer, 1970). The computer program Mokken scale analysis for polytomous items (MSP; Molenaar & Sijtsma, 2000) uses cluster analysis for selecting unidimensional subscales from a larger set of items. Each subscale is selected to optimize the scale H for the subset of items selected. The quality of individual items as contributors to reliable person ordering is guaranteed by only admitting items to a scale if the item scalability coefficient (item H, a weighted mean of all item pairs in which the studied item figures) is at least .3 (Molenaar & Sijtsma, 2000). Cronbach's alpha coefficients were used to calculate the internal consistency.

In Sample 1, test–retest reliability was established using a Pearson correlation between the FAS scores of the 241 patients who had completed the FAS twice (one-week interval). Construct validity (divergent) was examined in two ways. First, a principal component analysis (PCA) was employed with the FAS and the BDI in order to examine the divergent validity of the FAS. Again the scree plot criterion (Cattell, 1966) was used to determine the number of factors. Secondly, Pearson correlations were calculated between the FAS scores and the scores on the BDI. For the convergent validity, a Pearson correlation was calculated between the FAS scores and the WHOQOL-100 energy and fatigue scores. Gender differences in fatigue were examined with Mann–Whitney *U* tests within both samples. Gender bias was exploratively tested at the item-score level with one-way ANOVAs, also called 'conditional ANOVA' (Van de Vijver & Leung, 1997).

In order to carry out conditional ANOVA, score level groups were formed containing at least 50 persons. When both the gender main effect and the interaction of score level and gender are non-significant, the item is taken to be unbiased. A significant main effect

of gender means that the item has uniform bias. 'Uniform bias' refers to influences of bias on scores that are more or less the same for all score levels. A significant interaction between score level and gender indicates that the item has non-uniform bias. When some items are biased, a second total score has to be calculated by summing the unbiased items. Then, the difference between the means of the males and females is divided by the pooled standard deviation. This procedure has to be followed for both the original total score and the revised total score with only unbiased items. When the difference is negligible, the normal total score is valid. Gender bias was only explored in Sample 1 because the analyses require more than one group of 50 persons. Finally, a chi-square test was used to examine differences between the two sarcoidosis samples and the Dutch general population sample from Michielsen and colleagues (2004) with regard to the FAS scores that were divided in two groups: FAS scores ≤ 21 and FAS scores > 21.

Results

The demographic and psychological characteristics of both sarcoidosis populations are summarized in Table 1. Within Sample 1, patients using prednison had a higher mean rank score on the FAS compared to patients not using prednison ($U = 64,510.5$, $p = .001$). No associations were found between smoking status, age and illness duration on the one hand, and the FAS scores on the other. In Sample 2, the FAS scores were not associated with age, smoking status, illness duration and prednison use.

Table 1. Demographic, medical and psychological data of the patient organization DSS (Sample 1) and the outpatient sample (Sample 2). Percentages are presented in parentheses

	Frequencies	
	Sample 1	Sample 2
Demographic data		
Gender: male/female/missing	390/617/39	36/44
Age: 15–19	2 (0.2)	2 (2.5)
20–29	46 (4.4)	9 (11.3)
30–39	216 (20.9)	25 (31.2)
40–49	297 (28.4)	25 (31.2)
50–59	267 (25.5)	15 (18.8)
60–69	143 (13.7)	4 (5.0)
70+	67 (6.4)	—
Missing	5 (0.5)	
Medical data		
Smoking: yes/no/missing	82/951/13	9/71/0
Time since diagnosis[a]	4.61 ± 1.44	4.64 ± 6.27
Prednison use: yes/no/missing	282/609/155	21/59/0
Psychological data		
FAS score[a]	29.3 ± 7.6 (10–50)	28.8 ± 8.1 (10–48)
WHOQOL-100 Energy and Fatigue[a, b]	14.2 ± 2.8 (4–20)	9.8 ± 3.1 (4–20)
BDI score[a]	10.2 ± 6.4 (0–41)	—

Notes: [a] Data are expressed as mean ± *SD*; [b] Higher scores indicate more energy (less fatigue).

For Sample 1, the PCA of the FAS items showed one factor explaining 49.1% of the variance. This outcome supports the view that the 10 items of the FAS measure one underlying concept: fatigue. However, the scree plot is rather ambiguous and does not clearly distinguish between a one-dimensional solution and the extraction of two factors. The two-factor solution reflects physical fatigue and mental fatigue. Because of the possibility to interpret the scree plot as support for the existence of two factors, an additional MSP analysis was performed. The latter analysis clearly showed that the FAS is best conceived of as one scale (see Table 2). The internal consistency of the FAS was .88. The test-retest reliability of the FAS was good—a correlation of .89 ($p < .001$) for a one-week interval.

Table 2. Results of the Mokken Scale Analyses for the FAS (lowerbound = 0.3)

Scale	k	*N*	H	Rho	ItemH min.–ItemH max.
Sample 1: FAS	9	982	.52	.89	.41–.58
Sample 2: FAS	10	62	.51	.90	.38–.62

Notes: k = number of items; *N* = number of participants; H = scalability coefficient; Rho = reliability coefficient; ItemH = check for monotonicity.

The PCA on the combined pool of FAS and BDI items revealed two factors (see Table 3). Only three BDI statements (concerning fatigue [BDI-17], activity [BDI-15] and appetite [BDI-18]) loaded higher on the FAS factor (Factor 1), while BDI-19 (weight loss) did not load on any factor (see Table 3). FAS-10 (When I am doing something, I can concentrate quite well) loaded only a fraction higher on Factor 1 than on Factor 2. Overall, the FAS and the BDI are two separate scales that measure different concepts. The association between the FAS and the BDI was .59 ($p < .001$). Concerning convergent validity, the correlation between the FAS and the WHOQOL-100 energy and fatigue subscale was $-.75$ ($p < .001$). When corrected for item overlap, the correlation was still high ($r - .69, p < .001$). The separate dimensions are shown in Table 4.

For Sample 2, the scree plot of the PCA on the FAS questions resembled the scree plot in Study 1. Again, one factor seemed to underlie the data (51.8% of the variance), whereas the two-factor solution (65.2% of variance) resulted in the two dimensions physical fatigue and mental fatigue. To clarify this finding, again an MSP analysis was performed. This analysis clearly showed that the FAS formed one reliable scale (see Table 2). The internal consistency of the FAS was .89. Concerning construct validity, the correlations between the FAS and the WHOQOL-100 energy and fatigue subscale was $-.79$ ($p < .001$). When the FAS was corrected for overlap in items, the correlation with the WHOQOL-100 energy and fatigue subscale was still high ($r = -.77, p < .001$). The separate fatigue dimensions are shown in Table 4.

With regard to the total FAS score in Sample 1, women had a higher mean rank than men, $U(947) = 89, 552.5$, $p < .001$. At the item-level, women had a significant higher score on bothered by fatigue, $U(996) = 97, 298.5$, $p < .001$, tired quickly, $U(990) = 97, 574.0$, $p < .001$, don't do much, $U(983) = 97, 772.0$, $p < .001$, and physically exhausted, $U(995) = 99, 942.0$, $p < .001$, compared to men. On the question about having enough energy, men score higher, $U(985) = 98, 487.0$, $p < .001$. No gender differences were found on the other five FAS items. In Sample 2, at the item-level men had significantly higher mean rank scores on don't do much, $U(64) = 368.5$, $p = .032$, and physically exhausted, $U(64) = 371.5$, $p = .032$, compared to women. No gender differences were found on the other nine FAS items.

Table 3. Factor loadings of items of the FAS and the BDI (Sample 1)

	Factor 1	Factor 2
FAS-1: bothered by fatigue	**.81**	.03
FAS-2: tired quickly	**.80**	.03
FAS-5: physically exhausted	**.79**	.15
FAS-3: don't do much	**.72**	.07
BDI-17: fatigue	**.68**	.16
FAS-6: problems starting	**.68**	.23
BDI-15: activity	**.64**	.26
FAS-8: no desire to do things	**.62**	.26
FAS-9: mentally exhausted	**.61**	.43
FAS-4: enough energy	**−.58**	−.17
FAS-7: problems thinking clearly	**.57**	.28
BDI-18: appetite	**.30**	.09
FAS-10: concentrate well	**−.28**	−.28
BDI-19: weight loss	**.10**	.04
BDI-3: failure	.03	**.67**
BDI-7: disappointed	.13	**.66**
BDI-1: sad	.24	**.60**
BDI-5: guilty	.17	**.59**
BDI-4: not enjoying things	.32	**.56**
BDI-2: despondent about future	.20	**.56**
BDI-8: blaming oneself	.09	**.52**
BDI-9: ending life	.10	**.49**
BDI-6: expecting punishment	.01	**.48**
BDI-13: taking decisions	.22	**.47**
BDI-12: interest in others	.18	**.43**
BDI-10: crying	.14	**.42**
BDI-14: appearance	.13	**.41**
BDI-20: worry about physical problems	.15	**.41**
BDI-11: irritating	.10	**.39**
BDI-21: sex	.20	**.27**
BDI-16: sleeping	.23	**.26**
Cumulative percentage of variance: 34.4%		

Note: The factor on which items had their highest loading are presented in bold face type.

Gender bias was examined in Sample 1. Six of the 10 FAS items were clearly unbiased: the main effect of gender as well as the interaction of level and gender were non-significant. Three items, about bothered by fatigue, tired quickly and problems thinking clearly, were uniformly biased: there was a significant main effect of gender. One item, reflecting the amount of energy, was non-uniformly biased: there was a significant main effect of gender as well as an interaction of level and gender. All other items were unbiased.

To check whether the computation of the total score of the FAS in Sample 1 had to be adjusted for males and females separately, a new total score was calculated for the six unbiased items. Separately for the normal and adjusted total score, the mean difference between men and women was taken and divided by the pooled standard deviation. For the 10-item total score, the result was .039; for the unbiased total score it was .045. Thus, the difference in outcome is negligible: there is no difference in effect size.

Table 4. Data on the mean ± *SD* (range), the Cronbach alphas, and Pearson correlations for the fatigue dimensions physical fatigue and mental fatigue

	Sample 1[a]		Sample 2	
	Physical	Mental	Physical[b]	Mental
Mean ± *SD*	16.9 ± 4.5	12.4 ± 4.1	16.7 ± 4.7	12.6 ± 4.0
Range	5–25	5–25	5–25	5–23
Cronbach alphas	.85	.80	.89	.80
Correlations				
BDI	.49	.57	—	—
WHOQOL-100 Energy and Fatigue	−.81	−.53	−.85	−.52
WHOQOL-100 Energy and Fatigue C	−.76	—	−.81	—

Notes: [a] Women scored higher on physical fatigue, $U(968) = 90876.5$, $p < .001$, and higher on mental fatigue, $U(965) = 100176.5$, $p < .05$. [b] Men scored higher on physical fatigue, $U(80) = 577.5$, $p < .05$. WHOQOL-100 Energy and Fatigue C is the correlation between physical fatigue without the two-item overlap and the WHOQOL-100 facet Energy and Fatigue. All *p*s $< .05$.

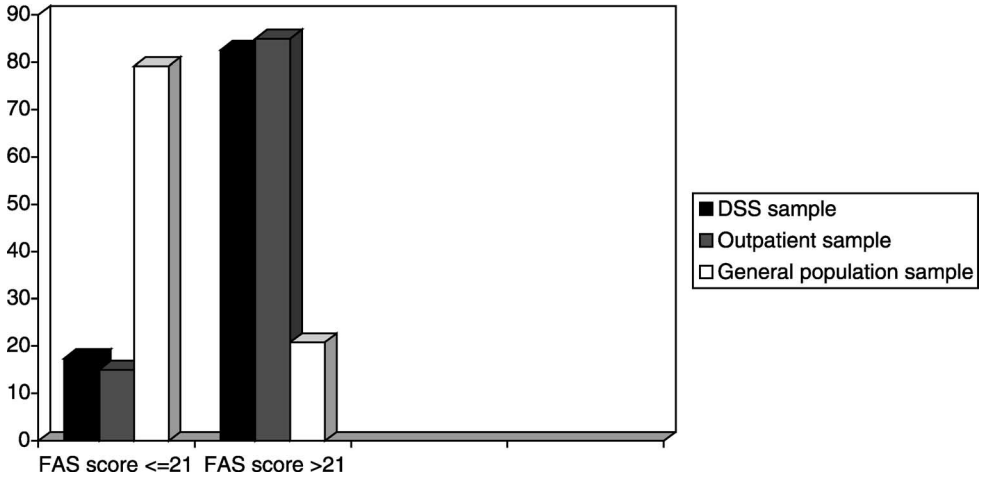

Figure 1. FAS scores divided in scores below 22 and scores of 22 or higher of both sarcoidosis samples (DSS sample and outpatient sample) compared with the general population sample by Michielsen *et al.* (2004) (in percentages of both populations).

Finally, the FAS scores were divided in scores below 22 and scores of 22 or higher. A subsequent comparison was made between both sarcoidosis samples and the scores of the general population sample from Michielsen *et al.* (2004). While the vast majority of the representative sample had a FAS score below 22, this was true for only a minority of both sarcoidosis samples, $\chi^2(2) = 1064.04$, $p < .001$. This is illustrated in Fig. 1.

Discussion

The aim of this study was to evaluate the usefulness of the FAS for measuring fatigue in sarcoidosis patients. The results showed good content validity and construct validity. Furthermore, the internal consistency and test–retest reliability also appeared to be

adequate. Concerning the divergent validity, it was established that fatigue and depression were related but clearly distinct constructs. The FAS scores could differentiate the sarcoidosis patients from a general population sample. With the exception of prednison use (Sample 1) and sex differences in fatigue, no other demographic differences emerged. Compared to men, women in the patient organization sample reported more fatigue (total score and five questions). In contrast, in the outpatient population of the Sarcoidosis Management Centre, men scored higher on two fatigue questions. Four FASitems were found to demonstrate evidence of gender bias. However, further analysis showed that the potential gender bias in these four items did not cause an appreciable difference on the FAS total score. Therefore, correction for gender bias in the calculation of the FAS total score is not indicated.

Previously, in line with these results, the FAS provided similar results: it is a fatigue measure with a good reliability and (content and construct) validity (Michielsen *et al.*, 2003; Michielsen *et al.*, 2004). The questionnaire appeared useful in the working population, the general population, and now also in the population of sarcoidosis patients. Sarcoidosis is a disease with a broad range of symptoms such as fatigue and muscle pain (Wirnsberger, De Vries, Wouters, & Drent, 1998). The usefulness of the FAS was further supported by the extent to which it was able to differentiate between a general population and the two sarcoidosis samples. The usefulness of the FAS in other patient populations needs to be examined in future studies.

The present study showed that the FAS is clearly a unidimensional scale. This result is in accordance with previous studies with the FAS (De Vries, Michielsen, & Van Heck, 2003; Michielsen *et al.*, 2003; Michielsen *et al.*, 2004) and empirical data reported by Studts *et al.* (2001). In two of these studies it was also demonstrated that fatigue is best conceived of as a unidimensional construct, although they used different fatigue measures (De Vries *et al.*, 2003; Studts *et al.*, 2001). In contrast, many existing fatigue measures are multidimensional (e.g. Chalder *et al.*, 1993; Smets, Garssen, Bonke, & De Haes, 1995; Vercoulen *et al.*, 1998). However, this claim for the multifaceted character of fatigue has not been convincingly supported by empirical data (Michielsen *et al.*, 2004; Studts *et al.*, 2001). Desmond and Hancock (2001) have suggested that fatigue is a multidimensional concept that can only be measured unidimensionally because it can only be translated into a unitary perception by the unity of consciousness.

The FAS contains five questions with regard to physical aspects and five questions for mental aspects. Despite this, the FAS demonstrated to be unidimensional (*cf.* Michielsen *et al.*, 2003; Michielsen *et al.*, 2004). In both samples in the present study, the *a priori* distinction between physical and mental fatigue was only found when the eigenvalue greater than one criterion was used. This is in contrast with earlier studies using the FAS reporting that only one factor had an eigenvalue greater than one (Michielsen *et al.*, 2003; Michielsen *et al.*, 2004). Studies should be conducted within populations of patients suffering from different disorders to reveal whether the present finding of unidimensionality is specific for sarcoidosis or not.

Only three depression items appeared to have substantial factor loadings on the fatigue factor. However, this was no surprise, because these questions ask about fatigue or fatigue-related aspects (see also Fuhrer & Wessely, 1995). A few depression items had cross-loadings on the fatigue factor, although their loadings on the depression factor were clearly higher. These items concerned positive and negative affect. Here, it should be kept in mind that it is plausible that being unhappy will influence the experience of fatigue and vice versa. Fatigue and depression are intertwined in a complex way. Fatigue is strongly related to depression (Frances, 1995), but is not a compulsory or core

symptom of the diagnosis (Fuhrer & Wessely, 1995). Dwight *et al.* (2000) examined fatigue and depression in patients with chronic hepatitis C. In that study, depression explained a large proportion of the variance of fatigue. However, the authors did not examine whether the two concepts were separate factors or not. Furthermore, Fuhrer and Wessely (1995) found that there was a strong relationship between fatigue and depression, but fatigue was neither sensitive nor specific for the diagnosis of depression. One FAS question, 'When I am doing something, I can concentrate quite well', loaded only a fraction higher on the fatigue factor than on the depression factor. This is not surprising because concentration is both depression and fatigue related. Nevertheless, in the present study, fatigue, measured with the FAS, and depression appeared to be two clearly separate factors. This result is in accordance with prior studies in which the FAS and another depression scale, the CES-D (Radloff, 1977), appeared to be two different factors (Michielsen *et al.* 2003). Therefore, the FAS can be used to measure fatigue distinctly from depression.

In Sample 1, the use of prednison was related to more fatigue. This finding was not related to a possible confounding of prednison use and gender or illness duration. As a matter of fact, male patients more often reported prednison use (data not shown). Furthermore, illness duration was unrelated to prednison use. It might be that the members of the patient organization (Sample 1) were more severely ill than the outpatient group (Sample 2).

In Sample 1 (the population obtained from the Dutch Sarcoidosis Society), female patients reported more fatigue than male patients. This finding is in accordance with the results from other studies on fatigue in patient populations (e.g. Bensing *et al.*, 1996; Chen, 1986; De Vries, Van Heck, & Drent, 1999; Fuhrer, 1994; Kroenke, Wood, Mangelsdorff, Meier, & Powell, 1988; Lewis & Wessely, 1992; Martikainen, Urponen, Partinen, Hasan, & Vuori, 1992). In contrast, male outpatients obtained from the Sarcoidosis Management Centre reported less activity than women (item 'don't do much') and more physical exhaustion. Previously (Michielsen *et al.*, 2003), men and women only differed in fatigue with regard to one question of the FAS focusing on level of energy. In the latter study, the respondents were persons who worked at least 20 hours per week. The difference between the studied populations might explain the different results. This assumption is supported by another study among working people which also found hardly any sex differences with regard to fatigue (De Vries & Van Heck, 2002).

In general, large populations are needed for validation studies. Because sarcoidosis is not very common, the only way to get a sizeable population of sarcoidosis patients in the present study was through the Dutch Sarcoidosis Society (Sample 1). Due to this way of recruiting participants, Sample 1 had some limitations. First, as we did not have access to medical records, we were not informed about how the diagnosis of sarcoidosis was confirmed. Secondly, the population of members of the sarcoidosis patient society might be biased. It might be that only patients who suffer from fatigue participated. This, however, was not supported by the data. Nearly 15% of the participants indicated as not suffering from fatigue when asked for symptoms. Furthermore, the full range of possible FAS scores was found in Sample 1. In addition, a previous study, comparing members of the sarcoidosis patient organization with an outpatient sample, revealed few differences in quality of life between both populations (De Vries *et al.*, 1998). However, in order to examine the generalizability of the results from Sample 1, the outpatient population was also included in the present study. As was mentioned before, both samples demonstrated similar psychometric properties of the FAS.

In conclusion, fatigue is a major symptom in sarcoidosis. This increases the importance of having a good questionnaire to assess fatigue in sarcoidosis patients because as yet there are no medical parameters available to measure fatigue. The FAS appeared to have good validity and reliability in sarcoidosis. It measures fatigue distinctly from depression. Therefore, in sarcoidosis the FAS is useful in monitoring and establishing fatigue.

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Appendix: The Fatigue Assessment Scale (FAS)

The following 10 statements refer to how you usually feel. Per statement you can choose one out of five answer categories, varying from never to always. 1 = never, 2 = sometimes, 3 = regularly, 4 = often and 5 = always.

	Never	Sometimes	Regularly	Often	Always
1. I am bothered by fatigue	1	2	3	4	5
2. I get tired very quickly	1	2	3	4	5
3. I don't do much during the day	1	2	3	4	5
4. I have enough energy for everyday life	1	2	3	4	5
5. Physically, I feel exhausted	1	2	3	4	5
6. I have problems to start things	1	2	3	4	5
7. I have problems to think clearly	1	2	3	4	5
8. I feel no desire to do anything	1	2	3	4	5
9. Mentally, I feel exhausted	1	2	3	4	5
10. When I am doing something, I can concentrate quite well	1	2	3	4	5

Items 4 and 10 require reversed scoring. The scale score is calculated by summing all item scores.