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ORIGINAL ARTICLE

Psychometric evaluation of a Swedish version of the Functional Outcomes of Sleep Questionnaire, FOSQ

LENA KORPE[1], JESPER LUNDGREN[2,3] & LARS DAHLSTRÖM[3,4]

[1]*Department of Orofacial Pain, Public Dental Service, Sahlgrenska University Hospital/Mölndal, Sweden,* [2]*Department of Psychology, University of Gothenburg, Göteborg, Sweden,* [3]*Research Center, Public Dental Service, Clinic of Odontology, Göteborg, Sweden, and* [4]*Department of Behavioral and Community Dentistry, Institute of Odontology, Sahlgrenska Academy,University of Gothenburg, Göteborg, Sweden*

Abstract

Objective. The Functional Outcomes of Sleep Questionnaire, FOSQ, is a self-administered 30 item questionnaire, designed to assess the impact of disorders of excessive sleepiness on activities of daily living. The aim was to evaluate the psychometric properties of a Swedish translation of the English original. ***Materials and methods.*** A Swedish version of the FOSQ was answered by 75 consecutive patients, diagnosed with obstructive sleep apnea syndrome and in need of treatment. The Short Form Health Survey (SF-36) and Epworth Sleepiness Scale (ESS) were also answered at the same time to evaluate validity. The first 25 patients answered the FOSQ a second time, 3 weeks later, to assess reliability. ***Results.*** The test–re-test reliability and intra-class correlation of the different sub-scales in the FOSQ varied between 0.71–0.92 and was 0.92 for the total scale, all statistically significant. Cronbach's alpha, calculated as a measure of internal consistency, varied between 0.84–0.92 for FOSQ sub-scales and was 0.96 for the total score. Statistically significant correlations between FOSQ sub-scales and the eight sub-scales in the SF-36 supported the validity. Discriminant validity, calculated by splitting responders with high and low ESS scores, revealed that FOSQs scores differed significantly between the groups. ***Conclusions.*** The results suggest that the Swedish version of the FOSQ has psychometric qualities in line with the original. It might, therefore, be a potentially useful, reliable and valid instrument for clinicians and researchers when measuring variables related to quality-of-life in sleep disorders in this language area.

Key Words: *obstructive sleep apnea syndrome, psychometrics, quality-of-life, questionnaires*

Introduction

Sleep-disordered breathing is a common condition that mostly affects middle-aged men [1]. Obstructive sleep apnea syndrome (OSAS) is characterized by recurrent episodes of upper airway collapse during sleep, accompanied by excessive daytime sleepiness [2]. OSAS could have a number of serious health consequences, both physical and mental. The diagnosis is established by measuring breathing patterns during sleep and evaluating subjective symptom. The number of breath-holds of > 10 s per sleeping hour, the apnea-hypopnea index (AHI) [3] is commonly used to specify the seriousness of the condition. Daytime sleepiness is often evaluated with questionnaires.

Quality-of-life (QoL) is regarded as a major outcome variable when evaluating sleep-related disorders [4]. A change in physiological parameters correlates only weakly with patient-oriented outcome [5] and generic QoL instruments may not be adequate for detecting important impacts and changes in patients experiencing OSAS [6]. The Functional Outcomes of Sleep Questionnaire (FOSQ) is a condition-specific measure designed for use in sleep disorders research and clinical practice [7]. It was developed in the US to assess the impact of disorders of excessive sleepiness on daily behaviour and QoL.

To be used in a trustworthy manner in a language area different from that in which it was constructed, the questionnaire must be conceptually and linguistically equivalent to the original instrument. Researchers and

Correspondence: L Korpe, Department of Orofacial Pain, Special Dental Care, Sahlgrenska University Hospital/Mölndal, 431 80 Mölndal, Sweden. Tel: +46 31 861500. Fax: +46 31 861501. E-mail: lena.korpe@vgregion.se

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clinicians must have confidence in a translation and accept that it is valid and reliable in a particular cultural setting, before using it. The purpose was therefore to evaluate the psychometric properties in a Swedish version of the FOSQ in a sample of patients diagnosed with OSAS.

It was hypothesized that a valid measure of sleep-related function would correlate negatively with sleepiness and positively with health-related quality-of-life, i.e. poor sleep, increase in daytime sleepiness and lower QoL. These correlations were expected to be moderate but statistically significant since existing, relevant instruments are supposed to reflect some, but not all, aspects of sleep-related dysfunction.

Materials and methods

Instruments

Recommendations concerning the procedures when adapting an instrument to a new cultural setting [8] include forward and backward translations. Translations from the original FOSQ to their mother tongue, Swedish, were made by the three bilingual authors independently and, after discussion of any discrepancies, unified into one consensus version. A Swedish version of FOSQ, translated and back translated by the Mapi Research Institute, already exists but no data from the adaptation procedure, in addition to the linguistic, have ever been published. This existing Mapi version has already been used in research [9]. The new consensus and existing Mapi versions were compared and found to correspond well. Since the differences between the versions were negligible and only one Swedish version is preferable, it was decided to accept the Mapi version as a basis for the continuous evaluation (Appendix).

The FOSQ is a self-administered questionnaire with 30 items comprising five sub-scales, General productivity (eight items, 1–4, 8–11), Social outcome (two items, 12–13), Activity level (nine items, 5, 14–16, 22–26), Vigilance (seven items, 6–7, 17–21) and Intimate relationship (four items, 27–30). If an item refers to an activity that the respondent is not performing for other reasons than sleepiness, it is scored zero. Otherwise an item is scored from 1–4. All positive scores within each sub-scale are averaged to a score that thus ranges from 1–4. These average scores of each of the five sub-scales are then added to get a total score ranging from 5 (least functional) to 20 (most functional).

The Epworth Sleepiness Scale (ESS) [10,11] is a well-established instrument, developed specifically for sleep disorders and used for many years. The ESS is also a self-administered questionnaire and comprises eight items dealing with daytime sleepiness. The probability of falling asleep, rated on a scale of increasing probability from 0–3, for eight different situations, is evaluated. The scores are added together, 0–24, and a score of 0–10 is considered a normal level of sleepiness.

The Short Form (36) Health Survey, SF-36, also used previously on OSAS patients [12], is a survey of patient health commonly used to measure health-related QoL. It consists of eight scaled scores, which are the weighted sums of the questions in their section. Each scale is directly transformed into a 0–100 scale on the assumption that each section carries equal weight. Swedish versions of both the ESS and SF-36 have been shown to have acceptable psychometric qualities [13,14].

Patients

Participating patients were referred from the Sleep Laboratory, Sahlgrenska University Hospital, Göteborg, Sweden to the Orofacial Pain Clinic, Sahlgrenska University Hospital/Mölndal, Sweden, for treatment with a mandibular advancement appliance (MAA) for their OSAS. All the patients had undergone nocturnal polysomnographic registrations, answered questions about daytime sleepiness and health, had the diagnosis of OSAS confirmed by a medical sleep specialist and were also judged to be in need of treatment. Further inclusion criteria were aged over 18 years, fluent in Swedish and able to understand instructions. None of them was receiving any ongoing treatment for his/her sleep-disordered breathing. Demographic and other data of possible relevance were collected at inclusion.

Seventy-nine consecutive patients were invited but four declined participation. Seventy-five eligible referrals were thus included after verbal and written information and signing a detailed consent form. The Regional Ethical Review Board, University of Gothenburg, Göteborg, granted ethical approval, Dnr 020-10.

Procedure

At the first visit to the dental clinic and after examination, the 75 included patients completed Swedish versions of the FOSQ, SF-36 and ESS on site. The first 25 participants answered the FOSQ a second time on the return visit 3 weeks later when the MAAs were dispensed.

Statistics

The PASW statistics, version 18, were applied in all statistical analyses. Intra-class correlation (ICC), two-way random single measures and absolute agreement were utilized to calculate the test–re-test reliability of the FOSQ. Cronbach's alpha was used to compute the internal consistency of the questionnaires in both

Table I. The 75 participating patients' demographic and baseline characteristics and self-reported affirmative answers to questions about certain health variables.

	n	%	Mean	SD
Gender, male/female	75	69/31		
Age, years	75		55.9	12.7
BMI	75		27.7	3.9
AHI	68		21.8	10.5
RDI	55		18.6	7.1
Supine AHI	15		34.6	0.8
No previous treatment	39	52		
Previous CPAP	31	41		
Previous UPPP	4	5		
Previous CPAP and UPPP	1	1		
Frequent headache	31	41		
High blood pressure	26	34		
Diabetes	9	12		
Heart/lung disease	8	11		
Allergy	20	27		
Current smoker	11	15		

SD, standard deviation; BMI, Body Mass Index; AHI, Apnea/hypopnea index; RDI, Respiratory disturbance index; CPAP, Continuous Positive Air Pressure; UPPP, Uvulo-Palato-Pharyngo-Plasty.

sub- and total scales. Spearman's correlations, r_s, were calculated to validate the FOSQ against the SF-36 and ESS, respectively.

Results

The participants' demographic data, sleep characteristics, previous treatment and some general health variables are given in Table I.

The FOSQ, SF-36 and ESS scores, respectively, are shown in Table II, together with Cronbach's alpha as a measure of internal consistency. Alpha for the FOSQ sub-scales varied between 0.84–0.92, with 0.96 for the total score. Cronbach's alpha for the sub-scales in the SF-36 varied between 0.84–0.98 and it was 0.81 for the ESS.

The percentage of participants that reached floor or ceiling scores for the total FOSQ did not exceed 2%. The test–re-test reliability of the FOSQ is also shown in Table II. The coefficients for the different sub-scales varied between 0.71–0.92 and the ICC for the total FOSQ scale was 0.92, all statistically significant, $p < 0.01$.

The results of analyses of concurrent validity are shown in Table III. Spearman's rank correlations between the five sub-scales, respectively, for the total FOSQ and the eight sub-scales in the SF-36 are given. The correlations were positive and statistically significant between the sub-scales and total FOSQ and all the sub-scales in the SF-36. Correlations between the ESS and the FOSQ sub-scales were all negative and statistically significant except for 'intimate relationship'. The relations between the ESS and the SF-36 were all negative and half of the eight correlations were statistically significant.

Table II. The number of items and responders to each sub-scale and total FOSQ, SF-36 and ESS, respectively, and distribution of scores (minimum, maximum, mean and standard deviation, SD), together with the percentage of responders at floor and ceiling and Chronbach's alpha. ICCs (two-way random single measures, absolute agreement) for each sub-scale and total FOSQ answered twice are also shown.

	Items	*n*	Min	Max	Mean	SD	% Floor	% Ceiling	Cronbach's α	ICC ($n = 25$)
FOSQ										
General productivity	8	75	1.88	5	3.45	0.52	0	21	0.88	0.92
Social outcome	2	74	1.50	5	3.52	0.60	0	53	0.84	0.71
Activity level	9	75	1.33	5	3.07	0.68	0	1	0.91	0.90
Vigilance	7	74	1.57	5	3.24	0.60	0	15	0.87	0.79
Intimate relationships	4	67	1.00	5	3.09	0.89	6	34	0.92	0.85
Total	30	66	8.53	20	16.57	2.68	2	2	0.96	0.92
SF-36										
Physical functioning	10	75	5	100	80.0	22.6	1	19	0.93	
Role-Physical	4	75	0	100	68.3	39.7	19	13	0.88	
Body Pain	2	75	12	90	68.5	23.5	1	36	0.87	
General Health	5	75	0	100	62.7	23.0	1	4	0.84	
Vitality	4	75	0	100	47.7	28.4	5	1	0.93	
Social function	2	75	13	100	74.3	27.3	4	39	0.98	
Role-emotional	3	75	0	100	67.6	42.1	23	57	0.86	
Mental health	5	75	20	100	71.4	22.5	3	7	0.91	
ESS										
ESS total	8	75	1	20	9.6	4.6	1	1	0.81	

Table III. Correlation matrix: Spearman's rank correlations (r_s) and p-values (two-tailed) between scores in the five sub-scales and total FOSQ and eight sub-scales in the SF-36. Correlations between the FOSQ and ESS and the SF-36 and ESS, respectively, are also shown.

SF-36/FOSQ	Physical functioning	Role-physical	Bodily pain	General health	Vitality	Social functioning	Role-emotional	Mental health	ESS
General productivity	0.48***	0.65***	0.34**	0.54***	0.74***	0.72***	0.69***	0.68***	−0.47***
Social outcome	0.37***	0.48***	0.34**	0.34**	0.60***	0.63***	0.44***	0.49***	−0.40***
Activity level	0.51***	0.63***	0.44***	0.58***	0.79***	0.76***	0.65***	0.66***	−0.48***
Vigilance	0.31**	0.42***	0.30*	0.38**	0.63***	0.43***	0.42***	0.41***	−0.68***
Intimate relationships	0.53***	0.32**	0.44***	0.46***	0.44***	0.45***	0.39**	0.30*	−0.21 NS
Total	0.53***	0.54***	0.45***	0.54***	0.75***	0.69***	0.56***	0.59***	−0.53***
ESS	−0.00 NS	−0.24*	−0.15 NS	−0.14 NS	−0.45**	−0.26*	−0.19 NS	−0.29*	

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.
NS, not significant.

Discriminant validity of FOSQ was calculated by splitting the responders according to their ESS scores. The means in the five FOSQs sub-scales and total scores for those who obtained low scores, 0–10, and high scores, ≥ 11, respectively, on the ESS are given in Table IV, together with p-values. The differences between high and low ESS-scores groups regarding FOSQ were all statistically significant apart from the 'intimate relationship' sub-scale.

Discussion

The results suggest that the Swedish version of the FOSQ possesses measurement qualities equal to those in the English original [7] and can, therefore, be regarded as trustworthy when used to elucidate important aspects of sleep-related disorders.

Quality-of-sleep is intrinsically linked to QoL [4]. The FOSQ was constructed to determine the seriousness of the consequences of sleep disorders to several common daily life activities. It is urgent that the cross-cultural adaptation of specific instruments involves assessments of not only linguistic equivalence but also evaluation of measurement properties [8]. The original English FOSQ has been adapted to several other cultural settings [15–19].

The stability of the Swedish version of the FOSQ data gathered over time, the test–re-test reliability, was found to be in line with the original [7] as well as other translations [15–17,19] and considered satisfactory [20].

Internal consistency, measured by Chronbach's alpha, was not inferior to the original [7] or other translations [15–17,19] in any sub-scales or overall. Thus, an important psychometric aspect of the Swedish translation was found to be gratifying.

Concurrent validity, measured as the relationships between the total FOSQ and its sub-scales and SF-36 sub-scales, was found to be convincing. The correlations were all statistically significant. However, the difference in strength of the correlations between ESS and SF-36 and the ESS and FOSQ, weak and strong, respectively, indicates that the FOSQ actually contributes more to sleep-related dimensions than the SF-36. In other words the SF-36 cannot replace FOSQ in this context.

Since there was no substantial floor effect in the FOSQ it can be concluded that it captures the variation in low scores in the sample. However, since a ceiling is reached for 53% in 'social outcome' and 34% in 'intimate relations', these sub-scales may not differentiate between higher levels of function in these domains.

The result of the analysis of the FOSQs discriminant validity, measured as the ability to separate

Table IV. Number of responders and FOSQ scores in each of the five sub-scales and total according to ESS scores split into 0–10 and ≥ 11, respectively, together with t-values and p-values (2-tailed) for the differences.

	ESS 0–10			ESS ≥ 11				
	n	Mean	SD	n	Mean	SD	t	p-value
General productivity	39	3.61	0.49	36	3.28	0.51	−2.821	< 0.01
Social outcome	39	3.69	0.51	35	3.33	0.64	−2.718	< 0.01
Activity level	39	3.27	0.65	36	2.86	0.66	−2.767	< 0.01
Vigilance	39	3.54	0.45	35	2.90	0.57	−5.413	< 0.001
Intimate relation	35	3.25	0.72	32	2.91	1.03	−1.559	NS
Total	35	17.58	2.28	31	15.44	2.69	−3.485	< 0.001

responders with low ESS scores from responders with high scores, was also satisfactory. The FOSQ scores, with the exception of 'intimate relationship', differed significantly for low and high ESS responders in the expected direction.

A restricted number of subjects were included in the present study which is a limitation. Another weakness is the fact that only subjects with diagnosed OSAS were included. No subjects with other sleep-related disorders participated, which reduces the generalizability of the results.

In conclusion, the Swedish version of the FOSQ was shown to have psychometric qualities in line with the original. There appears to be sufficient evidence to claim that the Swedish version is trustworthy in samples of patients with OSAS. It might, therefore, be a potentially useful, reliable and valid instrument for clinicians and researchers when measuring the seriousness of consequences related to QoL in sleep-related disorders like OSAS in this language area.

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Appendix: The Swedish version of the Functional Outcomes of Sleep Questionnaire.

Frågeformulär om konsekvenserna av sömnstörningar på patientens vardagsliv (FOSQ).

En del människor har svårt att utföra dagliga aktiviteter när de känner sig trötta eller sömniga. Syftet med detta frågeformulär är att ta reda på om du i allmänhet har svårt att genomföra vissa aktiviteter på grund av att du känner dig sömnig eller trött.

När orden 'sömnig' eller 'trött' används i detta frågeformulär, syftar det på känslan av att du inte kan hålla ögonen öppna, huvudet känns tungt, du vill 'slumra till' eller att du känner ett starkt behov av att ta en tupplur. Dessa ord hänvisar inte till den trötta eller utmattade känsla som du kan uppleva efter fysisk aktivitet.

ANVISNINGAR:

Var god sätt ett kryss (X) i den ruta som motsvarar ditt svar på varje fråga.

Välj endast **ett** svar för varje fråga. Försök att vara så exakt som möjligt.

All information kommer att behandlas konfidentiellt.

På vilket sätt har din relation till dem påverkats

Tack för att du besvarat detta formulär.

	(0) Jag utför inte denna aktivitet av andra skäl	(4) Inga svårigheter	(3) Ja, lite svårigheter	(2) Ja, måttliga svårigheter	(1) Ja, stora svårigheter
1. Har du svårigheter att koncentrera dig på sådant som du håller på med därför att du är sömnig eller trött?		☐	☐	☐	☐
2. Har du överlag svårigheter att komma ihåg saker därför att du är sömnig eller trött?		☐	☐	☐	☐
3. Har du svårigheter att avsluta en måltid därför att du blir sömnig eller trött?		☐	☐	☐	☐
4. Har du svårigheter att ägna dig åt en hobby (t. ex. handarbete, samla frimärken, trädgårdsarbete) därför att du är sömnig eller trött?	☐	☐	☐	☐	☐
5. Har du svårigheter att utföra arbeten hemma (t. ex. städning, tvätt, ta ut soporna, reparationer) därför att du är sömnig eller trött?	☐	☐	☐	☐	☐
6. Har du svårigheter att köra ett motordrivet fordon under kortare tid än en timme därför att du blir sömnig eller trött?	☐	☐	☐	☐	☐

	(0) Jag utför inte denna aktivitet av andra skäl	(4) Inga svårigheter	(3) Ja, lite svårigheter	(2) Ja, måttliga svårigheter	(1) Ja, stora svårigheter
7. Har du svårigheter att köra ett motordrivet fordon under längre tid än en timme därför att du blir sömnig eller trött?	☐	☐	☐	☐	☐
8. Har du svårigheter att få saker gjorda därför att du är för sömnig eller trött för att köra ett fordon eller åka kollektivt?	☐	☐	☐	☐	☐
9. Har du svårigheter att sköta penningaffärer och pappersarbete (t. ex. betala räkningar, hålla reda på kvitton, fylla i skatteblanketter etc.) därför att du är sömnig eller trött?	☐	☐	☐	☐	☐
10. Har du svårigheter att utföra arbete (avlönat eller frivilligt) därför att du är sömnig eller trött?	☐	☐	☐	☐	☐
11. Har du svårigheter att föra ett telefonsamtal därför att du blir sömnig eller trött?	☐	☐	☐	☐	☐
12. Har du svårigheter att umgås med familj eller vänner i ditt hem därför att du blir sömnig eller trött?	☐	☐	☐	☐	☐
13. Har du svårigheter att besöka familj eller vänner i deras hem därför att du är sömnig eller trött?	☐	☐	☐	☐	☐
14. Har du svårigheter att ge hjälp åt familj eller vänner därför att du är sömnig eller trött?	☐	☐	☐	☐	☐

	(4) Nej	(3) Ja, lite	(2) Ja, måttligt	(1) Ja, mycket
15. Har din relation till din familj, vänner eller arbetskamrater påverkats därför att du är sömnig eller trött?	☐	☐	☐	☐

	(0) Jag utför inte denna aktivitet av andra skäl	(4) Inga svårigheter	(3) Ja, lite svårigheter	(2) Ja, måttliga svårigheter	(1) Ja, stora svårigheter
16. Har du svårigheter att motionera eller delta i någon idrott därför att du är för sömnig eller trött?	☐	☐	☐	☐	☐
17. Har du svårigheter att se en film på bio eller titta på en video/DVD hemma därför att du blir sömnig eller trött?	☐	☐	☐	☐	☐
18. Har du svårigheter att njuta av en teaterpjäs eller en föreställning därför att du blir sömnig eller trött?	☐	☐	☐	☐	☐
19. Har du svårigheter att njuta av en konsert därför att du blir sömnig eller trött?	☐	☐	☐	☐	☐
20. Har du svårigheter titta på TV därför att du blir sömnig eller trött?	☐	☐	☐	☐	☐
21. Har du svårigheter att delta i kurser, möten, föreningar eller organisationer därför att du är sömnig eller trött?	☐	☐	☐	☐	☐
22. Har du svårigheter att vara så aktiv som du skulle vilja vara på kvällarna därför att du är sömnig eller trött?		☐	☐	☐	☐
23. Har du svårigheter att vara så aktiv som du skulle vilja vara på morgnarna därför att du är sömnig eller trött?		☐	☐	☐	☐
24. Har du svårigheter att vara så aktiv som du skulle vilja vara på eftermiddagarna därför att du är sömnig eller trött?		☐	☐	☐	☐
25. Har du svårigheter att hålla samma tempo som andra i din ålder därför att du är sömnig eller trött?		☐	☐	☐	☐

	(1) Mycket låg	(2) Låg	(3) Medel	(4) Hög
26. Hur skulle du bedöma din allmänna aktivitetsnivå?	☐	☐	☐	☐

	(0) Jag har inget intimt eller sexuellt förhållande	(4) Nej	(3) Ja, lite	(2) Ja, måttligt	(1) Ja, mycket
27. Har ditt intima eller sexuella förhållande påverkats därför att du har varit sömnig eller trött?	☐	☐	☐	☐	☐
28. Har din önskan om intimitet och sex påverkats därför att du har varit sömnig eller trött?	☐	☐	☐	☐	☐
29. Har din förmåga att bli sexuellt upphetsad påverkats därför att du har varit sömnig eller trött?	☐	☐	☐	☐	☐
30. Har din förmåga att uppnå orgasm påverkats därför att du har varit sömnig eller trött?	☐	☐	☐	☐	☐