

# Adaptation of the 10-Item Functional Outcomes of Sleep Questionnaire to Iranian Patients with Obstructive Sleep Apnea

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## Abstract

**Purpose** The purpose of this study was to evaluate the psychometric properties of the Farsi version of 10-item Functional Outcomes of Sleep Questionnaire (FOSQ-10) in Iranian patients with obstructive sleep apnea (OSA).

**Methods** The FOSQ-10 was translated into Farsi using the standard forward–backward method. One hundred patients who fulfilled the inclusion criteria completed a series of questionnaires including IR-FOSQ-10, Medical Outcome Survey Short Form 12 (SF-12) and Epworth Sleepiness Scale (ESS). Internal consistency, test–retest reliability, concurrent validity, discriminant validity and responsiveness of IR-FOSQ-10 were investigated.

**Results** The Cronbach's alpha coefficient was 0.85 in IR-FOSQ-10 total score and ranged from 0.78 to 0.83 in each subscale. The test–retest reliability demonstrated by intra-class coefficient was 0.92. There were significant moderate-to-good negative correlations between IR-FOSQ-10 subscales and ESS except for sexual relationship subscale. FOSQ-10 subscales generally correlated higher with related subscales of SF-12. The IR-FOSQ-10 was able to distinguish

patients with abnormal sleepiness score from those with normal sleepiness score. The results of sensitivity to change proved that the IR-FOSQ-10 was able to detect changes after continuous positive airway pressure therapy.

**Conclusion** The psychometric properties of the IR-FOSQ-10 suggest that it is a reliable and valid measure among Iranian patients with OSA.

**Keywords** Functional Outcomes of Sleep Questionnaire · Obstructive sleep apnea · Validity · Reliability · Medical Outcome Survey Short Form 12 · Epworth Sleepiness Scale

## Introduction

Obstructive sleep apnea (OSA) is a common sleep disorder characterized by repetitive upper airway obstruction during sleep. Prevalence studies suggest that 4 % of men and 2 % of women aged more than 50 years are affected by symptomatic sleep apnea [1]. Upper airway obstruction during sleep leads to intermittent awakening, disrupted sleep and excessive daytime sleepiness. Sleep disruption and recurrent hypoxemia cause several cardiovascular and neurocognitive complications. Considering the prevalence of OSA as well as its detrimental effects on physical, social and mental functions, it seems necessary to evaluate health-related quality of life (HRQOL) in OSA patients with a valid and responsive questionnaire.

Functional Outcomes of Sleep Questionnaire (FOSQ) is a self-administered, disease-specific questionnaire designed to assess the impact of excessive sleepiness on daily activities. The FOSQ-10, a shortened version of FOSQ-30, is a psychometrically strong instrument that captures the content of the original FOSQ subscales. It is a brief questionnaire that facilitates the assessment of

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functional status as an aspect of quality of life in patients with OSA [1–3].

The purpose of this study was to evaluate the psychometric properties of the Farsi version of FOSQ-10 in Iranian patients with OSA.

## Methods

### Instrument (FOSQ)

The FOSQ determines whether patients have difficulty in performing specific activities due to sleepiness or tiredness. The FOSQ-10 was published in 2009, by selecting items from each subscale of original FOSQ-30. These 10 items are distributed among 5 subscales as follows: general productivity (2 item), activity level (3 items), vigilance (3 items), social outcomes (1 item) and sexual relationship (1 item) [4, 5].

Items were rated on a scale of 1–4 (1 = extreme difficulty, 2 = moderate difficulty, 3 = a little difficulty, 4 = no difficulty). The total score ranged from 5 to 20, higher scores indicating better functional status.

### Translation

After receiving the authorization for cross-cultural adaptation of the FOSQ-10 from the copyright holder, standard forward–backward method was followed to translate the English version of FOSQ-10 into Farsi (the official language of Iran) [6]. The original English version was first translated into Farsi independently by two physicians. A bilingual author (A.A) critically reviewed the translations and provided a single provisional Farsi version. Two other professional translators who did not know the original questionnaire back-translated the provisional Farsi version into English. Translations were reviewed by a bilingual physician to form one English version from these two. The back-translated English version was not meaningfully different from the original version.

A pilot study was conducted in 15 patients with OSA to evaluate face validity. Obscure words and sentences were revised and the final Farsi version of FOSQ-10 (IR-FOSQ-10) was developed.

### Study Sample

This study included 100 patients referred to Baharloo Sleep Center for overnight polysomnography (PSG) from August 2013 to May 2014. Patients older than 18 years with OSA symptoms and apnea–hypopnea index (AHI)  $\geq 5$  were eligible for the study. Patients with severe comorbidities or cognitive impairment from any cause were excluded. Full

ethical approval was granted by the research ethics committee of Tehran University of Medical Sciences. During initial examination, all patients completed a series of questionnaires including IR-FOSQ-10, Medical Outcome Survey Short Form 12 (SF-12) and Epworth Sleepiness Scale (ESS) [7–12].

The SF-12 is a generic quality of life measure that measures eight important dimensions of health. The scores range from 0 to 100, with higher scores indicating greater level of functioning. The ESS is an eight-item questionnaire to measure daytime sleepiness. The scores range from 0 to 24, with higher scores indicating greater daytime sleepiness. ESS score  $\geq 10$  indicates pathologic sleepiness.

### Analysis

Reliability of IR-FOSQ-10 was assessed by two methods:

1. Internal consistency was assessed using Cronbach's alpha coefficient. Alpha values  $\geq 0.7$  considered satisfactory [13].
2. Test–retest reliability was calculated using intraclass coefficient (ICC). It was tested after 2 weeks on a subsample of 20 subjects who did not receive any treatment.

Validity of IR-FOSQ-10 was assessed by two methods:

1. Concurrent validity was tested by correlation of IR-FOSQ-10 subscales with SF-12 and ESS.
2. Discriminant validity tested how well the questionnaire discriminates between known groups as defined by ESS score (normal:  $< 10$ , excessive daytime sleepiness:  $\geq 10$ ) and AHI (mild: 5–14, moderate: 15–29, severe:  $\geq 30$ ).

We asked 20 patients who had well adherence to continuous positive airway pressure (CPAP) to complete the IR-FOSQ-10 again 3 months after treatment, and responsiveness of IR-FOSQ-10 was assessed by measuring the changes in FOSQ-10 scores after treatment with CPAP.

### Statistical Analysis

Several statistical tests were applied for assessing psychometric properties of the IR-FOSQ-10. The distribution of continuous variables was analyzed using the Kolmogorov–Smirnov test for normality. Reliability was assessed by internal consistency using Cronbach's alpha coefficient and test–retest analysis using intraclass coefficient (ICC). Discriminant validity was assessed using *t* test or ANOVA. Concurrent validity was tested by Pearson's correlation coefficients between ESS, SF-12 and IR-FOSQ-10 subscales and total score. Responsiveness of IR-FOSQ-10 was assessed by paired *t* test. *P* value less than 0.05 was

considered statistically significant. SPSS (version 18) was used for statistical analysis.

## Results

Cross-cultural adaptation of IR-FOSQ-10 was developed successfully, and the expert committee agreed that the Farsi version of FOSQ-10 was equivalent in meaning to the original English version. In the pilot test, patients declared that the translated questionnaire was easy to understand. The mean age of the patients was  $48.74 \pm 13$ , with an Epworth scale of  $11.71 \pm 4.39$ . Mean AHI was  $36 \pm 20 \text{ h}^{-1}$  (range 5–98) and the mean body mass index was  $28.3 \pm 4.15 \text{ kg m}^{-2}$ . Mean systolic and diastolic blood pressure was  $131.96 \pm 13.27$  and  $85.79 \pm 11.62 \text{ mmHg}$ , respectively.

The internal consistency investigated by Cronbach's alpha coefficient was 0.85 in IR-FOSQ-10 total score and ranged from 0.78 to 0.83 in each subscale (Table 1). The test–retest reliability demonstrated by ICC was 0.92 (95 % confidence interval 0.83–0.97,  $P$  value  $< 0.001$ ) in IR-FOSQ-10 total score.

Concurrent validity was examined by correlation of IR-FOSQ-10 subscales with SF-12 and ESS. As displayed in Table 2, there were significant moderate-to-good negative correlations between IR-FOSQ-10 subscales and ESS except for sexual relationship subscale. We found significant moderate correlation between IR-FOSQ-10 general productivity subscale and the SF-12 role limits-emotional subscale ( $r$  value = 0.43,  $P$  value  $< 0.05$ ). The IR-FOSQ-10 activity level subscale had significant moderate correlations with the SF-12 vitality ( $r$  value = 0.48,  $P$  value  $< 0.05$ ), physical functioning ( $r$  value = 0.41,  $P$  value  $< 0.01$ ) and role limits-emotional subscales ( $r$  value = 0.41,

$P$  value  $< 0.05$ ). The IR-FOSQ-10 social outcome subscale also had significant moderate correlations with SF-12 social functioning ( $r$  value = 0.45,  $P$  value  $< 0.05$ ) and role limits-emotional subscales ( $r$  value = 0.42,  $P$  value  $< 0.05$ ). We found fair but significant correlations between sexual relationship and vigilance subscales of IR-FOSQ-10 and SF-12 subscales.

When investigating discriminate validity, we found that there were statistically significant differences in the IR-FOSQ-10 total score and all subscales between patients with ESS score  $< 10$  and those with ESS score  $\geq 10$ , but we did not find any statistically significant difference in IR-FOSQ-10 total score and subscales among patients with mild, moderate and severe OSA as classified by AHI (Table 3). The results of responsiveness to change showed significant improvement in IR-FOSQ-10 total score and all subscales. The mean of IR-FOSQ-10 total score before and after 3-month CPAP therapy was  $12.72 \pm 2.53$  and  $16.21 \pm 2.02$ , respectively ( $P$  value  $< 0.001$ ).

## Discussion

Weaver et al. found that FOSQ-30 had very good internal consistency ( $\alpha$  ranged from 0.86 to 0.91 for subscales) and test–retest reliability ( $r$  ranged from 0.81 to 0.9 for subscales). The FOSQ-30 successfully discriminated between normal individuals (total score =  $89.59 \pm 8.64$ ) from those with sleep problem (total score =  $68.5 \pm 21.24$ ) [4].

The FOSQ-10 had similar reliability and validity as the FOSQ-30 with Cronbach's  $\alpha$  of 0.87. The FOSQ-10 total score showed high correlation with FOSQ-30 total score at baseline and after 3-month CPAP treatment (baseline  $r = 0.96$ , after treatment  $r = 0.97$ ). All subscales were also highly correlated at baseline and following treatment. The FOSQ-10 could discriminate well between normal subjects (total score =  $17.81 \pm 3.1$ ) from patients with OSA (total score =  $12.48 \pm 3.23$ ). In addition, following CPAP treatment, the FOSQ-10 detected significant change in the total score (baseline =  $12.48 \pm 3.23$ , post-CPAP =  $17.1 \pm 2.57$ ) [5].

In our study, the IR-FOSQ-10 showed a very good internal consistency by Cronbach's alpha coefficient of 0.85. The test–retest reliability demonstrated by ICC was 0.92, which represents high consistency of the IR-FOSQ-10. These findings were close to the original English version of FOSQ.

All FOSQ-10 subscales except sexual relationship subscale had moderate-to-good negative correlations with ESS score. Lower correlation between ESS score and sexual relationship subscale can be explained by Iranian cultural values since sexual relationship is a completely private issue and it is difficult for Iranians to answer such private

**Table 1** Results of internal consistency measured by Cronbach's alpha coefficients

	FOSQ-10 items	Mean	SD	Cronbach's alpha If item deleted
1	Concentration	2.59	0.92	0.79
2	Remembering	2.67	0.99	0.80
3	Driving short distance	2.68	1.58	0.80
4	Driving long distance	2.83	1.53	0.78
5	Visit in their home	2.8	1.07	0.79
6	Relationship affected	2.10	1.10	0.81
7	Watching movies	2.86	0.88	0.79
8	Activity in evening	2.29	0.98	0.80
9	Activity in morning	2.36	1.01	0.81
10	Desire intimacy	2.41	1.35	0.83
	FOSQ total score	12.88	2.69	0.85

**Table 2** Results of concurrent validity measured by Pearson's correlation coefficients ( $N = 100$ )

	General productivity	Activity level	Vigilance	Social outcomes	Sexual relationship	FOSQ-10 total score
ESS	-0.51 <sup>b</sup>	-0.60 <sup>b</sup>	-0.72 <sup>b</sup>	-0.56 <sup>b</sup>	-0.22 <sup>b</sup>	-0.61 <sup>b</sup>
SF-12						
Physical functioning	0.11	0.41 <sup>b</sup>	0.23	0.14	0.17	0.23
Vitality	0.16	0.48 <sup>a</sup>	0.23 <sup>a</sup>	0.17	0.18	0.29 <sup>a</sup>
Role limits-physical	0.14	0.14	0.21 <sup>a</sup>	0.36 <sup>a</sup>	0.24	0.22
Social functioning	0.37 <sup>a</sup>	0.17	0.12	0.45 <sup>a</sup>	0.13	0.30 <sup>a</sup>
Role limits-emotional	0.43 <sup>a</sup>	0.41 <sup>a</sup>	0.13	0.42 <sup>a</sup>	0.36 <sup>a</sup>	0.44 <sup>a</sup>
Mental health	0.28 <sup>a</sup>	0.33 <sup>a</sup>	0.09	0.38 <sup>a</sup>	0.27 <sup>a</sup>	0.30 <sup>a</sup>
Bodily pain	0.34 <sup>b</sup>	0.20	0.14	0.35 <sup>a</sup>	0.23	0.36 <sup>a</sup>
General health perception	0.19	0.10	0.07	0.11	0.30 <sup>a</sup>	0.18

<sup>a</sup>  $< 0.05$ , <sup>b</sup>  $< 0.01$

**Table 3** Results of discriminant validity according to ESS and AHI subgroups ( $N = 100$ )

	ESS groups					AHI groups						
	ESS < 10 $N = 22$		ESS $\geq$ 10 $N = 78$		$P$ value	5 $\leq$ AHI < 15 $N = 26$		15 $\leq$ AHI < 30 $N = 29$		30 $\leq$ AHI $N = 45$		$P$ value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	Mean	SD	
General productivity	2.97	0.94	2.53	0.91	0.04	2.81	0.97	2.51	1.21	2.60	1.13	0.25
Activity level	2.59	0.95	2.15	0.90	0.04	2.30	0.89	2.20	0.96	2.25	0.95	0.16
Vigilance	3.13	0.92	2.69	0.85	0.03	2.83	0.99	2.66	0.93	2.85	1.20	0.63
Social outcomes	3.11	0.84	2.71	0.78	0.03	2.87	1.32	2.62	0.99	2.87	1.07	0.23
Sexual relationship	2.62	0.91	2.35	0.83	0.22	2.51	1.06	2.38	1.17	2.37	1.11	0.37
FOSQ-10 total score	14.44	2.78	12.43	2.95	0.01	13.32	2.46	12.37	3.02	12.94	2.41	0.30

question. FOSQ-10 subscales generally correlated higher with related subscales. These findings were relatively compatible with reports in the USA and Norway [4, 14].

Our data demonstrated that the IR-FOSQ-10 was able to distinguish patients with abnormal sleepiness score from those with normal sleepiness score. There was no significant difference in IR-FOSQ-10 scores of patients with mild, moderate or severe. These results were close to report in Thailand and verified that AHI could not predict subjective elements of quality of life assessed by IR-FOSQ-10 [15].

The results of sensitivity to change proved that the IR-FOSQ-10 was able to detect changes after CPAP treatment. The limitation of this study worth mentioning is the lack of control group of healthy individuals. In addition, the treatment response was only based on subjective outcomes.

In conclusion, the findings suggest that the IR-FOSQ-10 is a reliable and valid HRQOL measure among Iranian patients with OSA and can be applied to assess the HRQOL in clinic and research studies. The FOSQ has been validated in many languages. The IR-FOSQ-10 let us compare the quality of life and the effectiveness of related intervention in Iran with other countries.

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