Validation of the Dutch Occupational Impact of Sleep Questionnaire (OISQ)

Joris C VERSTER[1]*, Beverley DAVID[2], Kevin MORGAN[2] and Berend OLIVIER[1]

[1]Utrecht Institute for Pharmaceutical Sciences, Faculty of Science, Section Psychopharmacology, Utrecht University, PO Box 80082, 3508 TB Utrecht, The Netherlands
[2]Department of Human Sciences, Clinical Sleep Research Unit, Loughborough University, Loughborough, Leicestershire, LE11 3TU, U.K.

Abstract: Sleep problems are often under-diagnosed, but may have a profound impact on work performance. The purpose of this study was to validate the Dutch version of the Occupational Impact of Sleep Questionnaire (OISQ). A total of 555 adults with a regular daytime job completed the OISQ. In addition, they also completed the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS) and the SLEEP-50 questionnaire. 443 surveys were included in the analysis (220 men and 223 women). The Dutch OISQ had high reliability (Chronbach's alpha=0.96). OISQ scores correlated significantly with scores on the SLEEP-50 questionnaire, ESS, and PSQI (*p*<0.0001). Mean score on the OISQ was 14.0. Poor sleepers (OISQ score around 20) had approximately double the OISQ score as good sleepers (OISQ score around 10), irrespective of this classification was based on self-ratings, PSQI-scores or SLEEP-50 scores. The Dutch OISQ is a suitable tool to examine the occupational impact of sleep.

Key words: Sleep, Work, Occupational, OISQ, PSQI, ESS, SLEEP-50

Introduction

Sleep complaints are commonly reported but are often under-diagnosed. The impact of sleep problems on daytime functioning may vary from simply being sleepy to lower productivity, mistakes, accidents or even death[1]. The association between sleep quality and on-the-job performance is bi-directional. Poor sleep affects daytime performance, but job stressors concerning work overload, role conflict, autonomy, and performing repetitive tasks may have a negative impact on sleep quality as well[2, 3]. The socioeconomic impact of the interplay between sleep quality and on-the-job performance is enormous and often underestimated[1, 4]. While impaired occupational functioning is a diagnostic criterion for primary insomnia in DSM-IV and ICSD-2, relationships between insomnia and work performance have received little research attention.

The Occupational Impact of Sleep Questionnaire (OISQ), initially piloted by David and Morgan[5, 6], is a 24-item questionnaire combining workplace scenarios from the Work Limitations Questionnaire (WLQ)[7] augmented with items specific to circadian variations in efficiency, and global work satisfaction. The likert-type response format is similar to those used in the WLQ, the Pittsburgh Sleep Quality Index (PSQI)[8] and the Short-Form 36 (SF-36)[9], while the time frame addressed by each item (the past 4 wk) matches the PSQI and the SF-36. The questionnaire assesses the construct 'occupational impact of sleep quality' conceptualized as a variable continuously distributed throughout the working population, and not restricted to those experiencing insomnia or other sleep disorders. This conceptualization allows for the scale to be used as: i) a clinical assessment tool; ii) a clinical outcome measure; and iii) a population screening tool.

The 24-item version of the OISQ was developed in the context of a longitudinal study of insomnia involving 86 participants, 43 people with insomnia (PWI) and 43 controls. The PWI group comprised 26 women and 17 men (mean age 39 ± 7.6) meeting DSM-IV criteria for primary insomnia. The control group included 32 women and

*To whom correspondence should be addressed.
E-mail: j.c.verster@uu.nl

11 men (mean age 36 ± 7.4) all of whom scored ≤5 on the PSQI. All participants were engaged in non-shiftwork daytime occupations, were non-obese (BMI<30), were not taking neuroleptic medication, and reported no 'chronic health conditions'. Each completed the 24-item OISQ. Data from all 86 participants showed activity across the potential OISQ score range (measured range=0–80; mean=25), and a Cronbach's alpha coefficient of 0.93. Scores also significantly discriminated between PWI and control participants (PWI Group mean=16.7 ± 12.2 v Control Group mean=8.1 ± 7.0; F=10.1, *p*<0.001). These results provided strong support for the internal consistency reliability and criterion validity of the scale. Scores on the OISQ correlate significant with performance on the psychomotor vigilance task (PVT)[5].

The purpose of this study was to validate the Dutch version of the OISQ among workers with a regular daytime job. To this extend subjects also completed the PSQI[8] and SLEEP-50 questionnaire[10] to determine the presence and severity of sleep problems, and the ESS[11] to asses daytime sleepiness.

Subjects and Methods

Subjects

We aimed at 500 useful surveys, completed by adults (18–65 yr old) with a regular fulltime day job. To validate the OISQ we aimed at a broad variety of workers to complete the survey. To that extend study personnel contacted various companies if it was allowed to administer the survey to their personnel. In addition, surveys were distributed from a children's daycare center. Participants who brought their child in the morning took a number of surveys to their office and returned them completed at the end of the day when they picked up their child. Although this method implies the risk of surveying participants with young children or part-time jobs (both exclusion criteria) and the lack of information on inclusion rates, the great advantage of this method is that a broad variety of random people could be reached to complete the survey. No other inclusion or exclusion criteria were applied.

Survey

The survey consisted of 4 pages and could be completed in approximately 10 to 15 min. In addition to demographics and information on job-type and working hours, the survey consisted of the OISQ (Occupational Impact of Sleep Questionnaire), the SLEEP-50 questionnaire, the PSQI (Pittsburgh Sleep Quality Index), and the ESS (Epworth Sleepiness Scale). The survey questions all concerned their previous week of work.

OISQ[5-6]

The OISQ is a 24-item questionnaire looking at how quality of sleep influences the ability to perform in the workplace. Scores on each question range from 0 ("never/not applicable"), 1 ("a little bit of the time"), 2 ("some of the time"), 3 ("most of the time"), and 4 ("all of the time"). The total OISQ score ranges from 0 to 96. The full OISQ can be found in Appendix 1.

For this study, the English version of the OISQ was translated into the Dutch language using international guidelines for cross-cultural adaptation, which require a certified translation of the original English version of the OISQ into Dutch followed by back-translation into English.

PSQI (Pittsburgh Sleep Quality Index)[12]

The PSQI consists of 19 self-rated questions, assessing a wide variety of factors relating to sleep quality, including estimates of sleep duration and latency and the frequency and severity of specific sleep-related problems. These 19 items are grouped into seven component scores, each weighted equally on a 0–3 scale. The seven component scores are then summed to yield a global PSQI score, which has a range of 0–21; higher scores indicate worse sleep quality. The seven components of the PSQI are standardized versions of areas routinely assessed in clinical interviews of patients with sleep/wake complaints. These components are subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction.

SLEEP-50 Questionnaire[10]

The SLEEP-50 questionnaire is a 50-item questionnaire about the intensity of a person's subjective sleep complaints. It was designed to detect both the sleep complaints and the sleep disorders as listed in the DSM–IV–TR, as well as factors influencing sleep. The first version of the SLEEP-50 followed the descriptions and criteria from the DSM–IV, leading to nine subscales. Five subscales (27 questions) of the SLEEP-50 were used, including Sleep Apnea (Cutoff≥15), Insomnia (Cutoff≥19), Narcolepsy (Cutoff≥7), Restless Legs (Cutoff≥7), and Nightmares (Cutoff≥3). The questionnaire starts with this statement: "Please respond to what extent a statement (item) has been applicable to you during the past 4 weeks." Each item is scored on a 4-point-scale: 1 (not at all), 2 (somewhat), 3 (rather much), and 4 (very much). The validated Dutch version of the SLEEP-50 was used for this study[10].

ESS (Epworth Sleepiness Scale)[13]

The ESS is a screening instrument to determine sleepi-

ness and the chances of falling asleep in certain instances such as while driving a car or after dinner. It consists of 8 situations of which subjects have to state the likelihood of falling asleep. Answers were scored in 4 ways: never (0), now and then (1), often (3) or always (4). The total ESS score ranges from 0 to 32.

Statistical Analysis

Statistical analyses were performed for subjects who met the inclusion criteria of having a fulltime day job (no shifting work hours or part-time job) and no young children or pregnancy that may have disturbed their sleep. Total scores of the OISQ, ESS, PSQI, and SLEEP-50 questionnaire were computed. Mean and Standard Deviation was computed for each variable. The frequency distribution of OISQ scores was computed as well.

Reliability and validity

The internal consistency (reliability) was measured by Cronbach's alpha. To examine validity of the OISQ, scores were correlated with PSQI, SLEEP-50 (including subscales), ESS scores. Factor analysis (applying a principal components analysis with Varimax rotation) was conducted to further investigate whether the OISQ is composed of different components.

Good versus poor sleepers

OISQ scores were computed for good and poor sleepers and compared with ANOVA ($p<0.05$). Good and poor sleep was categorized by (1) the subject's answer to the question if they consider themselves as good or poor sleeper, (2) using a cutoff score on the PSQI>5, or (3) presence of at least 1 sleep complaint on the SLEEP-50. For each way of categorization mean and SD of OISQ

scores were computed and compared using ANOVA. In addition, OISQ scores for the SLEEP-50 subscores were calculated as well.

To examine their relationship scores on OISQ, PSQI, SLEEP-50 and ESS, data were correlated with age and ANOVA ($p<0.05$) was used to see if scores differed between men and women.

Results

Demographics

A total of 555 surveys were completed, and 443 surveys were included in the analysis. Surveys were excluded (N=112) because they were incomplete (N=32), subjects had a part-time job (N=10), were shift-workers (N=41), or were pregnant or had a baby (N=28). Surveys of 220 men and 223 women were used in the analyses. Subject characteristics and their relationship with OISQ, PSQI, SLEEP-50 and ESS scores are summarized in Table 1.

According to the SLEEP-50 questionnaire, 36.6% of subjects were classified as having any sleep complaint, including insomnia (17.6%), narcolepsy (8.7%), sleep apnea (5.4%), restless legs syndrome (20.4%), or nightmares (1.6%).

Reliability and validity

Reliability of the OISQ was determined by computing Chronbach's alpha. Chronbach's alpha, based on 441 subjects, was 0.96.

Validity was determined by correlating the OISQ overall score with those of the PSQI, Epworth Sleepiness Scale and SLEEP-50 questionnaire. Results from these correlations, including the subscales of the SLEEP-50 are presented in Table 2.

Table 1. Subject characteristics and correlation with OISQ, PSQI, SLEEP-50, ESS

	Mean (SD)	Range	OISQ	PSQI	SLEEP-50	ESS
					Correlation and Significance	
Age (y)	38.44 (12.0)	18–63	–0.37*	0.007	–0.006	–0.070
Gender	--------------		–0.015	0.133*	0.065	0.058
Weight (kg)	74.08 (12.7)	45–125	0.048	–0.019	0.108*	0.044
BMI	23.63 (3.4)	16–44	0.028	0.011	0.127*	0.046
Start work	8 h 22 m (0.4)	6.30–10.00	–0.035	–0.027	0.001	0.046
Work hours	8 h 48 m (0.7)	5–12	–0.043	–0.006	0.024	–0.002
Sleep hours	6 h 58 m (0.5)	4–9	–0.116*	–0.559*	–0.321*	–0.141*
OISQ	14.0 (13.8)	0–92	xxxxxx	0.322*	0.468*	0.280*
PSQI	4.6 (2.4)	0–14	0.322*	xxxxxx	0.624*	0.225*
SLEEP-50	36.6 (6.5)	27–81	0.468*	0.624*	xxxxxx	0.341*
ESS	4.3 (3.1)	0–15	0.280*	0.225*	0.341*	xxxxxx

*=significant, $p<0.01$, h=hours, m=minutes, y=years, kg=kilogram. SD=Standard Deviation, Range=minimum and maximum score.

**Table 2. Correlation of OISQ scores with PSQI, ESS and SLEEP-50 scores**

SLEEP-50 questionnaire:	r=0.427, *p*<0.0001	(N=428)
SLEEP-50 Sleep Apnea score:	r=0.356, *p*<0.0001	(N=438)
SLEEP-50 Insomnia score:	r=0.278, *p*<0.0001	(N=434)
SLEEP-50 Narcolepsy score:	r=0.339, *p*<0.0001	(N=440)
SLEEP-50 Restless Legs score:	r=0.383, *p*<0.0001	(N=439)
SLEEP-50 Nightmare score:	r=0.201, *p*<0.0001	(N=441)
Epworth Sleepiness Scale:	r=0.280, *p*<0.0001	(N=435)
PSQI score:	r=0.339, *p*<0.0001	(N=410)

Table 2 shows that all correlations are high and significant, suggesting a high validity of the OISQ.

Factor analysis revealed 3 factors that were able to explain 66% of the variance in OISQ scores. A closer look at the 3 factors shows however that 53.5% of the 66% of variance is explained by 1 factor, 6.9% and 5.6% by factors 2 and 3 respectively. Hence, the data suggest no clear underlying factor structure.

Distribution of OISQ scores

Mean score on the OISQ for those not reporting sleep problems was 14.0 (95% CI: 12.7–15.3). Figure 1 shows the distribution of OISQ scores for all subjects. Figure 1 illustrates that the OISQ measures a continuum of the
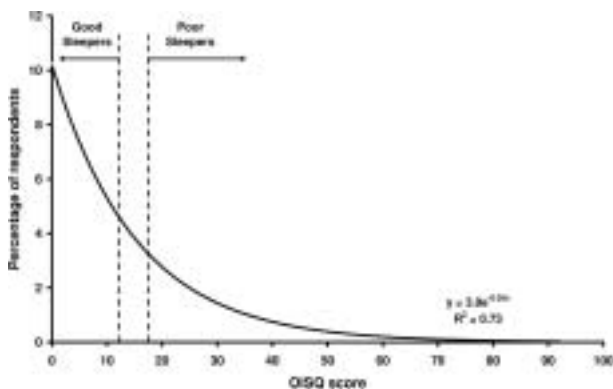
Fig. 1. Distribution of OISQ scores.
Shown is the best fitting line across the OISQ scores. Cut-off points are the means scores of the SLEEP-50, PSQI, and self rated scores of good versus bad sleeper. Poor sleepers have a score greater that 18.8, good sleepers have a score of 11.6 or less.

impact of sleep on on-the-job performance. This is understandable given the fact that items can be ordered from commonly experienced to seldom experienced, and that item scores range from "never" to "all of the time". Cut-off points for good sleepers (OISQ<11.6) and poor sleepers (OISQ>18.8) were average scores of the SLEEP-50, self-rated and PSQI.

Fifty percent of subjects scored 10 or less on the OISQ. No significant differences between men and women were found. A significant negative correlation between age and OISQ scores was found (r=–0.137, *p*<0.004), suggesting that less sleep-related work problems are experienced when people grow older.

OISQ scores for the SLEEP-50 subgroups of apnea (27.0), insomnia (20.7), narcolepsy (25.3), Restless Legs Syndrome (21.8) and Nightmares (26.0) were almost double the score of subjects without sleep complaints (*p*<0.01). These scores correspond well to the PSQI scores for the SLEEP-50 subgroups. SLEEP-50 scores of apnea (7.7), insomnia (8.2), narcolepsy (6.3), Restless Legs Syndrome (5.7) and Nightmares (6.6) were also about double the score of subjects without sleep complaints: 3.1 (95% CI: 2.9–3.2).

Good versus poor sleepers

Poor sleepers were categorized according to their own judgment (19.6%), having at least 1 sleep complaint on the SLEEP-50 (35.3%), or a cutoff score >5 on the PSQI (28.9%). Mean OISQ scores (and 95% CI) for good and poor sleepers are shown in Table 3.

Good and poor sleepers —independent from how they are categorized— show significantly different scores on the OISQ. Again, no significant differences were found between men and women. Of interest, the incidence of self-rated poor sleep (N=85) is much lower when compared to poor sleep assessed by the PSQI cut-off score (N=142) or the SLEEP-50 questionnaire (N=150).

Discussion

The occupational impact of sleep problems has been reported previously, but its assessment has often been established by means of broad measures such as days of absenteeism or number of accidents[14–16]. Further, many

Table 3. OISQ scores for good sleepers and poor sleepers based on self-rating, SLEEP-50 and PSQI

	Self rated		SLEEP-50		PSQI	
	Mean	(95% CI)	Mean	(95%CI)	Mean	(95%CI)
Good sleeper	12.56	(11.16–13.97)	10.38	(9.03–11.73)	11.94	(9.92–12.60)
Poor sleeper	19.96	(16.91–23.02)	20.19	(17.72–22.65)	16.27	(17.67–23.07)
ANOVA	*F=20.33, p<0.0001*		*F=56.32, p<0.0001*		*F=44.46, p<0.0001*	

of these studies concern shift-workers or healthcare professionals with extended working hours[17].

A limited number of studies focused on regular 9 to 5 daytime jobs. For example, Leger and colleagues[16] reported that insomniacs missed work twice as often as good sleepers. At work, they reported poor self-esteem, less job satisfaction and less efficiency. Also, people with insomnia had a 3-fold greater risk of having multiple serious road accidents. Lindberg and colleagues[14] reported a 2.2 fold increase in occupational accidents among male subjects matching the criteria of obstructive sleep apnea (snoring and excessive daytime sleepiness).

Results from the present study show that the Dutch OISQ has a high reliability (chronbach's alpha of 0.96). Its validity was shown by significant correlations with the SLEEP-50, ESS and PSQI scores ($p<0.001$). Further, the Dutch OISQ differentiates clearly between poor sleepers and good sleepers. OISQ scores for poor and good sleepers in our study (20 versus 10, respectively) are lower than those observed in the study performed by David and Morgan (32 versus 17.8). This difference is probably caused by the fact that our study included 6 times more subjects[6]. A possible other reason may be the fact that we included only subject with office jobs, i.e. not requiring heavy physical activity.

A limitation of this survey was that we used the SLEEP-50 questionnaire to categorize sleep problems such as sleep apnea and narcolepsy. Although the SLEEP-50 is useful as a screening instrument, clinical assessments using DSM IV criteria are more accurate. The percentages of subjects with sleep complaints observed in our study were much higher than those observed by Spoormaker and colleagues[10]. The differences between our percentages and those of Spoormaker and colleagues study were especially profound for narcolepsy (8.7% versus 0.3%) restless legs syndrome (20.4% versus 3.6%), and sleep apnea (5.4% versus 10.3%). We have no clear explanation for the differences, except that our sample consisted of unscreened people with a daytime job (N=443) and the Spoormaker's sample consisted of college students (N=377), sleep patients (N=278) and healthy volunteers (N=44).

To gain more insight in the relationship between the severity of specific sleep complaints and the corresponding OISQ scores, future studies should be performed in the confirmed patient population. In these studies it is important to do repeated measures in time to see how OISQ scores change over time, for example if they improve during treatment. Specific measured about job performance such as number of accidents or amount of processed work should be measured in these studies to have direct measures of the occupational impact of sleep complaints. Alternatively, subjects can be tested in the laboratory on cognitive and psychomotor functioning, or sleep diary results could be associated with OISQ scores. Unfortunately, the present study lacked these elements. Finally, the present sample of subjects comprised only those involved in "office work", i.e. jobs without heavy physical labor. It is likely that the type of occupation has an impact on sleep as well. This too should be elucidated in future studies. For example, specific scales could be developed for physical labor, or for shift-workers and aircraft personnel (to determine the impact of jetlag and time zone travel on work performance), which were all excluded in the present analyses.

In conclusion, the Dutch OISQ is a suitable measure of occupational performance.

Acknowledgement

References

1) Metlaine A, Leger D, Choudat D (2005) Socioeconomic impact of insomnia in working populations. Ind Health **43**, 11–9.
2) Edell-Gustafsson UM, Kritz EIK, Bogren IK (2002) Self-reported sleep quality, strain and health in relation to perceived working conditions in females. Scand J Caring Sci **16**, 179–87.
3) Knudsen HK, Ducharme LJ, Roman PM (2007) Job stress and poor sleep quality: data from an American sample of full-time workers. Soc Sci Med **64**, 1997–2007.
4) Rosenkind MR (2005) Underestimating the societal costs of impaired alertness: safety, health and productivity risks. Sleep Med **6** (Suppl 1), S21–5.
5) David B, Morgan K (2005) Occupational and daytime functioning in primary insomnia: a prospective study. J Sleep Res **15** (Suppl 1), 157.
6) David B, Morgan K (2007) Measuring the Occupational Impact of Sleep Quality: the OISQ. Sleep Biol Rhythms **5**, A160.
7) Lerner D, Amick BC, Rogers WH, Malspeis S, Bungay K, Cynn D (2001) The work limitations questionnaire. Med Care **39**, 72–85.
8) Buysse DJ, Reynolds CF III, Monk TH, Berman SR, Kupfer DJ (1989) The Pittsburgh sleep quality index for psychiatric practice and research. Psychiat Res **28**, 193–213.
9) Ware JE (1993) SF-36 health survey: manual and interpretation guide, Health Institute, Boston.
10) Spoormaker VI, Verbeek I, Van den Bout J, Klip EC (2005) Initial validation of the SLEEP 50 Questionnaire. Behav Sleep Med **3**, 227–46.
11) John MW (1994) Sleepiness in different situations mea-

sured by the Epworth Sleepiness Scale. Sleep **17**, 703–10.

12) Marinus J, Visser M, van Hilten JJ, Lammers GJ, Stiggelbout AM (2003) Assessment of sleep and sleepiness in Parkinson disease. Sleep **15**, 1049–54.

13) Verbraecken J, Declerck A, Van de Heyning P, De Backer W, Wouters EF (2001) Evaluation for sleep apnea in patients with Ehlers-Danlos syndrome and Marfan: a questionnaire study. Clin Genet **60**, 360–5.

14) Lindberg E, Carter N, Gislason T, Janson C (2001) Role of snoring and daytime sleepiness in occupational accidents. Am J Respir Crit Care Med **164**, 2031–5.

15) Melamed S, Oksenberg A (2002) Excessive daytime sleepiness and risk of occupational injuries in non-shift daytime workers. Sleep **25**, 315–22.

16) Leger D, Massuel M-A, Metlaine A, the SISYPHE Study Group (2006) Professional correlates of insomnia. Sleep **29**, 171–8.

17) Owens JA (2007) Sleep loss and fatigue in healthcare professionals. J Perinat Neonat Nurs **21**, 92–100.

Appendix 1: OCCUPATIONAL IMPACT OF SLEEP QUESTIONNAIRE (OISQ)

Quality of sleep can influence our ability to perform in the workplace. The following questions relate to ways in which your work performance may have been affected by your sleep during the past week. Please Indicate (✓) how often each item applied to you. Answer all the questions.

During the past week, how often did the quality of your sleep make it difficult for you to:

		All of the time	Most of the time	Some of the time	A little bit of the time	Never/Not Applicable
1.	Wake up for work on time?					
2.	Arrive at work on time?					
3.	Work the required number of hours?					
4.	Get going easily at the beginning of the workday?					
5.	Start on your job as soon as you arrive at work?					
6.	Do your work without stopping to take breaks or rests?					
7.	Keep working effectively during the afternoon?					
8.	Maintain your stamina throughout the day?					
9.	Keep to a routine or schedule?					
10.	Think clearly when working?					
11.	Wake up for work on time?					
12.	Keep your mind on your work?					
13.	Do work carefully?					
14.	Concentrate on your work?					
15.	Work without losing your train of thought?					
16.	Easily read or use your eyes when working?					
17.	Speak with people in-person, in meetings or on the phone?					
18.	Control your temper around people when working?					
19.	Help other people to get work done?					
20.	Handle the workload?					
21.	Work fast enough?					
22.	Finish work on time?					
23.	Do your work without making mistakes?					
24.	Feel you have done what you are capable of doing?					

Scoring: All of the time (0), Most of the time (1), Some of the time (2), A little bit of the time (3), Never/Not applicable (4).