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Translation, cross-cultural adaptation and psychometric properties of the Jenkins Sleep Scale in a sample of Portuguese shift workers

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Abstract

The aim of this work was to translate the Jenkins Sleep Scale into Portuguese, to culturally adapt it to the Portuguese culture and to assess its stability, internal consistency and convergent validity among a group of shift workers (airline pilots).

The scale was validated in a sample of 456 airline pilots. The original Jenkins Sleep Scale was translated and culturally adapted to the Portuguese Culture using recommended procedures. The psychometric methods used were confirmatory factor analysis using structural equation modeling, Cronbach's α coefficients, and intra-class correlation coefficients. The results confirmed the JSS-PT has a single factor model, like the original version, with the Comparative Fit Index and the Tucker-Lewis Index suggesting a very good fit. Cronbach's α coefficient was .84 for the extracted factor. Pearson bivariate correlations were performed on 75 participants, with an interval of 1 week for test-retest purposes with intra-class correlation of .99. Convergent validation showed significant correlations (r=.57).

The validity and reliability of this scale was established, enabling it to be used within the Portuguese language speakers. Nevertheless, this study should be replicated in other samples, with other forms of validity being explored.

Key-words: Jenkins Sleep Scale, Shift-work, Sleep, Translation.

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Resumo

O objectivo deste trabalho foi traduzir a Escala de Sono de Jenkins para português, fazer a sua adaptação à cultura portuguesa, e aferir as suas qualidades métricas. numa amostra de 456 pilotos de linha aérea. A Escala de Sono de Jenkins original foi traduzida e culturalmente adaptada para a língua portuguesa utilizando os procedimentos recomendados.

Os métodos psicométricos utilizados foram a Análise Factorial Confirmatória utilizando a Modelação de Equações Estruturais, o Alfa de Cronbach, e a Correlação Intra-classes. Os resultados confirmam a JSS-PT, como um modelo unifactorial tal qual a versão original, com os Índices Comparativo de Ajustamento e Tucker Lewis sugerindo um bom ajustamento. O Alfa de Cronbach foi de .84 para o factor extraído. Foram efectuadas correlações bivariadas de Pearson a 75 participantes, com um intervalo de uma semana para efeitos de teste re-teste e correlação entre classes (.99). A validação Convergente demonstrou correlações significativas (r=.57).

Foi estabelecida a validade e fiabilidade desta escala, permitindo usá-la entre os nativos de língua portuguesa. Contudo, este estudo deverá ser replicado noutras amostras, explorando outras formas de validação.

Palavras-chave: Escala de Sono de Jenkins, Trabalhadores por turnos, Sono, Tradução.

Introduction

During the last decades, there has been an increase in the understanding of sleep-related processes and pathologies (Auger & Morgenthaler, 2009). Sleep disturbances are prevalent in modern society and their costs are considerable (Åkerstedt, Fredlund, Gillberg, & Jansson, 2002). Driving while sleep deprived increases the risk of traffic accidents, to a higher level than driving under the influence of alcohol (Rodenstein, 2008). The severity of this problem is known for decades: traffic accidents caused by awareness changes and/or sleepiness are 27% of the total number of accidents; from these 83% are fatal cases. Also here there is a huge circadian influence, with the majority of cases occurring during early morning (Alonderis et al., 2008). According to Hossain and Shapiro (2002) problems with falling asleep or daytime sleepiness affect approximately 35-40% of the adult population of the U.S., and are a cause of morbidity and mortality (Hossain & Shapiro, 2002). According to the American Institute of Medicine (IOM) hundreds of billions of dollars per year are spent on direct medical costs related to sleep disorders. Included are costs for doctor visits, hospital services, prescriptions, and over-the-counter medications (Colten & Altevogt, 2006).

The causes of disturbed sleep are varied, but one obvious source are the effects of daily working life (Härmä, Tenkanen, Sjöblom, Alikoski, & Heinsalmi, 1998). The increased use of technology, such as artificial light and jet aircraft, increased the exposure to sleep-wake schedules that oppose intrinsic circadian physiology. The ever-increasing societal pressure in industrialized nations, abandoning the customary 9-to-5 workday, results in job-driven schedules and sleep times that are at odds with endogenous rhythms, which are tightly regulated by the internal biological clock (Drake & Wright, 2010). Professional drivers, airline crews, nurses or physicians, who have to stay awake for very long hours, are potential risk groups (Lamberg, 2004; Veasey, Rosen, Barzansky, Rosen, & Owens, 2002). Working sleep deprived increases fatigue and the risk of professional errors (Philip et al., 2005).

According to the American College of Occupational and Environment Medicine, fatigue in the U.S. costs more than $136 billion a year in health-related lost productivity – 84% of it related to reduced work performance, rather than absences (Ricci, Chee, Lorandeau, & Berger, 2007).

However, in these populations, alertness is not only a major concern for safety at work but also for traffic safety. Traffic accidents occurring from workplace to home are one of the major causes of injury and death among shift workers (Philip et al., 2005). Shift work is well established as a cause of disturbed or curtailed sleep (Åkerstedt, Wright, Kecklund, & Gillberg, 2009). Airline pilots while having sleep deprivation problems due to long duty periods, many times performed in the window of circadian low (2:00 AM until 6:00 AM), have also the additional problem of circadian disruption and jetlag (Caldwell, 2012; Powell, Spencer, Holland, Broadbent, & Petrie, 2007). There are studies affirming that these factors may contribute to depression symptoms (Srinivasan et al., 2010).

Sleep problems seem to be a common factor in anxiety and depression (Johnson, Roth, & Breslau, 2006; Neckelmann, Mykletun, & Dahl, 2007). Approximately 80% of patients with depression complain of changes in sleep patterns. When executing a polysomnography, a multi-parametric type of sleep study used as a diagnostic tool in sleep medicine, the changes that occur in depression can be divided into three main categories; sleep continuity, slow-wave sleep and REM (Rapid Eye Movement) sleep (Lucchesi, Pradella-Hallinan, Lucchesi, & André, 2005). Concerning anxiety, patients often complain that they cannot relax or stop worrying about problems while trying to fall asleep (Lucchesi et al., 2005).

The Jenkins Sleep Scale or JSS (Jenkins, Stanton, Niemcryk, & Rose, 1988) is one of the most commonly used self-response questionnaires to measure sleep disturbances (Lallukka, Dregan, & Armstrong, 2011). This scale was developed to examine sleep problems in clinical research and has been validated among air traffic controllers and in patients recovering from cardiac surgery (Rose, Jenkins, & Hurst, 1982). It is frequently used in epidemiologic studies and has good internal reliability (Jenkins et al., 1988). Being this an easy, self-answer, and a quick instrument to apply, it is perfect to use in clinic or investigating studies.

The aim of this study was to translate the Jenkins Sleep Scale into Portuguese language, to culturally adapt it to the Portuguese culture and to assess its stability, internal consistency and convergent validity among shift workers.

Methods

Subjects

Four hundred and fifty six (456) self-response questionnaires were answered by a sample of airline pilots obtained from a total of 1498 delivered questionnaires. Considering a total estimated Portuguese airline pilot's population of 1500 individuals across all airline companies, the response rate was 30.6%. The inclusion criteria were: being an airline pilot on active duty (Commanders and First Officers), aged between 20 and 65 years old, and having flown during the last six months.

Mean age was 39.31 (*SD*±8.39) years for a minimum age of 22 and a maximum of 64 years. Fourteen (3.1%) respondents were women, 442 (96.9%) were men; these numbers correspond approximately to the male/female ratio of Portuguese airline pilots. Regarding type of flight 314 (68.8%) were from short/medium haul, 127 (27.9%) from long haul, and only 15 (3.3%) flow both types of flight. There were 234 (51.3%) Commanders and 222 (48.7%) First Officers.

The Portuguese Airline Pilot's Association gave the agreement for the development of the study. In addition, the National Commission for Data Protection gave their approval. The Pilots Association made an announcement of the study to all pilots, and explained the importance and aim of the study.

Informed consent was not required because no interaction occurred between pilots and researchers jeopardizing individual privacy.

Instruments

The English version of JSS (Jenkins et al., 1988) was the original scale used for translation and adaptation. The original JSS is a self-administered scale and each participant answered individually, with no assistance from researchers. Instructions to fill out the questionnaire were available in the header's questionnaire. This instrument comprises four questions, rated on a 6 point frequency rating scale, ranging from 0 to 5 (0=Not at all; 1=1-3 days; 2=4 to 7 days; 3=8 to 14 days; 4=15 to 21 days; 5=22 to 31 days). The 4 items, belonging to a single factor, ask how frequently during the previous month the respondent experienced: "*1 – Have trouble falling asleep?; 2 – Wake up several times per night?; 3 – Have trouble staying asleep (including waking far too early)?; 4 – Wake up after your usual amount of sleep feeling tired and worn out?"* (Appendix I). Sleep disturbances are considered whenever mean score is 4 or greater, corresponding to at least 15 troubled nights per month. Higher scores indicate more severe sleep difficulties.

The Hospital Anxiety and Depression Scale (HADS) (Pais-Ribeiro et al., 2007) is a self-response questionnaire commonly used to measure anxiety and depression. HADS consists of two subscales scored separately, one measuring anxiety, with seven items, and one measuring depression, also with seven items. Each item is scored by the participant on a 4 point (0-3) response category so the answering scores range from 0 to 21 for anxiety and depression. The HADS manual (Snaith & Zigmond, 1994) indicates that a score between 0 and 7 is "normal", between 8 and 10 "mild", between 11 and 14 "moderate" and between 15 and 21 "severe". This instrument was used to access convergent validity.

Procedure

The study was performed in two stages. In the first stage, the scale was translated into Portuguese and culturally adapted to the Portuguese culture. In the second stage, we tested it in a sample of airline pilots to assess stability, internal consistency and convergent validity of the Portuguese JSS.

We assigned a random number to each inquiry, to ensure that all questionnaires were distributed by the investigating team, preventing duplication and consequent tampering.

All questionnaires were put in the personal locker of each pilot. Upon being answered, the inquiries were deposited in a locked ballot box. The pilots were informed that the inquiries should be answered between the 1st of April and May 15th, 2012.

We obtained permission to use the JSS and translate it to Portuguese. Recommended procedures proposed by Beaton, Bombardier, Guillemin and Ferraz were used (Beaton, Bombardier, Guillemin, & Ferraz, 2000). Following the same guidelines, the pre-final version of the JSS-PT was applied in an interview context, to 30 subjects. The aim was to confirm if each participant understood the question and the chosen response. The interviews content was examined and none of the participants had any difficulty understanding any particular item or answer. This procedure ensured that the adapted version retains its equivalence in an applied situation, thus the final version was established (Appendix I).

We constructed the database in SPSS (v. 22; SPSS IBM Corp., Armonk, NY). Construct validity was tested with the AMOS software (v.21; SPSS, v. 21). Sensibility of items were analyzed graphically and recurring to median, skewness (Sk) and kurtosis (Ku) coefficients. Items with Sk>|3| and Ku>|8| stray from a normal distribution and should be eliminated from the scale before performing factor analysis (Kline, 2010). For a frequency rating scale of 0 to 5, an acceptable median would be within a range of 2 to 3. Reliability was analyzed recurring to Cronbach α. Stability was performed according to Terwee et al. (2007), with one week interval between applications. The test-retest reliability analysis was performed with an interval of 1 week on 75 of the 456 participants. We asked them to keep the number of their first questionnaire, and write it on the second questionnaire, in order to match them. In the second application, responses were sent back to us by e-mail. Factorial validity was assessed by Structural Equation Modeling. Loading factors of .5 on factors was established as criteria for a minimum acceptable value in order to retain the item. The evaluation of adjustment measures used to check the suitability of the model to the data were: χ^2 test, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Root Mean Square of Error Approximation (RMSEA).

Convergent validity was assessed by computing the correlation (Frost, Reeve, Liepa, Stauffer, & Hays, 2007) between the JSS-PT and the Portuguese version of the HADS (Pais-Ribeiro et al., 2007). The 456 airline pilots together with the JSS-PT answered the HADS and a positive correlation was expected between them.

Results

Sensibility, reliability and validity of JSS-PT

Table 1 shows the median values (*Me*). All items fell within the acceptable range of skewness *(Sk)*<|3| and kurtosis *(Ku)*<|8|. Median values are close to the scale's middle point (*Me*=2, 3), therefore showing adequate sensitivity (Kline, 2010). Scale statistics show that results follow a normal distribution, suggesting a suitable sensitivity.

Table 1

Descriptive statistics relating to sensitivity of the items and scale

	N	*Me*	*Sk*	*Ku*	*Min*	*Max*
Item 1	456	2	.289	-.677	0	5
Item 2	456	2	.055	-.926	0	5
Item 3	456	3	-.057	-1.040	0	5
Item 4	456	2	.104	-.873	0	5

Construct Validity of JSS-PT

Table 2 shows item factor loading for a single factor model and Table 3 shows the corresponding model fit statistics. As expected, Chi square statistics penalized the relatively large sample size, and the small number of items (four) translated into reduced degrees of freedom, with the corresponding negative

impact on RMSEA (Marôco, 2010). CFI and TLI suggest a very good fit, and all items had factor loadings above the .5 criteria.

Table 2

Loading factors for each item

	Factor loadings
Item 1 – *Have trouble falling asleep?*	.63
Item 2 – *Wake up several times per night?*	.83
Item 3 – *Have trouble staying asleep (including waking far too early)?*	.85
Item 4 – *Wake up after your usual amount of sleep feeling tired and worn out?*	.68

Table 3

Model fit statistics (CFI=Comparative Fit Index; TLI=Tucker-Lewis Index; RMSEA=Root Mean Square Error of Approximation)

χ^2	*Df*	*p-value*	*CFI*	*TLI*	*RMSEA*
14.614	2	0.001	0.983	0.949	0.118

Convergent validity was assessed by calculating a Pearson's correlation coefficient between sleep disturbances and anxiety/depression scores. An *r* value of .57 was calculated, indicating a medium to strong correlation between JSS and HADS results (Cohen, 1988).

Reliability of the scale, accessed by Cronbach's alpha, was .84 for the extracted factor, suggesting a very good level of internal consistency (Cronbach, 1951; Terwee et al., 2007). In order to establish the test-retest reliability, a Pearson bivariate correlation was performed. Intra-class correlation coefficient was .99, revealing good stability (Cohen, 1988).

Discussion

The main objective of this study was to adapt the JSS to the Portuguese speaking population and to establish its psychometric properties in a Portuguese shift workers sample.

Shift workers are a risk group for sleep disorders (Åkerstedt, 2003). Due to the characteristics of shift work and its implications on job performance and health, it is of the highest importance to study sleep disorders on these workers.

Regarding airline pilots, we have to consider the specificities of their job, that increase the likelihood of developing sleep disturbances, namely circadian rhythm disturbances, disruptive schedules, long duty periods and jet lag. The consequences of sleep disturbances in airline pilots have a direct influence in aviation safety, so it is important to study this phenomenon in this population. To our knowledge, until now the studies developed in Portugal were done with truck drivers (Catarino,

Spratley, Catarino, & Pais-Clemente, 2014; Souza, Paiva, & Reimão, 2005), so it is necessary to extend these studies to other professional groups, such as airline pilots, medical professionals, armed forces, etc. The JSS-PT is simple and quick to apply, an added value for research within these populations, which have little free time. The obtained results showed that the JSS-PT has suitable psychometric qualities, notably factorial and convergent validities; some of the fit indicators suggested a poor fit, but they are indicators that are sensitive to large sample size and/or number of parameters in the model. From a reliability point of view, the scale met the criteria for adequate stability and internal consistency. As expected, the JSS-PT presented a unifactorial structure, like the original version (Jenkins et al., 1988); Cronbach's alpha was higher in the present study (.84), compared to the original one (.79 for Air Traffic Controllers and .63 for Cardiac Surgery Recovery patients group).

In other studies using the JSS, the Cronbach's alpha was .80 in patients with unexplained chest pain (Jerlock, Gaston-Johanson, Kjellgren, & Welin, 2006), and .77 in Japanese and British civil servants (Nasermoaddeli et al., 2005).

The JSS-PT showed adequate results regarding convergent validity among the studied group. Item and scale statistics showed adequate sensitivity, which means the scale can adequately express variation in quality of sleep in different respondents. We therefore conclude that the JSS-PT is a good option to assess self-reported sleep problems in the Portuguese speaking population. Due to its fast and easy application and quotation, it is a good instrument to use in research and clinical settings.

Due to their work schedules, the study population has a considerable prevalence value of sleep disturbances (Reis & Mestre, 2013), which may have skewed the results in some way. Because of this, it will be important to replicate this study in other Portuguese speaking labor groups and populations. Studies among shift and non-shift workers, as well as other forms of validity, should be developed, particularly Discriminant Validity and Criterion-related Validity.

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Appendix I

Jenkins Sleep Scale – Portuguese version (JSS-PT) from Jenkins et al. (1988)

Responda às seguintes questões, quantificando a frequência da ocorrência de cada um dos episódios abaixo descritos, numa escala de 0 a 5.

0 – Nunca, 1 – Poucos dias (1-3), 2 – Alguns dias (4-7),
3 – Metade dos dias (8-14), 4 – Maioria dos dias (15-21) e 5 – Todos os dias (21 a 31)

Com que frequência no passado mês:	**Frequência**
1. Teve dificuldade em adormecer	
2. Acordou várias vezes durante a noite	
3. Teve problemas em manter o sono (incluindo acordar demasiado cedo)	
4. Acordou e sentiu-se cansado ou desgastado, mesmo depois de um período completo de sono	

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