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Sleep health assessment: A scale validation

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ABSTRACT

Sleep health is a new and important concept. Considering the need to expand the research on sleep from the health perspective, this research proposes to validate a Sleep Health Scale (SHS) for use with the Portuguese adult population. A sample of 540 community-dwelling adults aged 18–90 years old was included. The SHS scores ranged from 0 to 30 with a mean of 19.09 (SD ± 6.49). The distribution indicated that all socio demographic variables (age, gender, and literacy) influenced sleep health. Exploratory factor analysis (EFA) demonstrated one factor for this measurement model with poor indices (Chi-square (df) = 55.02(9), $p < 0.001$). Confirmatory factor analysis (CFA) was performed on the single factor and showed a well-adjusted model except for question 5 (Chi-square (df) = 11.443(4), $p = 0.022$; RMSEA = 0.084; CFI = 0.99; GFI = 0.98; AGFI = 0.94), the convergent validity (AVE = 0.55) and reliability values (α = 0.85 /CR = 0.86) were good. In conclusion, the Sleep Health Scale (SHS) is valid and reliable for the assessment of the several sleep health indicators of Portuguese adults. An investigation on the relationship between sleep health and well-being in promoting quality of life with this scale is recommended for future research.

1. Introduction

Sleep Health can be defined as a multidimensional pattern of sleep-wakefulness, adapted to the individual, social and environmental requirements, which promotes physical and psychological well-being (Buysse, 2014). It concerns a positive frame of reference for the sleep of individuals since adequate sleep is an integral and fundamental part of a healthy lifestyle.

Research consistently demonstrates that sleep is a significant component of physical and mental health, as well as overall well-being (Knutson et al., 2017). Sleep is important for optimal cognitive performance and physiological processes, emotional regulation and quality of life (O'Leary et al., 2017). Thus, sleep can be considered a complex and dynamic behavioral state that greatly influences our waking hours and contributes to the body's physical and mental recovery (João et al., 2017).

Sleep can be assessed across self-report, behavioral, physiological, circuit, cellular, and genetic levels of analysis. Within each level of analysis, sleep can be further characterized along multiple dimensions, such as quantity, continuity, timing, satisfaction/quality, sleep stage, and action/deactivation (Buysse, 2014). Sleep questions and surveys are used in research using instruments that assess sleep focus, such as the Pittsburgh Sleep Quality Index (Buysse et al., 1989), the Epworth Sleepiness Scale (Johns, 1992), and the National Institutes of Health Patient-Reported Outcomes Measurement Information System (PROMIS) Sleep Disturbance Scale (Buysse et al., 2010). Therefore, sleep health assessment neither has one specific assessment instrument nor a uniform definition.

Recently, the National Sleep Foundations group (Knutson et al., 2017) has proposed that the overall sleep health may include the quantity, quality, and impact of sleep, which are all essential, especially for a large proportion of the population that does not suffer from sleep pathologies. Although this group proposes a sleep health index that contemplates three dimensions of sleep (quality, duration and disorder), the conceptual model of sleep health proposed years before by Buysse (2014) contemplates more dimensions (satisfaction, alertness, timing, efficiency, duration and regulatory). This second model is based on a comprehensive review of specific dimensions of sleep and their association with specific health outcomes and is used for the proposed Regulatory Satisfaction Alertness Timing Efficiency Duration (RU SATED) scale (Buysse, 2014).

Sleep health is not the absence of a sleep problem or a disorder, and

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therefore, to adequately assess general sleep health, multiple dimensions of sleep should be assessed (Buysse, 2014; Knutson et al., 2017). It is essential to develop a instrument to assess this concept. Today, with the need to develop low-cost research that is capable of covering many individuals, it is indispensable to utilize an applicable, valid and reliable self-report test.

As such, it is necessary to expand the research on sleep from the health perspective, to include not only sleep disorders and deficits but also sleep health. This need for studies reinforces the importance of our aim: to validate a sleep health scale that enables the assessment of several sleep health dimensions.

2. Methods

2.1. Research tools

2.1.1. Sleep Health Scale (SHS)

SHS is an adapted and translated scale based on the “regularity satisfaction alertness timing efficiency duration (RU SATED)” scale originally proposed by Buysse (2014). RU SATED is a self-reported scale that evaluates six central dimensions of good sleep health, which have been consistently associated with various health outcomes, and is characterized by (1) regularity, (2) subjective satisfaction, (3) alertness during waking hours, (4) appropriate timing, (5) high efficiency, and (6) adequate duration. It presents specific quantitative criteria for five of the six dimensions that have parallel measures within behavioral (Actigraph) and physiological (PSG) levels, except for the sleep satisfaction, which is, by definition, subjective (Buysse, 2014). The items of this scale can be summed up to have a single score ranging from 0 (poor sleep health) to 30 (good sleep health).

2.1.2. Pittsburgh sleep quality index

Sleep quality was evaluated using the Portuguese version of the Pittsburgh Sleep Quality Index (PSQI-PT; João et al., 2017). This questionnaire evaluates the quality and quantity of sleep in the last month. The PSQI consists of 19 questions addressed to the subject and 5 questions answered by partners (if applicable). These latter five questions are only used in a clinical setting. The 19 questions are grouped into seven components, such as subjective sleep quality (C1), sleep latency (C2), sleep duration (C3), habitual sleep efficiency (C4), sleep disturbances (C5), use of sleeping medications (C6) and daytime dysfunction (C7). Each of these components is scored from 0 to 3. The overall PSQI score is obtained by summing the scores of the seven components, ranging from 0 (no difficulty) to 21 (severe difficulties). Scores between 0 and 4 refer to individuals with good sleep quality, between 5 and 10 indicate poor sleep quality, and over 10 represent subjects with sleep disorders (Buysse et al., 1989). Regarding the psychometric data concerning the validation of the Portuguese version of the instrument, the Cronbach's Alpha (α) value for the seven components is 0.70, which reveals a good internal consistency (João et al., 2017). The internal consistency for the present study, was $\alpha = 0.723$.

2.2. Translation

The RU SATED was translated to European Portuguese by two independent and bilingual translators, who were aware of the study objectives. Then, these two versions were synthesized with comparisons and analysis of their semantic, idiomatic, contextual and linguistic discrepancies, in order to obtain a single version. The synthesized version was evaluated regarding the structure, the layout, the instrument instructions, scope and appropriateness of expressions contained in the items. This procedure tried to ensure the generalization of the terms and expressions for different contexts and populations. In order to assess the clarity and generalization power of the items between the translation and original questionnaire, the Portuguese version of RU SATED, SHS was applied to 20 individuals.

2.3. Sample

This study used a cross-sectional descriptive design. The instruments (PSQI-PT, and SHS) were applied in a convenience sample of 540 Portuguese community-dwelling aged 18–90 years old, where 228 were undergraduate students (42.4%), 206 were senior (38.1%) and 106 were adults (19.6%). For each person data regarding age (M = 45.7 SD ± 22.1), sex (330 Female and 204 Male), and literacy (113 had completed basic scholarship, 241 held a Bachelor's degree, and 174 held Master's or Ph.D. degrees) were recorded.

The application process occurred online, via email, where the participants were informed of the research objectives. Only questionnaires from participants over 18 years of age and having Portuguese as their native language were considered.

2.4. Statistical analysis

A total of 540 questionnaires were completed and checked for data entry errors, missing data, or presence of major outliers. Data analyses were performed with SPSS v21 and AMOS v29. The SHS item's responses had small amounts of missing data, with no more than 5% missing data for any composite. Single-point multiple imputation procedures for missing data replacement (Schafer and Graham, 2002) were conducted for the missing points.

Descriptive statistics were computed for each socio demographic, SHS and PSQI (global and components scores) variable, and their reliability was examined by Cronbach's Alpha [α] and Composite Reliability (CR). Descriptive statistics were calculated as frequencies (%) for categorical variables, whereas means and standard deviations were computed for continuous variables. KMO and Bartlett's tests were performed to determine the suitability of this sample for factor analysis. Subsequently, the sample was split randomly into two independent groups to perform EFA (exploratory factor analysis) and CFA (confirmatory factor analysis) through software command (SPSS 21).

EFA was performed on the first random sample (n = 270) using maximum likelihood estimate extraction and direct oblimin rotation to examine the factor structure of the PSQI-PT in older adults. CFA was conducted using the AMOS-20 in the second random sample (n = 270). The existence of outliers was evaluated by the square distance of Malahanobis (D^2), and the normality of the variables was evaluated by the uni- and multivariate coefficients of skewness (sk) and kurtosis (ku). Five observations showed D^2 values that would suggest their removal as outliers; therefore, the analysis was made without these observations. In this analysis, we tested the model identified through the EFA, the single factor structure of the SHS. The adjustment of the model was assessed using several statistical indices including a chi-squared test (non-significant values indicate good model fit), the root mean square error of approximation (RMSEA; values ≤ 0.05 indicate a very good adjustment), and the comparative fit (CFI), goodness of fit (GFI), and Tucker-Lewis (TLI) indexes (values ≥ 0.95 indicate a very good adjustment) (Marôco, 2014). Finally, the convergent validity was assessed using the Average Variance Extracted (AVE > 0,5 is used as an indicator of good convergent validity) (Marôco, 2014).

2.5. Ethical aspects

This research was performed in accordance with the European research guidelines and received approval from the Consulting Board of the Research Centre for Spatial and Organizational Dynamics (CIEO - Universidade de Algarve, Portugal). All the participants freely consented to answer the questionnaires and signed an informed consent form before their inclusion in the study.

3. Results

No structural adaptations to the questionnaire were necessary