Cross-cultural adaptation and psychometric studies of the Dysfunctional Beliefs and Attitudes about Sleep scale and the Sleep Problem Acceptance Questionnaire

Marwin M I B Carmo

Cross-cultural adaptation and psychometric studies of the DBAS-16 and SPAQ

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Marwin M I B Carmo

Orientação:

Dra. Renatha El Rafihi Ferreira

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Contents

Summary

Insomnia disorder is characterized by frequent complaints about the quality and quantity of sleep and may cause physical and psychological damage. Maladaptive beliefs about sleep were identified as reinforcers of insomnia. A insônia se caracteriza por queixas frequentes sobre a qualidade e quantidade de sono e tende a implicar em danos físicos e psicológicos à saúde do indivíduo. Crenças desadaptativas sobre o sono vem sendo identificados como fatores reforçadores da insônia e, com isto, tratamentos com foco nos aspectos cognitivos como a Terapia Cognitivo-Comportamental e a Terapia de Aceitação e Compromisso tem sido adotados por pesquisadores e clínicos, demonstrando efetividade. Como forma de avaliar essas cognições foram desenvolvidas escalas como a Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS-16), avaliando a força de concordância com crenças desadaptativas a respeito do sono, e o Sleep Problem Acceptance Questionnaire (SPAQ), como alternativa para mensurar a aceitação dos problemas de sono. Embora ambas as escalas apresentem boas evidências de validade e boas propriedades psicométricas, ainda se faz necessário verificar sua validade para o contexto brasileiro a fim de que seja possível alcançar resultados válidos, confiáveis e reprodutíveis com estes instrumentos. O objetivo deste estudo é realizar a adaptação transcultural e verificação das propriedades psicométricas e evidências de validade das escalas DBAS-16 e SPAQ com uma amostra brasileira. Participarão do estudo adultos com idade entre 18 e 59 anos com diagnóstico de insônia e o tamanho amostral mínimo estimado será de 200 participantes. A adaptação transcultural será realizada em um processo de tradução, retrotradução, síntese e estudo piloto. Serão conduzidas análises estatísticas para se verificar a estrutura fatorial dos instrumentos, estimativas de confiabilidade e evidências de validade relacionadas a variáveis externas.

Introduction

Insomnia is a disorder related to dissatisfaction with duration or quality of sleep. It can be a source of distress and impairment by decreasing productivity and lowering energy to engage in social activities (American Psychiatric Association, 2013). A prolonged exposure is associated with higher risk of adverse outcomes on mental health (Johnson et al., 2006; Taylor et al., 2005) and cognitive functioning (Fortier-Brochu et al., 2012).

Cognitive arousal is crucial to several behavioral models of insomnia as a maintainer of the disorder (Espie et al., 2006; Harvey, 2002; Lundh, 2005; Morin et al., 1993; Ong et al., 2012; Perlis et al., 1997). Cognitive and behavioral models of insomnia emphasize the role of sleep related cognitions as maintainers of insomnia. Cognitive-behavioral treatments target modification of habits, routines and ineffective beliefs about sleep, which is shown to be correlated with objective and subjective improvements in sleep (Harvey et al., 2014; Montserrat Sánchez-Ortuño & Edinger, 2010). Despite its known effectiveness in insomnia treatment, some patients gain little from the cognitive-behavioral approaches (Dalrymple et al., 2010). An alternative treatment for insomnia is the Acceptance and Commitment Therapy (ACT), which also focuses on cognitions but promotes acceptance of feelings and thoughts related to symptoms rather than its control (Hayes et al., 2011).

Be it either approach, these non-pharmacological treatments for insomnia are an effective and reliable alternative or complement to the use of medication (Hertenstein et al., 2014; Thakral et al., 2020). Because of that, it is also important that valid and reliable assessment tools are available to examine the severity of symptoms and/or the results of an intervention, either in clinical or research settings. Two tools for the assessment of sleep-related cognitions are the Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS) and the Sleep Problem Acceptance Questionnaire (SPAQ). Although used widely worldwide, to date no study has assessed its' psychometric properties with a Brazilian sample. Given that those measures were developed in a distinct cultural setting, it's necessary to obtain evidence for the applicability of these instruments within a specific context of a Brazilian-Portuguese speaking population prior to usage in high stakes settings.

Dysfunctional beliefs and attitudes about sleep

A. G. Harvey's model (2002) is frequently mentioned as theoretical background in investigations about cognitive process in insomnia. It posits that the excess of negatively toned activity about sleep triggers arousal and distress, channeling attention and monitoring to sleep threats. This may create distorted perceptions of sleep and overestimation of the real deficits during the day. To cope, the individual may engage in safety behaviors that paradoxically increase worry and preclude sleep self correction. In Harvey's model, dysfunctional beliefs about sleep exacerbates negatively toned cognitive activity. Such beliefs are also the backbone of the Microanalytic model (Morin, 1993), one of the most popular models for insomnia (Marques et al., 2015).

Current evidence favors that beliefs and attitudes about sleep mediates insomnia perpetuation (Akram et al., 2020; Chow et al., 2018; Harvey et al., 2017; Lancee et al., 2019), although not all studies have found this association (Norell-Clarke et al., 2021). Morin (1993) suggests that insomnia maintenance feeds from a cyclic process of arousal, dysfunctional cognitions, maladaptive habits and consequences. Arousal refers to excessive activity in emotional, cognitive or physiologic domains, which can create core beliefs that guide information processing (Marques et al., 2015). This may give rise to unrealistic expectations and rigidly held beliefs about requirements for sleep, as well as increased worry about the causes and consequences of sleep disturbances. Subsequent unhealthy sleep practices may include daytime napping, excessive time in bed or indiscriminate use of sleep medication. Consequences, real or perceived, are linked to diminished performance during the day.

Constructs and Their Relations. Individuals with higher insomnia symptoms are typically strong endorsers of dysfunctional beliefs about sleep (Carney & Edinger, 2006; Crönlein et al., 2014; Eidelman et al., 2016). Challenging those beliefs is at the core of the Cognitive Behavioral Therapy for insomnia (CBT-I) (Belanger et al., 2006). A recent meta-analysis observed clinically significant improvements in beliefs and attitudes about sleep favoring CBT-I over controls – although, as the authors warn, those results should be interpreted with care given the low quality of evidence (Edinger J. D. et al., 2021). Insomnia severity was identified as risk factor for anxiety (Neckelmann et al., 2007) and depression

(Blanken et al., 2020; Li et al., 2016), but some suggest these relationships the other way around (Chen et al., 2017; Jansson-Fröjmark & Lindblom, 2008). A relationship between anxiety and depression with dysfunctional beliefs about sleep is also expected: Beck's classic cognitive mechanism for the cause and maintenance of depression gives a central role to inaccurate beliefs and maladaptive information processing (Beck, 1979). Anxiety can be elicited from displeasing memories created through exposure to adverse experiences (Brewin, 1996). Thus, unrealistic attributions and expectations about sleep (or lack of sleep) may elicit anxiety-provoking thoughts. Associação entre Depressão e DBAS (Sadler et al., 2013).

Measurement. To assess sleep-disruptive cognitions, Morin et al. (1993) developed the Dysfunctional Beliefs and Attitudes About Sleep Scale (DBAS). The DBAS started as a 30-item self-report instrument rated in a 100-mm visual analog scale of agreement/disagreement. Later, Morin and colleagues (2007) shortened it to a 16-item version, and replaced the response format for a 10-point scale ranging from 0 (strongly disagree) to 10 (strongly agree). The items of the brief version were selected from the original scale based on criteria of response distribution, range, item-total correlations and exploratory oblique factor analysis. A 4-factor structure was fitted to the 16 items in a confirmatory factor analysis, labeled (a) consequences of insomnia, (b) worry about sleep, (c) sleep expectations, (d) medication, and a fifth second-order general factor. The DBAS is broadly employed in experimental studies assessing sleep-related cognitions, especially the 16-item version (Thakral et al., 2020). Moreover, the DBAS-16 outperformed the 30 and 10-item versions in reproducibility of factor structure, measures of internal consistency, concurrent validity and sensitivity to change (Chung Ka-Fai et al., 2016). Many researchers have translated and validated the DBAS-16 across various cultures. These studies successfully replicated the original factor structure and presented good validity evidences (Boysan et al., 2010; Dhyani et al., 2013; Lang et al., 2017).

Acceptance of sleeping problems

Shifting from the sole focus on the cognitive processes, Third Wave behavior therapies include metacognition as a target for intervention (i.e., changing how one relate to their own thoughts rather than changing its contents) (Hayes, Follette, et al., 2004). Early models of

insomnia including the metacognitive content refer to the interpretation of one's own sleep patterns or consequences of poor sleep, as sleep interpreting processes (Lundh & Broman, 2000). These models also integrate arousal events as key components to the causal chain that leads to insomnia. Lundh (2005) presented the idea that insomnia originates from the inability to disengage from information processing. He further argues that cognitive deactivation is essential for sleep occurrence and efforts of metacognitive control prevents the spontaneous processes of relaxation. Ultimately insomnia is maintained by the mutual contribution of sleep interfering process and sleep interpreting process. Acceptance of the natural occurring sleep processes through the adoption of an adaptive stance may help reduce arousal preventing the perpetuation of this cycle (Ong et al., 2012).

Constructs and Their Relations.

Measurement. To date, the Sleep Problem Acceptance Questionnaire (SPAQ) (Bothelius et al., 2015) is the only measure of acceptance of sleep difficulties with validated scores. This instrument is an adaptation of the Chronic Pain Acceptance Questionnaire and share its same two-factor structure: *Activity Engagement* and *Willingness* – which were shown to be negatively correlated (r = -0.26) (Bothelius et al., 2015). Ultimately, SPAQ's aim is to examine the role of acceptance in relation to the quality of sleep. Its items were purposely developed to resemble similar acceptance questionnaires used in other behavioral medicine contexts. Four items compose each factor; they are rated on a 7-point scale, where 0 means "Disagree" and 6 indicates "Completely agree". *Activity Engagement* relates to persistence with normal activities despite perceived dissatisfaction with sleep, whereas *Willingness* captures the ability to give up fighting sleep problems and controlling sleep. SPAQ is gradually gaining popularity as an assessment tool in ACT-based interventions for insomnia in addition or replacement of more general measures of acceptance (Paulos-Guarnieri et al., 2022).

The cross-cultural adaptation process

Psychometric evidence studies are essential as evidence that the scale items are good approximations of the intended construct (McNeish, 2022). Before using a existing psychological instrument in a distinct context of how it was originally developed, it's

important to assess the construct existence and similarity, since it may manifest itself differently (Flake et al., 2017; Herdman et al., 1998). A model proposed by Herdman et al. (1998) devise five types of equivalence to be assessed, namely: (1) Conceptual equivalence; (2) Item equivalence; (3) Semantic equivalence; (4) Operational equivalence; and (5) Measurement equivalence. There are many suggestions for the required steps of a cross-cultural adaptation process (Reichenheim & Moraes, 2007). Nevertheless, the guidelines by Beaton et al. (2000) are followed closely by much of the published research in cross-cultural adaptation (Arafat et al., 2016).

1. Items translation. A minimum of two translators, fluent in both source and target language and acquainted with both cultural backgrounds, should produce the initial translation of the instrument (Borsa et al., 2012; Epstein et al., 2015; Geisinger, 1994; Reichenheim & Moraes, 2007). They should work independently and it is preferred that one translator is aware of the concepts underlying the questionnaire while the second should have no expertise in its context and be blind or unfamiliar to it (Beaton et al., 2000). The mixed configuration of the translation team justifies because the informed translators are capable of finding appropriate correspondences to highly domain-specific words or expressions while the naive translators are prone to choose terms closer to those used routinely by the target population (Beaton et al., 2000).

2. Synthesis of the translations. Once the initial translations are completed, a committee should consider the original instrument and the translated versions, and reach an agreement for a single version. Most cross-cultural adaptation guidelines suggest that at least three members form the committee: the two initial translators and a third unbiased judge (Koller et al., 2012). There are also suggestions that this committee can be composed of judges expert on the concepts underlying the questionnaire (Epstein et al., 2015; Guillemin et al., 1993). Regardless, judges and authors should work together to assess the equivalence between the original version and the translations regarding semantics, idiomatic equivalence, experiential equivalence, and conceptual equivalence (Borsa et al., 2012).

3. Backtranslation. In the backtranslation phase, the synthesized version should be translated back to the source language in at least two new versions, produced by translators fluent on the source language and with a strong domain of the target language (Gjersing

et al., 2010; Guillemin et al., 1993). While Beaton et al.'s (2000) guideline suggest that the backtranslation should proceed the synthesis of the initial translations, authors such as Borsa et al. (2012) argue that this process should be delayed to the last stage of the cross-cultural adaptation process, given that the translation must be thoroughly evaluated before the appreciation by the original authors. There are therefore different views of when this phase must be executed – or even if it is really necessary, given the lack of evidence of its contribution for improving the instrument adaptation (Epstein et al., 2015; Geisinger, 1994; van Widenfelt et al., 2005). Be that as it may, the backtranslation process is a way for the original authors to assess the equivalence of meaning between the original and translated items, as well as a way of identifying inconsistencies or conceptual errors (Beaton et al., 2000; Borsa et al., 2012).

4. Expert committee. As hinted in previous sections, there are different views on the formation of the expert committee or when it should be called to action. Authors such as Beaton et al. (2000) suggests that the group should be composed of methodologists, health professionals, language professionals, and the translators (forward and back translators) so far involved in the process. They also encourage carefully recording of each decision made by the committee. What underlies this phase is the assessment of aspects not yet considered, such as instrument structure, layout, instructions and adequacy of expressions in the items (Borsa et al., 2012).

5. Pilot study. After all adjustments are completed, the instrument is ready for a pre test with a small sample representative of the target population. To many authors the pilot study is succeeded only by the final semantic adjustments suggested by the pretesting sample (Beaton et al., 2000; Dortas Junior et al., 2016; Gjersing et al., 2010; Reichenheim & Moraes, 2007; Wild et al., 2005). The pretesting may unveil unanticipated issues the test subjects might encounter, and any divergences regarding the comprehension of item meaning and expressions as well as the test instructions (Borsa et al., 2012; Epstein et al., 2015; van Widenfelt et al., 2005). In short, the purpose of the pre test is to assess whether the examinees can comprehend the concept of the questions in a consistent way and as intended by the researchers (Collins, 2003). The pretesting can be executed with a focus group – where researchers collect the participants impressions about the writing

and content of the instrument –, and/or through individual cognitive interviews, which allow a deeper understanding of the issues raised by the participants (Epstein et al., 2015). Recommendations following the exact sample size for the pilot study also vary. For instance, Beaton et al. (2000) suggests probing 30 to 40 subjects. Other authors suggest more modest numbers, like 6 to 10 (Epstein et al., 2015) or 5 to 8 subjects (Wild et al., 2005). More relevant than an exact sample size for the pilot study is that participants are a representative sample, in the sense that they should reflect the diversity of cultural backgrounds in the target population (Borsa et al., 2012).

Objectives

The present project therefore aims at (a) developing a Brazilian portuguese translation of the Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS-16) and the Sleep Problem Acceptance Questionnaire (SPAQ), (b) examining its factorial structure, and (c) examining its construct validity.

Method

Participants and Study Design

To estimate an adequate sample size for the confirmatory factor analyses (CFAs) we used MacCallum et al.'s (1996) root-mean-square error of approximation (RMSEA) tests of close and not-close fit. All tests were conducted in R 4.1.3 (R Core Team, 2022) using `semTools` version 0.5.6 (Jorgensen et al., 2021). Morin (2007) reports a RMSEA of 0.059 in a CFA for DBAS-16. Taking this value as prior guess for the populational RMSEA value, we calculated the sample sizes required to to reject the test for not-close fit of RMSEA $>$ 0.08 and the test of close fit of RMSEA $<$ 0.05 with a power of 0.80 and α of 0.05. Results show that 216 subjects are necessary to reject the test for not-close fit, and 920 participants are required for rejection of the test of close fit. Therefore, we aimed at a minimum sample size of 920 participants. SPAQ's fit index was not considered in this power analysis due to the large RMSEA (0.081) reported by the original publication (Bothelius et al., 2015).

This study was approved by the Ethics Committee of the General Hospital of the University of São Paulo, School of Medicine (HC-FMUSP), São Paulo, Brazil (CAAE: 46284821.1.0000.0068). Inclusion criteria was age between 18 and 59 years and reporting having no difficulties in reading or writing in Portuguese.

Participants were recruited mainly from advertisement on the internet, especially on HC-FMUSP's social media platforms (Instagram and Facebook). The data collection took place between May 2021 through July 2022, with brief breaks in between. Because the measures evaluated in this study refer to sleep difficulties, we sought to include participants both with and without insomnia complaints. The first group was composed by people registered for an experimental behavioral treatment for insomnia, which this study is a branch of. To recruit participants without insomnia complaints we asked for volunteer participation of people believing not having sleeping problems.

Bad sleepers were classified according to the presence of insomnia complaints: (i) difficulty initiating and/or maintaining sleep, defined as a sleep onset latency and/or wake after sleep onset greater than or equal to 30 minutes, with a corresponding sleep time of less than or equal to six hours per night; (ii) presence of insomnia for more than three

nights per week and more than three months; (iii) sleep disturbance (or associated daytime fatigue) causing significant distress or impairment in social, occupational, or other areas of functioning. This definition represents a combination of criteria from the American Academy of Sleep Medicine, the International Classification of Sleep Disorders, and the Diagnostic and Statistical Manual of Mental Disorders, along with quantitative cutoffs typically used in insomnia research (American Academy of Sleep Medicine, 2014; American Psychiatric Association, 2013; Edinger et al., 2004). In addition to these criteria, participants total score on the Insomnia Severity Index should not exceed 7 points (Bastien et al., 2001).

Participants were informed about the main objective of the research and signed the informed consent. They were informed that their answers would be kept confidential, and that all procedures guaranteeing the privacy of their results would be adopted. Then, they were requested to respond to an online survey using REDCap electronic data capture tools (Harris et al., 2009, 2019), including the Brazilian-Portuguese versions of DBAS-16 and SPAQ and other auxiliary instruments.

Item translation. We mainly based our methods on Beaton's (2000) recommendations with the addition of more up to date insights from Borsa et al. (2012). The following procedures were applied both to DBAS-16 as well as to SPAQ. Only the expert committee and the first translation team had a different configuration for each instrument. Figure 1 summarize the steps taken in the process.

In the first stage the items of the original versions were translated from English (source language) to Portuguese (target language) by three independent translators, of which two were familiar with the instrument constructs and the other English teachers unaware of the instrument concepts and with no clinical or medical background. The three versions were synthesized by an expert committee of health professionals experts in insomnia. A form adapted from Koller et al. (2012) was given to each member of the committee to register the rationale for the decisions (see Appendix C). Then, two independent translators native speakers of the source language back translated the synthesized version to English. We reconciled the back translations into a single version and submitted it to appreciation by both first authors of the original questionnaires. Together with the expert committee we debated over suggestions raised by the original authors and made changes accordingly to

the translated version.

At the final step, we conducted a pilot study with 15 participants from the target population to probe the pre-final version. There were 12 female participants and overall mean age was 43 years (range: 19–57 years). To prevent restricting feedback to specific regional contexts (Borsa et al., 2012), we recruited participants from the five Brazilian regions and with varying educational levels. We were able to interview nine participants from the Southwest region, three from South, two from Northeast and one from Middle-west. We conducted individual cognitive interviews with each participant.

Aditional measures

1. *Insomnia Severity Index (ISI)* (Bastien et al., 2001; Morin et al., 2011) is a 7-item questionnaire to assess insomnia severity and its impact on the patient's life. Raters use a 5-point scale ranging from 0 (no problem) to 4 (very severe problem). We used the Brazilian-Portuguese version (Castro, 2011).
2. *The Hospital Anxiety and Depression Scale (HADS)* (Zigmond & Snaith, 1983) is a scale used to assess psychological distress in non-psychiatric patients. It is formed by a two-factor structure with seven items assessing Anxiety plus seven other items measuring Depression. A Brazilian-Portuguese version produced by Botega et al. (1995) was used.
3. *Acceptance and Action Questionnaire-II (AAQ-II)* (Bond et al., 2011; Hayes, Strosahl, et al., 2004) is a measure of psychological flexibility composed by seven items rated in a scale from 1 (never true) to 7 (always true). It is scored by adding up scores for each question. Higher scoring indicate less flexibility. The Brazilian-portuguese version used in this study was produced by Barbosa and Murta (2015).

Analytical Plan

Descriptive statistics. This phase comprise examination of response frequency and item statistics in order to assess item variation, distribution and data entry quality. Items with insufficient variation might be bad for differentiating respondents and may need to be excluded or merged into fewer categories (Dima, 2018). We'll also diagnose inter-item

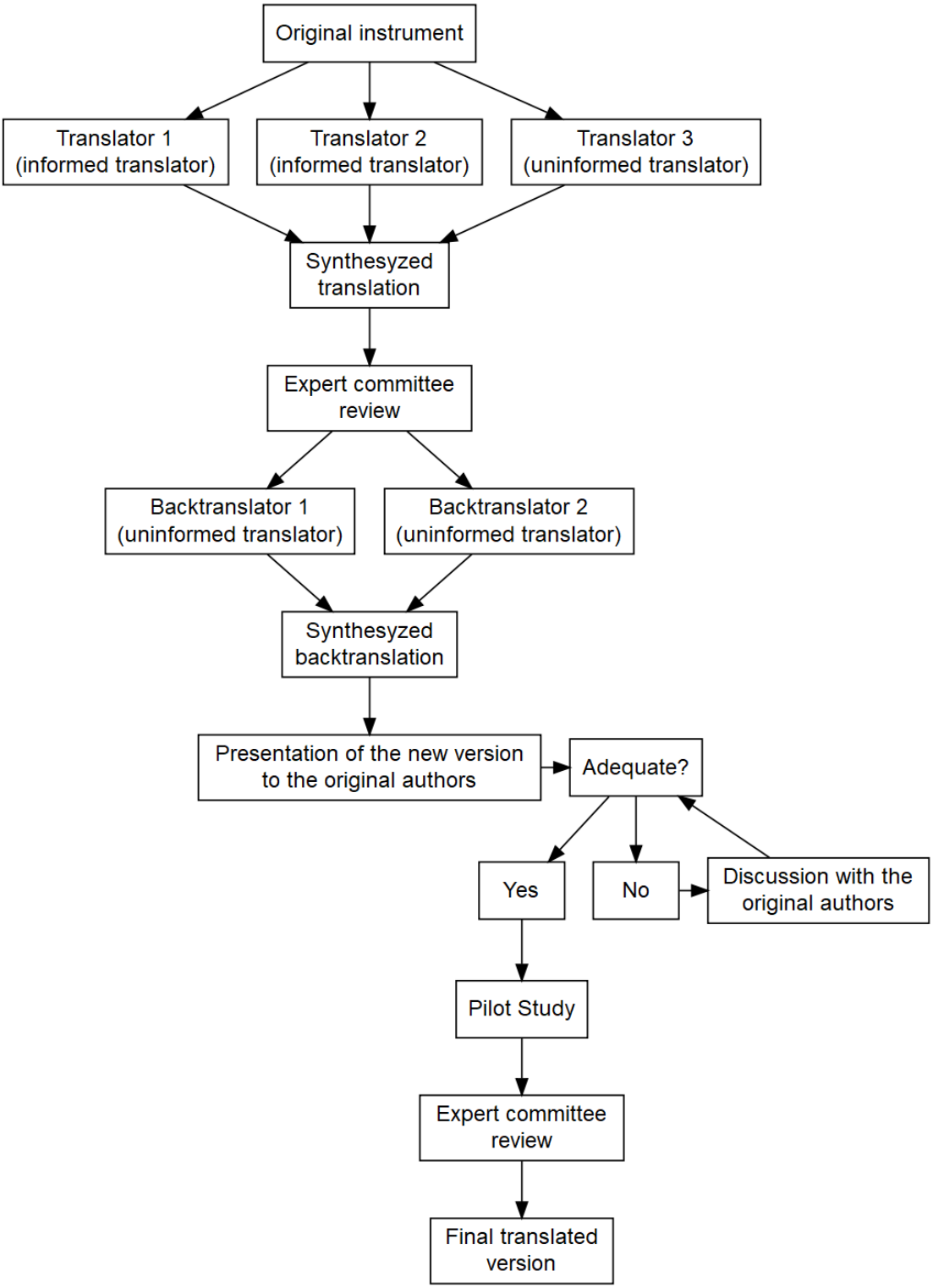

Figure 1. Stages of cross-cultural adaptation. Adapted from "Cross-Cultural Adaptation and Validation of Psychological Instruments: Some Considerations", by J. C. Borsa, B. F. Damásio and D. R. Bandeira, 2012, Paidéia, 22(53), 423-432; "Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures", by D. E. Beaton, C. Bombardier, F. Guillemin and M. B. Ferraz, 2000, SPINE, 25(24), 3186-3191.

correlations, scan for multivariate outliers (via Mahalanobis distance) to identify if there are any anomalous response patterns, and verify if the items follow a multivariate normal distribution.

Non-parametric item response theory (NIRT). Next, we examine item response patterns using Mokken Scaling Analysis (MSA), a non-parametric Item Response Theory (NIRT) technique. NIRT models provide a more flexible alternative to models from the parametric item response theory (PIRT) family, by employing less restrictive assumptions about the data. However pertaining both family of models, assumptions such as Local independence, Monotonicity and Unidimensionality can be weakened in such ways in NIRT, that an ordinal measurement is possible (Junker & Sijtsma, 2001). The MSA approach requires that the item response function (IRF) meet only ordering requirements, exempting the need to match a particular shape (Wind, 2017). MSA allows ordering people on latent variable θ by their test scores; investigating unidimensionality by identifying subscales and deviating items using the AISP algorithm; estimation of the item step response functions (ISRFs; i.e., the probability of obtaining at least score x_j given a latent variable θ, $P(X_j \geq x_j|\theta)$) and assessment of the non-monotonicities (i.e., probability of endorsing a 'correct' response option not increasing with increasing levels of the latent dimension); and differential item functioning (i.e., if the same item have different response probabilities for people having the same θ level but who are members of two different groups) (Sijtsma & van der Ark, 2017). To run the analyses we'll use the `mokken` package available in R (Van der Ark, 2007, 2012).

Structural Validity Evidence. To assess the factorial structure of both measures, we will conduct Confirmatory Factor Analyses (CFAs) taking as a priori guess the aspects of the original models (i.e, the number of factors present in the data, which indicators are related to which factors, presence of higher-order or bi-factor structure etc.). Given that our data was collected using Likert scales with more than six ordered categories, we have opted to follow recent suggestions to use the Maximum Likelihood with Robust standard errors (MLR) estimator (Rhemtulla et al., 2012). To evaluate model fit we'll use the following fit statistics: chi-squared (χ^2); Tucker-Lewis Index (TLI); Comparative Fit Index (CFI); Relative Noncentrality Index (RNI); Root Mean Square Error of Approximation (RMSEA);

and Standardized Root Mean Squared Residual (SRMR).

CFA studies have traditionally relied on fixed cutoffs values such as SRMR $\leq$ .08, RMSEA $\leq$ .06, and CFI, TLI and RNI $\geq$ .96 to assess model misspecification (Hu & Bentler, 1999). Although used largely, the adoption of such criteria does not comes without its problems, as with much of other one-size-fits-all solutions used in applied psychological research (McNeish & Wolf, 2021). Moreover, these cutoff values were established for continuous data analyzed using the normal-theory maximum likelihood (ML). Therefore, following Xia and Yang (2019) recommendations, we'll interpret the aforementioned fit indices as diagnostic tools rather than a blind criteria for accepting or rejecting the hypothesized models.

We also plan to investigate measurement invariance across groups with and without insomnia symptoms (i.e., if psychometric properties of the scales are equivalent across groups). To attain this goal we'll use the multiple-group CFA (MGCFA) approach. The MGCFA approach tests invariance by constraining measurement properties (i.e., factor structure, factor loadings, intercepts, and residual variances) across groups in a series of increasingly restrictive models (Flake & Luong, 2021). In each stage we test differences in fit between the restricted model and the less-restricted model looking at exact fit in terms of χ^2 and degrees of freedom, CFI and RMSEA as well as the Akaike information criterion (AIC) and the Bayesian information criterion (BIC), where for those two lower values are an indication of better fit (Wicherts & Dolan, 2010). To conduct tests regarding factorial structure, the R package `lavaan` (Rosseel, 2012) will be used.

Reliability Estimators. In Classical Test Theory (CTT) the reliability of a test is the ratio of true score variance to test score variance (McDonald, 1999). The internal consistency of a scale is a test of reliability that measures the degree to which the set of items co-vary, relative to their sum score (Cronbach, 1951). To indicate it we'll estimate Cronbach's alpha (α), McDonald's omega total (ω_t), and omega hierarchical (ω_h). Although α is the most common measure of internal consistency reliability, ω_t (assumes an unidimensional scale) and ω_h (best for scales that may contain subfactors) are better alternatives because, contrary to α, it does not assume tau equivalence (i.e., loadings are not assumeded to be equal) (McNeish, 2018). The internal consistency indices will be calculated using the R

package `MBESS` (Kelley, 2022). Common guidelines suggests internal consistency indices $\geq$ .70 as an acceptable threshold for reliability (Kline, 1986).

In addition to internal consistency, we'll estimate the test–retest reliability to assess the consistency of test scores across time. This phase comprise a simple calculation of the Pearson product-moment correlation between baseline test scores and a second administration taken 14 days later. Higher correlation coefficients indicate higher test-retest reliability.

Convergent validity evidence. Convergent validity refers to the expected relationship between test scores and other measures of the same or similar constructs (American Educational Research Association, American Psychological Association and National Council on Measurement in Education, 2014). Regarding the DBAS-16, we expect positive correlations between its scores and the HADS subscales of depression and axiety as well as with IGI scores. For SPAQ the same relationships are expected with the addition of also showing a negative correlation with AAQ-II scores.

Network psychometrics. Psychiatry and psychology have recently begun to shift from viewing psychopathology as originating from a root cause (e.g., latent variable models) to an approach that models it as a network of causal interactions among symptoms (Borsboom, 2008; Borsboom & Cramer, 2013; Bringmann et al., 2022). In line with these recent formulations we will conduct exploratory analysis of the scales subject of this study following a psychometric network perspective. We'll conduct this phase following the steps outlined by Christensen, Golino, et al. (2020) to test validity from the network perspective: a) Redundancy Analysis; b) Dimension Analysis; and c) Internal Structure Analysis. All of these analysis will be performed using the `EGAnet` (H. Golino & Christensen, 2021) package for R.

Redundant items can cause unintended effects when estimating dimensionality in psychometric modeling. The shared substantive cause may obscure the interpretation of centrality measures in network models, and for latent variable models, it has the potential to cause a violation of the principle of local independence, resulting in a poor fit (Christensen, Garrido, et al., 2020). To detect redundant items, we can use the *Unique Variable Analysis* (UVA) (Christensen, Garrido, et al., 2020). This algorithm first computes the association structure of the observed data, then uses a threshold or significance test to determine

redundancy between pairs of variables. The redundant variables can be either removed, leaving only one non-redundant indicator, or aggregated as latent variables.

To estimate dimensionality we take advantage of a popular technique in the psychometric network literature called *Exploratory Graph Analysis* (EGA) (H. F. Golino & Epskamp, 2017). This method estimates the number of dimensions in multivariate data using undirected network models. The EGA algorithm first estimates a Gaussian Graphical Model, using the graphical least absolute shrinkage and selection operator (GLASSO), then applies the Walktrap community detection algorithm to determine the number and content of communities in the network. These communities in network models are statistically equivalent to factors of latent variable models (H. F. Golino & Epskamp, 2017).

A network equivalent of factor loadings is a measure called *network loading* (Christensen & Golino, 2021a). These loadings represent the unique contribution of each node to the emergence of a dimension in a network. The authors of this method also argue that network and factor loadings are comparable when the data generating model is a factor model.

Computing internal consistency measures from a network perspective is not possible because the necessary common covariance between items is removed in network models (Christensen, Golino, et al., 2020). To overcome this limitation, Christensen, Golino, et al. (2020) suggests examining "the extent to which items in a dimension are homogeneous and interrelated given the multidimensional structure of the questionnaire" (p. 8), which they refer to as *structural consistency*. To estimate this measure, Christensen and Golino (2021b) developed the *Bootstrap Exploratory Graph Analysis* (bootEGA). In rough terms, bootEGA generates a sampling distribution of EGA results using simulated data to inform how often dimensions are replicated exactly across the bootstrap replicates (structural consistency), and how many times each item is allocated in its respective empirical dimension across replications (item stability).

Partial results

Cross-cultural adaptation

The initial translation of SPAQ and DBAS-16 instructions, rating scale, and items was a mix of translations produced by the three (for each instrument) forward translators. To some items a certain translation was taken with minor or no modifications. Others were a merge of two or more versions with additions were it deemed necessary. The instruments versions produced in each stage of the cross-cultural adaptation process, as well as a detailed documentation of criteria for decisions, are available at osf.io/av45j.

Once each stage of the translation process was completed, both instruments were submitted to appreciation by a sample of 15 subjects of the target population. Overall, participants had a good comprehension of the test items and instructions and only a single term of the DBAS-16 required alteration for a more natural reading in the target language. We also noted that participants without sleeping problems had trouble relating to some SPAQ items due to the ambiguity added from item wording. For instance, to the first question some participants expressed that they would disagree with the sentence because they do not have sleep problems despite agreeing that they're living a normal life. After debating these issues with the original authors, we added a sentence to the instrument instructions asking people to think about any difficulties with sleep they have, or have had, no matter how small they feel them to be and then answer accordingly. The final version of both DBAS-16 and SPAQ are on Appendices A and B, respectively.

Sample description

After excluding individuals who did not meet the inclusion criteria and those who failed to complete at least the first questionnaire on the survey (DBAS-16), the final sample was comprised of 1397 individuals, of which 1130 were female and 1062 reported insomnia symptoms. Sample mean age was 38.41 years (SD = 9.79, range: 18–59.80 years). There were 619 participants who reported having a formal job, and 1085 had a university degree. A detailed description of the sample is found on Table 1.

Table 1
Sample description

	n = 1397
Sex Male (%)	267 (19.1)
Age [mean (SD)]	38.41 (9.79)
Race (%)	
Asian	48 (3.4)
Black	331 (23.7)
Other/Not informed	13 (0.9)
White	1005 (71.9)
Marital Status (%)	
Cohabiting	179 (12.8)
Divorced	129 (9.2)
Married	488 (34.9)
Single	588 (42.1)
Widowed	13 (0.9)
Educational Level (%)	
Primary School	17 (1.2)
Secondary School	295 (21.1)
University degree or higher	1085 (77.7)
Monthly income [mean (SD)]	9197.40 (7946.13)
Occupation (%)	
Informal work	46 (3.3)
Regular job	619 (44.3)
Retired	29 (2.1)
Self-employed	410 (29.3)
Student	172 (12.3)
Unemployed	121 (8.7)
Insomnia (%)	1062 (76.0)
Region (%)	
Central-West	54 (3.9)
Northeast	105 (7.6)
Northern	36 (2.6)
Southeast	1083 (77.9)
Southern	112 (8.1)

Next steps

Table 2
Timeline of the next steps

Period	Activities
Nov/22 – Jan/23	Execute all data analyses
Feb/23 – May/23	Write manuscripts
Jun/23	Submit thesis

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Appendix A

Crenças e Atitudes Disfuncionais sobre o Sono (CADS-16)

Uma série de afirmações refletindo as crenças e atitudes das pessoas em relação ao sono estão listadas abaixo. Por favor, indique o quanto você concorda ou discorda de cada afirmação. Não há respostas certas ou erradas. Para cada afirmação, circule o número que corresponde à sua crença pessoal. Por favor, responda todos as afirmações, mesmo que não se apliquem diretamente à sua situação.

Discordo Fortemente										Concordo Fortemente
0	1	2	3	4	5	6	⑦	8	9	10

1. Preciso de 8 horas de sono para me sentir revigorado(a) e funcionar bem durante o dia.

0	1	2	3	4	5	6	7	8	9	10

2. Quando não durmo o suficiente à noite, preciso recuperar o sono no dia seguinte com um cochilo ou dormindo mais na próxima noite.

0	1	2	3	4	5	6	7	8	9	10

3. Estou preocupado(a) que a insônia crônica possa trazer consequências graves em minha saúde física.

0	1	2	3	4	5	6	7	8	9	10

4. Estou preocupado(a) que eu talvez perca o controle sobre minha habilidade de dormir.

0	1	2	3	4	5	6	7	8	9	10

5. Sei que uma noite de sono ruim vai interferir nas minhas atividades cotidianas no dia seguinte.

0	1	2	3	4	5	6	7	8	9	10

6. Para estar alerta e funcionar bem durante o dia, eu acredito que seria melhor tomar um remédio para dormir do que ter uma noite de sono ruim.

0	1	2	3	4	5	6	7	8	9	10

7. Quando me sinto irritado(a), deprimido(a), ou ansioso(a) durante o dia, provavelmente foi porque não dormi bem na noite anterior.

0	1	2	3	4	5	6	7	8	9	10

8. Quando durmo mal uma noite, sei que irá atrapalhar meu sono pelo resto da semana.

0	1	2	3	4	5	6	7	8	9	10

9. Sem uma noite de sono adequada, eu mal consigo funcionar no dia seguinte.

0	1	2	3	4	5	6	7	8	9	10

10. Não consigo prever se vou ter uma noite de sono boa ou ruim.

0	1	2	3	4	5	6	7	8	9	10

11. Tenho pouco controle sobre as consequências negativas de um sono ruim.

0	1	2	3	4	5	6	7	8	9	10

12. Quando me sinto cansado(a), sem energia, ou não funciono bem durante o dia, geralmente é porque não dormi bem na noite anterior.

0	1	2	3	4	5	6	7	8	9	10

13. Acredito que a insônia seja essencialmente o resultado de um desequilíbrio do meu organismo.

0	1	2	3	4	5	6	7	8	9	10

14. Sinto que a insônia está arruinando minha capacidade de aproveitar a vida e me impede de fazer o que eu quero.

0	1	2	3	4	5	6	7	8	9	10

15. Medicação é provavelmente a única solução para a minha falta de sono.

0	1	2	3	4	5	6	7	8	9	10

16. Evito ou cancelo compromissos (sociais, familiares) após uma noite de sono ruim.

0	1	2	3	4	5	6	7	8	9	10

Appendix B

Questionário de Aceitação dos Problemas no Sono (QAPS)

Abaixo você irá encontrar uma lista de afirmações. Por favor, avalie o quanto você concorda com cada frase escolhendo uma alternativa. Responda da melhor forma que puder mesmo que você não tenha (mais) problemas de sono, ou que eles sejam pouco frequentes. Poucas pessoas tem um sono perfeito todas as noites. Deste modo, pense em qualquer dificuldade com sono que tenha, ou já tenha tido, por menor que seja, e responda de acordo.

0	1	2	3	4	5	6
Discordo	Concordo muito pouco	Concordo levemente	Concordo parcialmente	Concordo moderadamente	Concordo quase completamente	Concordo completamente

1.	Embora as coisas tenham mudado, estou vivendo uma vida normal apesar dos meus problemas de sono.	0	1	2	3	4	5	6
2.	Eu levo uma vida plena apesar de ter problemas de sono.	0	1	2	3	4	5	6
3.	Minha vida está indo bem apesar dos meus problemas de sono	0	1	2	3	4	5	6
4.	Apesar dos problemas de sono, agora estou seguindo um certo curso na minha vida.	0	1	2	3	4	5	6
5.	Manter meus problemas de sono sob controle é minha maior prioridade.	0	1	2	3	4	5	6
6.	Eu preciso me concentrar em me livrar dos meus problemas de sono.	0	1	2	3	4	5	6
7.	É importante eu continuar lutando contra meus problemas de sono.	0	1	2	3	4	5	6
8.	Meus pensamentos e sentimentos sobre meus problemas de sono devem mudar antes de eu dar passos importantes na minha vida.	0	1	2	3	4	5	6

Appendix C

Reconciliation: decisions and documentation form

Adapted from: Koller, M., Kantzer, V., Mear, I., Zarzar, K., Martin, M., Greimel, E., ... & ISOQOL TCA-SIG. (2012). The process of reconciliation: evaluation of guidelines for translating quality-of-life questionnaires. *Expert review of pharmacoeconomics & outcomes research, 12*(2), 189-197.

Parte I: decisões

Opções de decisões para a tradução reconciliada

1. Tradução A como está
2. Tradução B como está
3. Tradução C como está
4. A com pequenas modificações
5. B com pequenas modificações
6. C com pequenas modificações
7. Mesclar A, B e C como elas são, com A adaptado de B e C
8. Mesclar A, B e C como elas são, com B adaptado de A e B
9. Mesclar A, B e C como elas são, com C adaptado de A e B
10. Mesclar A e B como elas são, com B adaptado de A
11. Mesclar A e B como elas são, com A adaptado de B
12. Mesclar A e C como elas são, com C adaptado de A
13. Mesclar A e C como elas são, com A adaptado de C
14. Mesclar B e C como elas são, com B adaptado de C
15. Mesclar B e C como elas são, com C adaptado de B
16. Mesclar A e B com modificações/adições, com A adaptado de B
17. Mesclar A e B com modificações/adições, com B adaptado de A
18. Preparar uma tradução completamente nova C

Critérios de decisão para escolher qualquer uma das opções acima

1. Fonte e compreensibilidade

1.1. Reflete melhor as definições conceituais e o significado do texto de origem

1.2. Reflete melhor a ênfase do texto de origem (i.e., qual é o ponto principal do texto de origem)

1.3. É compreensível para um leigo sem conhecimentos médicos

1.4. É compreensível para uma população de diversos níveis educacionais

1.5. É o mais próximo possível do texto de origem

1.6. É lido com mais naturalidade no idioma de destino

2. Cultural

2.1. É culturalmente apropriado no âmbito de tópicos sensíveis

2.2. É culturalmente apropriado no âmbito das diferenças culturais da vida

3. Gramatical

3.1. A sintaxe está correta

3.2. As formas e tempos verbais estão corretos

3.3. Gênero e número estão adaptados e corretos

3.4. Outros elementos estão corretos (especialmente artigos e preposições)

4. Terminologia

4.1. Inclui todas as palavras-chave

4.2. É semanticamente preciso

4.3. O vocabulário/terminologia é consistente em toda a tradução

Parte II: Documentação do processo de reconciliação

Tradução A:

Tradução B:

Tradução C:

Tradução reconciliada:

Opção de decisão: escolher uma das opções 1 a 18

Critérios de decisão: escolher dentre os critérios 1.1 a 4.3