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Rapid office strain assessment (ROSA): Cross cultural validity, reliability and structural validity of the Brazilian-Portuguese version

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ABSTRACT

Forty-three occupational health professionals (observers) and 90 workers were enrolled in this study to perform the cross-cultural adaptation of the Rapid Office Strain Assessment into Brazilian Portuguese (ROSA-Br) and evaluate its psychometric properties. After cross-cultural adaptation, the measurement properties were checked in three stages: study 1: pre-testing (27 observers rated 15 office worker videos), study 2: intra- and inter-observer reliability (26 observers rated 15 office worker videos), and study 3: validity and accuracy of ROSA-Br final scores (90 office workers). For the ROSA scores, acceptable intraclass correlation coefficients were found for 75% and 86% of the intra-observer reliability comparisons for non-trained and trained observers, respectively, and for 100% of the inter-observer reliability comparisons (0.43–0.86). For construct validity, moderate correlations were observed for 70% of the comparisons between ROSA final scores and other ergonomic instruments. Moderate accuracy was observed for a ROSA-Br final score of 6 (AUC [area under the curve] = 0.72, 0.89). Taken together, these results support the use of the ROSA-Br for ergonomic field assessments and research.

1. Background

Observational assessment of biomechanical exposure has been in widespread use in the literature (David et al., 2008; Hignett and McAtamney, 2000; McAtamney and Corlett, 1993; Karhu et al., 1977) focusing on the assessment of postures adopted during work. The results of a systematic review showed that observational methods assessing biomechanical exposure demonstrated moderate to good agreement with the corresponding assessments made from video recordings (Takala et al., 2010). There are instruments that address particularly upper extremity musculoskeletal risk (McAtamney and Corlett, 1993), others approached whole-body activities (Hignett and McAtamney, 2000; David et al., 2008), and manual handling (Karhu et al., 1977), and others are specifically designed to assess workstation ergonomics (Pereira et al., 2016; Sonne et al., 2012).

Workstation ergonomic assessments are centered on the workstation and the interaction between workers and their work devices. There are few instruments particularly designed to assess computer office work (Pereira et al., 2016; Sonne et al., 2012; Eltayeb et al., 2007). However, the limitations of these tools are the restricted number of items related to office workstation ergonomics, that they are based on worker self-reports (Eltayeb et al., 2007), and that there is an absence of action levels that direct the user to the urgency (or lack thereof) of interventions required to minimize musculoskeletal disorders (MSDs) risk factors (Pereira et al., 2016). The Rapid Office Strain Assessment (ROSA) is a workstation ergonomic instrument designed to assess computer office work based on observational assessment which showed acceptable levels of reliability, accuracy, and validity for the action levels assigned for on-site (Sonne and Andrews, 2011; Sonne et al., 2012) and photography-based observations (Liebregts et al., 2016).

In addition, several ergonomic tools are available in Brazilian Portuguese (Rapid Upper Limb Assessment [RULA] - Valentim et al., 2018; Maastricht Upper Extremity Questionnaire [MUEQ] -Turci et al., 2015; Quick Exposure Check [QEC] - Comper et al., 2012). However, no

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specific ergonomic observational tool focused on the assessment of computer office work with risk levels validated, like ROSA, is available in this language. In this way, it is recommended that studies on cross-cultural adaptation must be conducted (Beaton et al., 2000) in order to properly adapt the instrument to the sociocultural characteristics of the population being studied (Beaton et al., 2000). Cross-cultural adaptation and validation of instruments to other languages help to standardize research instruments and enable comparisons of results across different studies in different countries (Wild et al., 2009). Ultimately, translated versions should be evaluated according to their psychometric properties and must show similar psychometric indexes as the original tool (Mokkink et al., 2012).

Indeed, an instrument should retain both item-level characteristics, such as item-to-scale correlations and internal consistency, as well as reliability and construct validity at the score and domain levels (Beaton et al., 2000). The reliability of an instrument could be influenced by several factors. In the cases in which the instrument is rater/observer-dependent, differences in intra- and inter-observer reliability levels, and whether the level of observer's training affects the reliability levels, must be assessed (Kottner et al., 2011), considering that the level or type of training may have an impact on reliability estimates (Szklo and Nieto, 2007). In addition, because of the easy availability of many instruments on the internet, professionals usually download these tools and try to use them in practice without any previous training. In this way, it is important to conduct research to investigate the reliability levels when comparing trained and non-trained observers. To the best of our knowledge, there is no previous report showing if training is crucial to achieve acceptable intra- and inter-observer reliability levels.

To check for construct validity, the instrument should be tested against other tools found in the literature that assess the same or a similar construct, and it is recommended that the magnitude of such correlations should be stated *a priori* (Terwee et al., 2007). In the study of the original ROSA (Sonne et al., 2012), the scores on the instrument were compared with the scores on the Cornell University Discomfort Questionnaire (CUDQ) (Hedge et al., 1999), a self-reported measure of symptoms; only modest magnitude correlations were shown. It is likely that comparisons with instruments more closely related in construct (computer office work) or structure (checklists) may improve the levels of correlation and construct validity obtained.

Along this line of reasoning, the MUEQ is a self-administered questionnaire used to assess physical and psychological work-related factors associated with computer use (Eltayeb et al., 2007). There is a Brazilian-Portuguese version of the questionnaire - MUEQ-Br revised - which is composed of six domains: workstation, body posture during work, job control, job demands, quality of break time and social support. Research on this tool demonstrated acceptable levels of internal consistency, reliability, and construct validity (Turci et al., 2015). Additionally, in the study of the original version of the ROSA, the authors recognized that future studies could examine the relationship between ROSA and RULA (McAtamney and Corlett, 1993) scores when examining workstations, considering that both instruments provide an action level assessment, include questions regarding upper limb/head and trunk posture, and are both applied by an observer (checklist). There is a Brazilian-Portuguese version of the RULA tool (Valentim et al., 2018). RULA scores are calculated from the Group A section, which consists of the upper arm, lower arm, and wrist (upper limb score) and the Group B section, consisting of the neck, trunk, and legs. The scores for Group A and B postures are modified by scores for working force and repetition, and a final score is calculated. The final score may be graded in four levels: a) level 1: posture is acceptable if not maintained and repeated for a long time, b) level 2: further investigation needed, c) level 3: further investigation and changes needed soon, and d) level 4: investigation and changes required immediately. The intra- and inter-observer reliability of RULA scores have been found to be acceptable (Takala et al., 2010). Considering the similarity between the ROSA, MUEQ and RULA tools, for construct validity, one can expect moderate levels of correlation between their scores.

In light of the above, the aim of this study was to conduct the cross-cultural adaptation of the ROSA into Brazilian Portuguese and evaluate the psychometric measures of reliability (internal consistency, intra- and inter-observer reliability, and measurement error), construct validity (cross-cultural validity and hypothesis testing), and accuracy in a sample of occupational health professionals and computer office workers. An additional aim was to identify differences in the reliability levels between trained and non-trained observers; it was hypothesized that the training conducted by a tutor could improve the reliability of the scores obtained. For hypothesis testing (construct validity), moderate to strong positive correlations were expected between scores for the RULA and MUEQ-Br-revised *vs*. the ROSA scores.

2. Methods

2.1. Study population

This study was conducted in three stages and three different samples were recruited. The sample for the pre-testing phase of the adapted ROSA instrument (study 1) involved observation-based assessment by 27 occupational health professionals. The participants were from a convenience sample, recruited through advertising at local companies and graduate courses in physical therapy and ergonomics.

In the second study (study 2: reliability), 26 occupational health professionals were recruited to establish the test-retest reliability of the adapted tool after one-week. The third study sample (study 3) comprised 90 office workers recruited from university administrative staff. The inclusion criteria for this group were aged between 18 and 65 years, worked in their current role for at least one year, had no significant changes to their workplace in the last 12 months, and used their desktop computer for at least 4 h per day. Workers with acute musculoskeletal pain that was not related to their job (e.g., a sports or motor vehicle accident) or individuals with degenerative or rheumatic systemic MSDs, were excluded from the study.

The sample size used for checking internal consistency, construct validity, and reliability followed the recommendations from the COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) (Mokkink et al., 2012), which suggests the sample needs to be a minimum of four times the number of items of the instrument (the ROSA has 8 items = 32 participants) (Terwee et al., 2007). The study was approved by the ethics committee for research with human participants of the Ribeirão Preto Medical School, University of São Paulo (USP) (Process No. 4527/2013) and all volunteers received and signed an informed consent form.

2.2. Instruments and procedures

2.2.1. Rapid Office Strain Assessment–ROSA

The ROSA (Sonne et al., 2012) allows observers to quickly quantify risk factors related to office computer work and provide information on future workplace interventions. The checklist in English can be found at the following website: http://ergo.human.cornell.edu/ahROSA.html.

The initial research on the ROSA demonstrated construct validity with respect to musculoskeletal discomfort and established a ROSA final score of 5 as a cut-off for recommended ergonomic intervention. Sonne et al. (2012) also demonstrated acceptable levels of inter- and intra-observer reliability for the ROSA. The Brazilian-Portuguese version of the ROSA is available as Appendix 1.

All postures or equipment configurations that fulfilled neutral or optimal postures (as per CSA Z412 standards on office ergonomics [CSA, 2000]) were given a score of 1. Deviations from these postures were scored between 1 and 3, representing increasing risk of musculoskeletal discomfort or disorders, based on a literature review and other ergonomics tools (Sonne et al., 2012). Risk factors were grouped into the following three sections: chair, monitor and telephone, and