Original Article

Validity and Reliability of the Rapid Office Strain Assessment [ROSA] Thai Version

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Objective: Translate the original English version of the Rapid Office Strain Assessment [ROSA] into Thai version and evaluate the validity and reliability of Thai ROSA in office worker.

Materials and Methods: The original version of ROSA was translated into Thai using a standard forward-backward procedure and Translation Equivalence testing. The content validity was approved by four experts in ergonomic and occupational health. Inter-rater reliability was examined by researcher and other expert in ergonomics in 48 subjects, university office workers. All subjects were re-assessed one week later by the researcher to obtain intra-rater reliability.

Results: The Thai version of ROSA, translated according to international standard, had universal agreement calculation method (S-CVI/UA) = 0.80, scale-level content validity index (S-CVI/Ave) = 0.95 and very high inter- and intra-rater reliability as following ICC final score = 0.99 and ICC final score = 0.91.

Conclusion: The Thai version of ROSA is a valid and reliable measurement method for Ergonomic Assessment in Thai office worker.

Keywords: The rapid office strain assessment [ROSA], Reliability, Validity, Office worker, Thai

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Computer technology is involving in daily living and plays important roles in working organization. Computer technology can be applied to many tasks with high efficacy. About one-third of Thai population use computer in daily life, which highest usage among university graduates (79.2%)[1]. Computer use by occupation were found highest among pro-fessional work (91.8%), followed by clerks (82.7%), and technician or technical officer (80.3%)[2]. According to work-related incident reports between 2011 and 2014, musculoskeletal disorder [MSD] has an average incidence of 2,922 per year[3]. MSDs are the most common among office workers. The studies on MSDs among Thai office worker reported the past 12 months prevalence of shoulder disorders were 16% to 51%, neck pain 42%, lower back pain 35%, upper back pain 28% and hand or wrist pain 20.0%[4-6]. Many study reported that computer used are related to MSDs, i.e., neck pain 36.0% to 69.2%, shoulder pain 15.2% to 30.0%, upper back pain 39.5% to 51%, lower back pain 42.0%, and hand or wrist pain 36%[7-10]. The risk assessment and management such as work station rearrangement, computer equipment redesign, and suitable working and resting period are important in MSDs prevention.

There are several tools to assess ergonomic risk among workers. They depend on work characteristics and objective of assessment. Ergonomic risk assessment can be performed by three methods, 1) observational methods, 2) self-reports, and 3) direct measurement by specific measurement, i.e., goniometer and electromyography [EMG][11].

The Rapid Office Strain Assessment [ROSA] is one of the observational methods. It is a pen and paper checklist, developed by Sonne and Andrews[12]. ROSA can quickly indicate MSD risk factors specific to office and computer work. The risk factors incorporated into ROSA includes three sections, A) chair, B) monitor and telephone, and C) mouse and keyboard. These sections indicate the risk factors of the office workstation, and weight risk scores based on The Canadian Standards Association [CSA] "Guideline on Office Ergonomics". The score in each section was combined to obtain a ROSA final score, indicating the overall risk of musculoskeletal discomfort as a result of the

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configuration of the office. ROSA final score of 5 or more requires work station improvement. Comparing with other observational methods, the ROSA is somewhat similar to some part of Rapid Upper Limb Assessment [RULA] for Computer Users, used for the risk of MSDs of upper extremities[13]. However, RULA for computer users does not assess the risk regarding chair and lower extremities. ROSA is now widely used for assessing ergonomic risk for office worker. A self-translated Thai ROSA has been used in Thailand[14-16]. However, standard translation procedure of Thai version of ROSA is needed, as well as its validity and reliability.

Materials and Methods

Translation protocol

1. The researcher sent E-mail to Michael Sonne for authorization of translating ROSA to Thai language.

2. Forward translation were performed by two specialists in Occupational Health and Ergonomics with excellent English skill.

3. Synthesized the Translated Version by two experts in Industrial Engineering (Ergonomics) discussed together and select the most appropriate wordings.

4. Backward translation by two bilingual translators who never seen the original ROSA.

5. Translation Equivalence testing of three versions, original ROSA, forward translation version, and backward translation version, was carried on by expert on Occupational Medicine, graduated in Occupational Health from the University of Birmingham, by comparing in content, semantic, and technical equivalence.

Validity measurement

Content validity rating form and ROSA Thai version were sent to four experts in Ergonomics, who are Ergonomic professors in Faculty of Engineering and Industrial Technology, Faculty of Public Health, Faculty of Industrial Technology, and School of Occupational Health. These four experts evaluated the concordance of item objective and definitions with wording of each item in ROSA Thai version, rating scale from 1 to 4. Then, content validity index [CVI] was calculated with acceptable validity index at least 0.8[17].

Reliability measurements

Subjects in reliability measurement were back office staffs of Suan Sunandha Rajabhat University, Samut Songkhram campus. Inclusion criteria were those who had been working for at least one year and using desktop computer at least two hours per day. Exclusion criteria were those take maternity leave. The sample size was calculated by WinPepi version 2.92. According to two observations per subject, expected intraclass correlation coefficient [ICC] was 0.8[12], probability of precision 80%, required lower limit of ICC of not less than 0.75, and allow for loss of 10%. The optimal sample size was 47. Then, all of 48 eligible staffs were observed.

Inter-rater reliability was conducted by the researcher and one ergonomist, who were trained for 18 hours in Ergonomic from the Ergonomics Society of Thailand. Both understood the original version of ROSA, and ROSA Thai version. Inter-rater observed each of 48 subjects, at the same day, separately. The intra-rater reliability was performed by researcher with re-evaluation of all 48 subjects in one week later.

Data were coding, double entry, and verified. Then, data were analyzed using SPSS version 17.0 to obtain interclass correlation coefficient and ICC.

Research ethics

The translation of ROSA was authorized by Michael Sonne, the developer. Participants were informed about objectives of the study and voluntarily participated. The observers kept the distance form participants and did not disturb their work. This research was approved by the Khon Kaen University Ethics Committee in human research, reference No. HE571443.

Results

The forward translation from two experts were slightly different in wordings but still similar in meaning. In the process of synthesizing the translated version, the wording of each item was discussed and the most appropriate was selected. Then, in the backward translation version, most of the items had slightly different wording but similar meaning to the original. Only two items had deviation. Therefore, in translation equivalence testing, the expert slightly edited the wordings in ROSA Thai version for content, semantic, and technical equivalence.

Validity

The 48 items in ROSA Thai version were evaluated by four experts. It was found that 38 items were indicated as very good concordance in content to be measured, providing 38 items content validity = 1.0. For the other 10 items, one expert indicated poor concordance of content validity, resulting in these 10 items content validity = 0.75. The ROSA Thai

version obtained content validity in term of universal agreement calculation method, S-CVI/UA = 0.80. The average of scale-level content validity index, S-CVI/Ave = 0.95, was higher than acceptable validity level of 0.8[17].

Among 48 subjects in reliability measurement, 68.8% were female with the average age of 31 years, SD 8.59. Most of them had bachelor degree (60.4%), and has been working less than five years (64.6%). The average working period was seven years, SD 8.4. About half (45.8%) used computer more than six hours per day, with the average of 6.27 hours per day, SD 2.14.

Inter-rater reliability

The ROSA final scores of the researcher (rater 1) and the rater 2 obtained $ICC_{(2,1)} = 0.99$. Considering ICC by section, $ICC_{(2,1)}$ of ROSA section A for chair, section B for monitor and telephone, and section C for mouse and keyboard were 0.93, 0.86, and 0.92, respectively, as shown in Table 1.

Intra-rater reliability

The final score of ROSA Thai version, observed by researcher (rater 1) for the first time evaluation and second time evaluation, one week later, provided $ICC_{(3,1)} = 0.91$. Considering by section, the $ICC_{(3,1)}$ were 0.91, 0.93, and 0.93, in sector A for chair, sector B for monitor and telephone, and sector C for mouse and keyboard respectively, as in Table 2.

Discussion

The present study performed forward and backward translation using the translation method of Brislin[18-21]. It provides slightly different in wordings but still similar in meaning. This might be caused by ROSA checklist scoring, which provides illustrations of the work stations or work posture along with short and clear phrases. However, translation equivalence testing had approved the meaning of most of the observation items, which were not much different from the original ROSA. Furthermore, four experts' ratings gave good concordance of content to be observed, providing very high content validity.

ROSA Thai version provided excellent level of inter-rater reliability, ICC of ROSA final score was 0.99, with section A, chair at 0.93, section B, monitor and telephone at 0.86, and section C, mouse and keyboard at 0.92, whereas ICC greater than 0.75 means excellent[22]. These ICC were similar to the original ROSA by Sonne, which ROSA final score had good correlation, ICC = 0.74. In sector B, monitor and telephone, ICC was 0.83 and sector C, mouse and keyboard, ICC was 0.91 showing excellent correlation[12]. Considering ICC by sector in the present study, sector B, monitor and telephone had least correlation with ICC of 0.86 because sector B required observers' judgment in scoring, i.e., angle of neck and monitor. The sector A, chair, had the highest correlation with ICC of 0.93. This is because this part observed the value of the item such as chair is adjustable, with or without armrest or neck support.

The intra-rater reliability, ICC of final score and each sector also provided excellent correlation, with ICC 0.91 to 0.93. This is because ROSA observes

Table 1. Inter-rater reliability

ROSA score	ROSA score, mean ± SD		$ICC_{(2,1)}$ (95% CI)	*p*-value	SEM
	Rater 1	Rater 2			
Final score	6.00±1.08	6.03±1.10	0.99 (0.98 to 0.99)	<0.001	0.10
Section A chair	5.95±1.13	5.83±1.48	0.93 (0.85 to 0.95)	<0.001	0.37
Section B monitor and telephone	2.78±1.16	2.88±1.22	0.86 (0.76 to 0.92)	<0.001	0.43
Section C mouse and keyboard	3.13±1.22	2.98±1.12	0.92 (0.88 to 0.96)	<0.001	0.29

ROSA = rapid office strain assessment; ICC = intraclass correlation coefficient; SEM = standard error of measurement

Table 2. Intra-rater reliability

ROSA score	ROSA score, means ± SD		$ICC_{(3,1)}$ (95% CI)	*p*-value	SEM
	1st observe	2nd observe			
Final Score	6.00±1.08	6.13±1.18	0.91 (0.85 to 0.95)	<0.001	0.32
Sector A chair	5.95±1.13	6.08±1.22	0.91 (0.85 to 0.95)	<0.001	0.32
Sector B monitor and telephone	2.78±1.16	2.80±1.20	0.93 (0.75 to 0.92)	<0.001	0.43
Sector C mouse and keyboard	3.13±1.22	3.13±1.26	0.93 (0.88 to 0.96)	<0.001	0.31

ROSA = rapid office strain assessment; ICC = intraclass correlation coefficient; SEM = standard error of measurement

mainly office equipment with some work posture. The equipment cannot be modified in short period, and the second observation was performed one week later. However, it was noticed that there were some changes in score related to modification of work station or move of the monitor from it original position. For instance, the monitor was originally situated in front of the worker as a standard[23] but was moved to the side to give space for visitors.

Conclusion

This ROSA Thai version was translated by standard protocol and is similar in meaning. It has a good level of content validity, both S-CVI/UA and S-CVI/Ave, as well as excellent level of inter- and intra-rater reliability, ICC 0.86 to 0.99. ROSA Thai version can be used in Ergonomic risk assessment in office worker who use computer in daily work.

What is already known on this topic?

MSDs is a common health problem among office workers who are sedentary and have a repetitive work posture. The ROSA, one of the observational method, can quickly highlight MSD risk factors specific to office and computer work, as well as leading to actions to reduce risk of MSDs.

What this study adds?

The present study evaluated the ROSA Thai version, which has good level of validity and excellent level of both inter- and intra-rater reliability. ROSA Thai version is proven to be appropriate to assess Ergonomic risk, in term of work station and work posture, in office workers. It can advise on modification of work station or equipment for better work posture to reduce the risk of MSDs in Thai office workers.

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Potential conflicts of interest

None.

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การศึกษาเพื่อทดสอบความเที่ยงตรงและความน่าเชื่อถือของแบบประเมิน the Rapid Office Strain Assessment [ROSA] ฉบับภาษาไทย

วรรณวิมล เมฆวิมล กิ่งแก้ว, สุชาดา ภัยหลีกลี้, พงษ์ศักดิ์ เจริญงามเสมอ

วัตถุประสงค์: เพื่อแปลและทดสอบความตรงและความเชื่อมั่นของ the Rapid Office Strain Assessment [ROSA] เป็นฉบับภาษาไทย เพื่อใช้ประเมินความเสี่ยงในพนักงานสำนักงาน

วัสดุและวิธีการ: แบบประเมิน ROSA ต้นฉบับภาษาอังกฤษได้รับการแปลเป็นภาษาไทยโดยวิธีแปลไปแปลกลับ และทำการตรวจสอบความเท่าเทียมทางภาษา จากนั้นทำการทดสอบความตรงตามเนื้อหาโดยผู้เชี่ยวชาญด้านการยศาสตร์ และอาชีวอนามัย จำนวน 4 คน การทดสอบ inter-rater reliability โดยนักการยศาสตร์ จำนวน 2 คน โดยกลุ่มตัวอย่างที่ได้รับการประเมินเป็นพนักงานสำนักงานในมหาวิทยาลัย จำนวน 48 คน intra-rater reliability เป็นการประเมินโดยผู้วิจัย 2 ครั้ง ห่างกัน 1 สัปดาห์

ผลการศึกษา: แบบประเมิน ROSA ฉบับภาษาไทยมีกระบวนการแปลด้วยวิธีมาตรฐาน มีค่าความตรงตามเนื้อหาตามข้อตกลงสากล (S-CVI/UA) = 0.80 ค่าความตรงตามเนื้อหาเฉลี่ย (S-CVI/Ave) = 0.95 inter-rater reliability และ intra-rater reliability อยู่ในระดับสูงมาก มีค่า ICC(2,1) Final Score = 0.99 และ ICC(3,1) Final Score = 0.91

สรุป: แบบประเมิน ROSA ฉบับภาษาไทยมีความเที่ยงตรง สามารถนำไปใช้ในการประเมินความเสี่ยงทางการยศาสตร์ของพนักงานสำนักงานในประเทศไทยได้