Validation of Malay-Adapted Nordic Occupational Skin Questionnaire (NOSQ-2002/SHORT) As A Reliable and Specific Screening Tool For Occupational Skin Diseases

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ABSTRACT

Occupational skin disease is one of the most reported occupational diseases. Its prevention is important to ensure good health and quality of life of workers which can be achieved through screening, for which the Nordic Occupational Skin Questionnaire, NOSQ-2002/SHORT was developed. The questionnaire had been adapted and translated into Malay Language for use in Malaysia and other Malay-speaking communities. A cross-sectional pilot study was carried out to check the validity and reliability of the Malay-adapted NOSQ-2002/SHORT, using purposive sampling among a few factory workers in East-Coast Malaysia. The results showed that the finalized version of the Malay-adapted questionnaire has good validity and reliability, with the Cronbach alpha of 0.867. The specificity and negative predictive values were quite high, with the values of 86.0% (95% CI: 80.1, 90.8) and 96.9% (95% CI: 93.6, 98.5), respectively. Even though the sensitivity and positive predictive values were a bit lower at 72.2% (95% CI: 46.5, 90.3) and 34.2% (95% CI: 24.7, 45.2), respectively, it is still higher than previously reported questionnaire used to screen skin condition. In conclusion, the Malay-adapted NOSQ-2002/SHORT is valid and reliable as a screening tool for occupational skin diseases, in which it is inexpensive, simple, and quick to be used.

Keywords: Questionnaire, screening, occupational skin disease, reliable, specific

INTRODUCTION

It has been reported that significant number of workers from different industries are exposed to different irritants which predispose them to several conditions, including occupational skin diseases (OSD), which is one of the most common occupational diseases in many countries (Trotto, 2023; Susitaival et al., 2003). In Malaysia, even though only 436 cases of OSD were reported in 2020, but it constitutes 20.4% of all occupational diseases reported to the Social Security Organization (SOCSO) which is probably an under-reporting, considering the difficulties in confirming the diagnosis of OSD (SOCSO, 2020). It is important to note that these statistics are an increased from 228 or 9.6% cases of OSD reported in 2014 (SOCSO, 2014).

Malaysian government regularly carries out screening for occupational diseases through Occupational Health Surveillance program. The number of workers that need to be screened could be very large, and this could incur a lot of expense, not to mention time-consuming. There is a need for inexpensive and fast yet valid and reliable screening methods to ensure efficient and effective detection of diseases to improve its health outcome (Herman, 2006). One such method is the use of questionnaire, which can be a reliable and specific screening tool for OSD that can be utilized in any industries in Malaysia.

MATERIALS AND METHODS

Source of the questionnaire

Through literature search, brainstorming and discussion sessions with occupational health experts (OHE), it was noted that Nordic Occupational Skin Questionnaire (NOSQ-2002) is one of the questionnaires that is well-documented and commonly used in many countries for screening of OSD. Originally developed in English, NOSQ-2002 has since then been translated into many different languages (Susitaival, 2003; Flyvholm et al., 2002). With support from the

Nordic Council of Ministers, the Nordic Occupational Skin Questionnaire Group had developed the standardized tool, NOSQ-2002, to facilitate research on OSD and environmental factors exposures. Available in a long version to be used in research, and a short version for screening and monitoring of OSD, NOSQ-2002 was developed from experience in combination with several existing questionnaires on OSD (Flyvholm et al., 2002). Since the purpose of this study was to validate a fast and inexpensive screening tool for OSD, the NOSQ-2002/SHORT was adapted for use. Although the Nordic Council of Ministers holds the copyright to the NOSQ-2002 questionnaires, its use is free of charge provided it is not used commercially and available online (Flyvholm et al., 2002).

Adaptation of NOSQ-2002/SHORT into Malay Language

The NOSQ-2002/SHORT was translated from English into Malay language to facilitate its use among the workers in Malaysia. The forward and backward translation process has been conducted by experts in both English and Malay languages, to ensure that the translated questionnaire is acceptable and perform similarly as its original English version by maintaining the cross-cultural function and concept (Su & Parham, 2002). NOSQ-2002 had been verified in many studies, but to complete the validation process, the content validity was checked by several skin specialists and OHE. Content validity explains whether an instrument such as a questionnaire has sufficiently covered all the contents that is associated with a variable (Oluwole-Sangoseni et al., 2013). It is commonly practiced by the rational analysis of the instruments by experts who are familiar with the subject of research (DeVon et al., 2007).

Some changes were made into this Malay-adapted version, in which the images of human hands marked with eczema sites had been included in the items describing the area of eczema to assist the workers in answering the questionnaire. Furthermore, instead of asking when they last had eczema, item 3 of the Malay-adapted NOSQ-2002/SHORT requires the workers to identify whether they have eczema upon starting work at the current workplace. The question on atopic eczema from the original NOSQ-2002/SHORT was omitted because it was not suitable for current research purposes. The finalized Malay-adapted NOSQ-2002/SHORT questionnaire is available in the appendix.

Checking for the reliability and validity of the Malay-adapted NOSQ-2002/SHORT

Study design and area

A cross-sectional pilot study was carried out to check the validity and reliability of the Malay-adapted NOSQ-2002/SHORT. Several factories in East-Coast Malaysia were purposively selected based on the possible hazards found in these factories, to ensure the possibilities of getting positive cases through the screening so that sensitivity and positive predictive value (PPV) of the screening tool can be calculated. Johanson and Brooks (2010) suggested that 30 participants would be a reasonable minimum sample size for a pilot study.

Employees in selected factories had been invited to participate in this study by answering the Malay-adapted NOSQ-2002/SHORT. Afterwards, all the respondents were interviewed and examined by two Occupational Health Doctors (OHDs) to obtain a clinical diagnosis for the OSD. The clinical diagnosis was used as the gold standard to make a comparison between the calculated sensitivity and specificity, as well as the positive and negative predictive values of the screening tool. Then, the two OHDs discussed the cases to ensure that they came to a correct diagnosis for the respondents examined. In cases of any doubt, a skin specialist was consulted using the photos taken during the initial examination.

Statistical Analysis

The data was analyzed using the IBM SPSS Version 24 to determine the validity and reliability of the Malay-adapted NOSQ-2002/SHORT. Validity is the extent to which a measurement accurately measures what it is supposed to measure, while reliability is the repeatability of the measurement (Bolarinwa, 2015; Heale & Twycross, 2015). On that note, Cronbach alpha is one of the most used values to check the internal consistency reliability (ICR) of a tool, method or test (Bolarinwa, 2015; Tavakol & Dennick, 2011). The Cronbach alpha values between 0.70 - 0.95 are usually accepted as a good alpha value for a survey form, though values greater than 0.90 are less favorable as it could be due to the redundancies in the survey form (Tavakol & Dennick, 2011).

Additionally, corrected item-total correlation (ITC) value for each item was also analyzed to show the relevance of each item with the construct of the screening tool where the acceptable values are between 0.3 to 0.7 (De Vaus, 2004). It is interesting to note that the Questionmark blog (2013) claimed that "higher positive values for the item-total correlation indicate that the item is discriminating well between high- and low-performing participants". On the other hand, factor analysis was also done to obtain the loading factor value which shows the relationship of each item in the construct of the screening tool, where the value calculated is considered good if it is greater than 0.4 (Rahn, 2018).

To assess the validity of the Malay-adapted NOSQ-2002/SHORT, crosstab analysis using SPSS had been used to calculate the sensitivity and specificity of the screening tool, as well as the positive and negative predictive values (PPV and NPV, respectively), along with their 95% confidence intervals which were analyzed using a freely available software, MEDCALC Diagnostic test evaluation calculator (MedCalc Software, Belgium).

The U.S. Department of Health & Human Services (2015) defines sensitivity as "the proportion of persons with disease who are correctly identified by a screening test or case definition as having disease" and specificity as "the proportion of persons without disease who are correctly identified by a screening test or case definition as not having disease". On the other hand, PPV and NPV are defined as "the proportion of patients with positive test results who are correctly diagnosed" and "the proportion of patients with negative test results who are correctly diagnosed" (Altman & Bland, 1994). The sensitivity and specificity values are not dependent on the population undergoing the test so can be applied to any population. However, the PPV and NPV depend on the prevalence of the disease in the population being tested. If the prevalence of the disease is high in the population, the PPV will be higher but the NPV will decrease (Lalkhen & McCluskey, 2008).

Ethical consideration

The approval for this study was given by the Malaysian Department of Occupational Safety and Health (DOSH/No. Petender-(03)/04/2016/Rekod) and consent was also obtained from one of the authors of the original NOSQ-2002 through email correspondence. The employers of the workplace involved in this study were agreeable to the data collection, and they were explained regarding the purpose and processes of the study before they answered the questionnaire. The participations were voluntary, and confidentiality of the participants was kept safe where the results were presented in an aggregate form and any participant was not identified individually.

RESULTS

The validity and reliability of the Malay-adapted NOSQ-2002/SHORT are presented in Table 1 for corrected ITC and factor loading, and in Table 2 for sensitivity, specificity, PPV and NPV.

Cronbach alpha, corrected ITC and factor loading of the Malay-adapted NOSQ-2002/SHORT

For analysis purposes, only the items on aggravating factors were analyzed for Cronbach alpha, corrected ITC and factor loading (items 3 to 6). With the Cronbach alpha of 0.867, the ITC and factor loading for all items are more than 0.4 as shown in Table 1, it shows the Malay-adapted NOSQ-2002/SHORT has good validity and reliability of the questionnaire and the items.

Table 1: Validity and reliability of items in the Malay-adapted NOSQ[a]-2002/SHORT by corrected item-total correlation (ITC) and factor loading (n=79)

Items	ITC	Factor loading
3	0.556	0.717
4	0.756	0.874
5	0.814	0.908
6	0.756	0.874

[a]Nordic Occupational Skin Questionnaire

Sensitivity, specificity, PPV and NPV of the Malay-adapted NOSQ-2002/SHORT

In checking for the sensitivity, specificity, PPV and NPV of the Malay-adapted NOSQ-2002/SHORT, the gold standard used was the clinical diagnosis by OHDs, while the screening test was considered as positive when any respondent answered "yes" or "not sure" in item 1 or 2 which asked about the presence of previous or current hand eczema, respectively, in the presence of exposure to hazards in workplace (from the occupational section) or the aggravating factors. The results obtained are shown in Table 2. The specificity and NPV (86.0% and 96.9%, respectively) were higher as compared to the sensitivity and PPV (72.2% and 34.2%, respectively).

Table 2: Validity and reliability of Malay-adapted NOSQ[a]-2002/SHORT by sensitivity, specificity, PPV[b] and NPV[c](n=197).

			Diagnosis		
			Positive	Negative	Total
Screening	Positive	Number	13	25	38
		PPV[b] (95% CI[d])	**34.2% (24.7, 45.2)**	65.8%	
		Sensitivity (95% CI)	**72.2% (46.5, 90.3)**	14.0%	19.3%
	Negative	Number	5	154	159
		NPV[c] (95% CI[d])	3.1%	**96.9% (93.6, 98.5)**	
		Specificity (95% CI[d])	27.8%	**86.0% (80.1, 90.8)**	81.1%
		Total	18	179	197
		Prevalence	**9.1%**	90.9%	100.0%

(95% CI[d])	**(5.5, 14.1)**

[a]Nordic Occupational Skin Questionnaire [b]Positive Predictive Value
[c]Negative Predictive Value [d]Confidence interval

DISCUSSION

The use of questionnaire as a screening tool

In designing a good questionnaire, Stone (1993) described that it should be "appropriate, intelligible, unambiguous, unbiased, capable of coping with all possible responses, satisfactorily coded, piloted, and ethical". Despite their limited sensitivity and specificity which might not be comparable to laboratory or clinical tests, questionnaires have been used as screening tools, not only in the field of occupational health such as the NOSQ-2002, but also in another fields (Starvard et al., 1999; El Sayed, 2012; Tyagi et al., 2021; Ode et al., 2023; Rigal et, al., 2023). In the current study, the NOSQ-2002/SHORT was selected as a tool to screen for OSD because it is widely accessible, simple, and easy to be used by employers and workers. Furthermore, using questionnaires as a screening tool will incur minimal cost, especially for the smaller industries where limited budgets are available for such screening program. Additionally, a questionnaire can be carried out quickly with minimal disruption of the usual processes and activities in the workplace.

The validity and reliability of Malay-adapted NOSQ-2002/SHORT

The result from this study shows that the reliability and validity of the Malay-adapted NOSQ-2002/SHORT is quite good with the Cronbach alpha of 0.867, the corrected ITC of between 0.556 to 0.814 and the factor loading of between 0.717 to 0.908. On the other hand, the sensitivity, specificity, PPV and NPV were 72.2%, 86.0%, 34.2% and 96.9%, respectively. Even though the PPV is quite low, but as explained above, PPV value depends on the prevalence of the disease in the population. In this study, the resulting prevalence of OSD was quite low at only 9.1%, hence the low PPV. The results from this study, however, are quite comparable to the validity and reliability of questionnaire as a screening tool for OSD in other studies, as summarized in Table 3.

It can be seen from Table 3 that the sensitivity of the Malay-adapted NOSQ-2002/SHORT in current study (72.2%) is lower as compared to the Italian (86%) (Chiesi et al., 2016) and Spanish (96.5%) (Martí-Margarit, 2015) versions, but this could be due to the short version of NOSQ-2002 used in the current study. However, the current sensitivity is higher than a few previous studies (Meding & Barregård, 2001; Vermeulen et al., 2000). It is good to note that the specificity achieved in the current study is quite good at 86%, which is higher than the Spanish NOSQ-2002 (75.2%) and symptom-based questionnaire (Martí-Margarit, 2015; Vermeulen et al., 2000). High specificity means that it is almost assured that a negative screening test means the subject can be ruled-out from the disease or the person does not have the disease of concerned (Safari et al., 2015).

Table 3: Comparison of the validity and reliability of questionnaires as the screening tools for skin disease.

Screening tool used	Population studied	Cronbach alpha	Sensitivity	Specificity
Malay NOSQ[a]-2002/SHORT (current study)	Factory workers	0.867	72.2%	86%
Italian NOSQ[a]-2002 (Chiesi et al., 2016)	Patients	0.88 and 0.97	86%	89%
Spanish NOSQ[a]-2002 (Martí-Margarit, 2015)	Workers in cleaning company	-	96.5%	75.2%
Hand eczema in past 12 months (Meding & Barregård, 2001)	Car mechanics, dentists, and office workers	-	53-59%	96-99%
Symptom-based questionnaire (Vermeulen et al., 2000)	Rubber workers	-	71.4%	76.1%
Self-reported (Yngveson et al., 1997)	Schoolchildren	-	73%	99%

[a]Nordic Occupational Skin Questionnaire [b]United Kingdom

Current study used clinical diagnosis as the gold standard to base the sensitivity and specificity of the screening tool evaluated, similar to a number of other studies evaluating questionnaires to screen hand dermatitis, either as occupational-related or not (Meding & Barregård, 2001; Vermeulen et al., 2000; Yngveson et al., 1997). In many of these studies, the criteria for clinical diagnosis or positive cases from the questionnaire were not explicitly defined, which might create a problem due to the variability in interpreting the positive cases when the comparison between these studies are to be made (Susitaival, n.d.). To overcome this problem, Nordic Occupational Skin Questionnaire Group had come up with a standardized NOSQ-2002 for OSD and the UK Working Party had come up with a minimum set of discriminating criteria to diagnose atopic eczema (Susitaival et al., 2003; William et al., 1994). A standardized criteria to diagnose contact dermatitis, especially as an OSD could have been developed to minimize the variability to facilitate valid comparison between researchers.

CONCLUSION

With the Cronbach alpha, sensitivity and specificity of 0.867, 72.2% and 86.0%, respectively, the Malay-adapted NOSQ-2002/SHORT has good validity and reliability. It is inexpensive and suitable to be used as a screening tool for OSD in Malaysia or any Malay-speaking population. It can be applied easily and completed quickly in identifying OSD among workers, hence preventing it from becoming a chronic condition.

ACKNOWLEDGEMENT

The cooperation from all participants, employers and everyone involved in this study is highly acknowledged and appreciated. The researchers are also very grateful for the funding from the Malaysian Department of Occupational Safety and Health under the Developmental Research Project of 11th Malaysian Plan which enable the success of this study.

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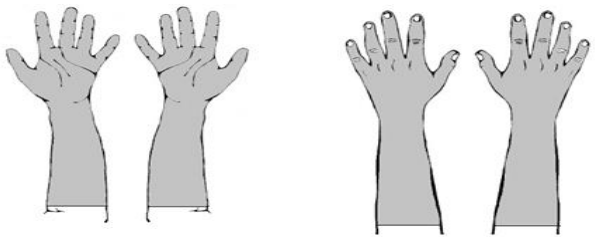
Appendix: The Malay-adapted NOSQ-2002/SHORT

1. Pernahkah anda menghidapi ekzema tangan atau / dan pergelangan tangan atau / dan lengan bawah (kecuali pada pelipat siku)?
   Definisi ekzema: keradangan (kemerahan) pada kulit yang disertai dengan kekeringan kulit, lelehan, sisik atau keruping, dan menyebabkan pesakit rasa gatal dan tidak selesa
   ☐ Ya
   ☐ Tidak
   ☐ Tidak pasti



2. Adakah anda masih mengalami ekzema itu sekarang?
   ☐ Ya
   ☐ Tidak

Terus ke soalan berikut jika anda menjawab "Ya" atau "Tidak pasti" pada soalan 1 atau 2 di atas.

3. Adakah anda mula mendapat ekzema tersebut di atas apabila anda mula bekerja di tempat kerja sekarang?
   ☐ Ya
   ☐ Tidak
   ☐ Tidak pasti

4. Adakah anda perasan sentuhan dengan bahan tertentu, bahan kimia atau bahan-bahan lain **di tempat kerja anda** membuatkan ekzema anda semakin teruk?
   ☐ Ya
   Bahan apa? : _____
   ☐ Tidak
   ☐ Tidak pasti

5. Adakah anda perasan sentuhan dengan bahan tertentu, bahan kimia atau bahan-bahan lain **di luar tempat kerja anda** membuatkan ekzema anda semakin teruk?
   ☐ Ya
   Bahan apa? : _____
   ☐ Tidak
   ☐ Tidak pasti

6. Adakah ekzema anda bertambah baik apabila anda berada jauh dari tempat kerja biasa anda? Contohnya hujung minggu atau tempoh yang lebih lama.
   ☐ Ya
   ☐ Tidak
   ☐ Tidak pasti