

Cross-cultural adaptation and reliability of pediatric sleep questionnaire in assessment of sleep-disordered breathing in the Malay speaking population

AL Hasniah, AR Jamalludin, AW Norrashidah, MZ Norzila, K Asiah, A Rus Anida, A Ahmad Fadzil, Z Ramli, H Samsinah

Kuala Lumpur, Malaysia

Background: Sleep-disordered breathing (SDB) is common but often underdiagnosed in children. The Pediatric Sleep Questionnaire developed by University of Michigan, USA (English UM PSQ) has high sensitivity and specificity in identifying children with sleep-disordered breathing. This study aimed to translate and adapt the English UM PSQ into Malay language as a screening tool to assess SDB among the Malay speaking population. The second objective was to determine the psychometric measurements of the translated UM PSQ (Malay UM PSQ).

Methods: The Malay UM PSQ was translated through forward-backward translation techniques by two independent accredited bodies and reviewed by a panel of experts. The questionnaire was tested in two phases. The respondents were from hospital staffs with children and parents of primary school children aged 6-10 years. The reliability of questionnaires was measured by Cronbach's α and Kappa (κ) statistics.

Results: The overall scale of internal consistency of the Malay UM PSQ was good, i.e., Cronbach's $\alpha = 0.760$ ($\alpha = 0.457, 0.608$ and 0.688 for snoring, sleepiness and behavioral domains respectively). The English UM PSQ also had good internal consistency at $\alpha = 0.753$ ($\alpha = 0.589, 0.524,$

to 0.793 for snoring, sleepiness and behavioral domains respectively). Test-retest reliability for most items was good with correctness of $>85.0\%$ in all items. Only one item was seen in the Malay UM PSQ with $\kappa=0.348$, while the remaining ranged from $\kappa=0.489$ to 0.811 . For the English UM PSQ, κ ranged from 0.660 to 0.945 .

Conclusion: Both English and Malay UM PSQ have acceptable psychometric measurement properties as screening tools to assess SDB in the Malay speaking population.

World J Pediatr 2012;8(1):38-42

Key words: pediatric;
questionnaire;
reliability;
sleep-disordered breathing

Introduction

Sleep-disordered breathing (SDB) is a common condition in children. This disorder has a wide spectrum of presentations in children ranging from primary snoring, upper airway resistance syndrome (UARS), obstructive hypoventilation and obstructive sleep apnoea syndrome (OSAS) based upon the severity of airway collapsibility and/or airway resistance. The condition is increasingly recognized and the reported prevalence was between 1.0% and 3.0% among school-aged children.^[1,2]

SDB in children cannot be readily diagnosed from symptoms and clinical findings alone.^[3] Full polysomnography (PSG) is the gold standard procedure in the diagnosis of spectrum of SDB; however, it requires trained personnel in the pediatric sleep medicine and is labor intensive, time-consuming and very costly.^[4-6]

A validated Pediatric Sleep Questionnaire (PSQ) can be used as a screening tool to identify SDB when PSG is not feasible.^[3,4,7] Several validated PSQs have been designed and published to assess SDB in children.^[8-12] We chose the PSQ developed by the University of Michigan, USA (English UM PSQ) due

Author Affiliations: Pediatric Department, Universiti Kebangsaan Malaysia Medical Centre, Malaysia (Hasniah AL); Department of Community Health, International Islamic University Malaysia (Jamalludin AR); Pediatric Department, Serdang Hospital, Malaysia (Norrashidah AW); Pediatric Institute, Kuala Lumpur Hospital, Malaysia (Norzila MZ, Asiah K); Pediatric Department, Penang Hospital, Malaysia (Rus Anida A); Pediatric Department, Tengku Ampuan Afzan Hospital, Malaysia (Ahmad Fadzil A); Institute for Health Systems Research, Malaysia (Ramli Z); University of Malaya, Kuala Lumpur, Malaysia (Samsinah H)

Corresponding Author: Assoc. Prof. Dr Abdul Latif Hasniah, Pediatric Department, Universiti Kebangsaan Malaysia Medical Centre, Jln Yaacob Latif, 56000 Cheras, Kuala Lumpur, Malaysia (Tel: +6 03 91455395/91455380; Fax: +603-91456637; Email: hasniah@ppukm.ukm.my)

doi: 10.1007/s12519-011-0279-3

©Children's Hospital, Zhejiang University School of Medicine, China and Springer-Verlag Berlin Heidelberg 2011. All rights reserved.

to its simplicity, high sensitivity and specificity in identifying children with SDB.^[8]

Malay or Bahasa Melayu is the ninth most spoken language in the world.^[13] At present, the estimated Malay-speaking population has reached more than 200 millions, living in regions including Malaysia, Singapore, Brunei, Indonesia, Southern Philippines and Southern Thailand.^[14] The English UM PSQ has to be translated and validated before being adapted cross-culturally among the Malay speaking population.

The objectives of this study were to 1) translate the English UM PSQ into Malay language and to adapt the original English version as a screening tool to assess SDB, and to 2) determine the reliability of the translated Malay UM PSQ.

Methods

University of Michigan Pediatric Sleep Questionnaire (English UM PSQ)

The PSQ consists of 22-item questions divided into three domains, i.e., snoring (9 items), sleepiness (7 items), and behavioral (6 items). This validated questionnaire has a sensitivity and specificity of 0.81 and 0.87, respectively.^[8] It classifies 85% of patients correctly in controls and children with polysomnographically defined SDB. Instrument performance is not varied with participant's age (2-18 years). Responses are 'Yes=1', 'No=0' and 'Don't know=Missing'. The cumulative score is calculated from responses of 'Yes' and 'No' only. The optimal SDB scale cut-off indicating the presence of SDB is a score of at least 0.33 (i.e., 33% of the all question-items answered positively). This SDB scale also shows good internal consistency (Cronbach's α of 0.86, 0.66 and 0.84 for snoring, sleepiness and behavioral domains, respectively) and test-retest reliability (Spearman's correlation coefficient, ρ of 0.92, 0.66 and 0.83 for snoring, sleepiness and behavioral domains, respectively).

Study design

This was part of the national epidemiological study of the prevalence of sleep-disordered breathing in Malaysian school children.

The English UM PSQ was translated into Malay language by Institut Terjemahan Negara Malaysia (ITNM) and backward translation was performed by another independent company. Both independent accredited bodies were blinded from the reason and rationale of the study.

A Review Panel of Experts was constituted to determine the face validity and cross-cultural equivalence of the Malay UM PSQ. The panel was chaired by the principal investigator and comprised

six pediatric respiratory physicians and two other non-clinical members. The process of translating and adapting the English PSQ is summarized in the Fig.

Both of the English and Malay UM PSQ were tested in two phases. Phase 1 study was conducted in August 2009. The questionnaires were distributed among hospital staffs with children aged 6-10 years who were conveniently selected from five different local hospitals to determine the psychometric measurements of the questionnaire. The respondents answered the questionnaire twice after at least an interval of 14 days.

Based on the findings of the phase 1 study, further modifications of the Malay UM PSQ were made. Phase 2 study was performed in December 2009, involving parents of school children aged 6-10 years from a randomly selected primary school.

Ethical approval

The study was approved by the Medical Research Ethics Committee, Ministry of Health Malaysia (NMRR code: 08-860-2015) and Ethics Committee UKM (code: FF-043-2009). Copyright permission for

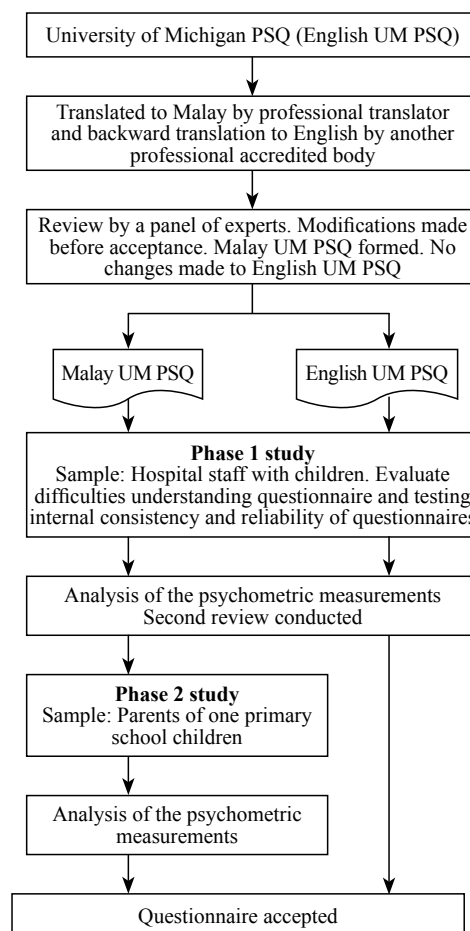


Fig. A flow chart showing the process of translating and adapting the English University of Michigan Pediatric Sleep Questionnaire (UMPSQ).

the use of the UM PSQ was obtained from the original author and University of Michigan, USA.^[8]

Statistical analysis

Content validity was verified by qualified pediatric respiratory physicians. Internal consistency was assessed by Cronbach's α where a value ≥ 0.7 indicated a high reliability, 0.5 to 0.7 = moderate, 0.2 to 0.4 = fair, and ≤ 0.2 = low reliability.^[15] Long-term stability of the translated questionnaire was tested using Kappa test, κ (test-retest reliability) for both the English and Malay UM PSQ in the phase 1 study. Magnitude of κ value was set according to Landis and Koch as follows: ≤ 0 = poor, 0.01 to 0.20 = slight, 0.21 to 0.40 = fair, 0.41 to 0.60 = moderate, 0.6 to 0.80 = substantial, and 0.81 to 1 = almost perfect agreement.^[16]

The minimum sample size required to test the internal consistency was calculated to detect the difference of Cronbach's α of 0.70 from 0.60. Based on the formula by Feldt et al^[17] and Bonett,^[18] a minimum of 194 samples were required to test all 22 items in the questionnaire at 80% power and 0.05 significant level (two-tailed).

For Kappa statistics, based on a formula by Flack et al,^[19] a minimum of 133 samples were required to detect the difference of 0.8 from 0.6 of degree of agreement at the 80% power and the 0.05 significant level. Anticipating some non-responses, at least 250 respondents were sampled for each version of the questionnaire. Correlations of score between domains were tested using Pearson's correlation coefficient test. ρ more than 0.3 is considered moderate and anything 0.8 and above is strong.

Diagnostic properties, i.e., the sensitivity, specificity and predictive values of the questionnaires, will be tested using PSG on randomly selected respondents with SDB and non-SDB symptoms in the next phase of the study. Data were put into a custom made database using PHP and MySQL, and analyses were made using SPSS 19 (SPSS Inc, Chicago, Illinois).

Results

Translation and adaptation of the English UM PSQ

In the phase 1 study, the panel strived for conceptual and not literal equivalence translation. Changes were made in Behavioral Scale of the English UM PSQ. We reconstructed the phrase 'fidgets with hands or feet or squirms in seat' (item C10) which became anomalous and poorly understood by respondents, when it was literally translated. The phrase 'on the go' or often acts as if 'driven by a motor' (item C14) was also changed to suit the local context.

Phase 1 study

Two-hundred and seventy respondents had consented to answer the PSQ. The mean (SD) age of the respondents for the Malay UM PSQ and English UM PSQ were 34 (9) years and 35 (7) years respectively. The majority of respondents who answered the Malay UM PSQ and English UM PSQ were Malay females with tertiary education. However, more respondents with tertiary education chose to answer the English rather than Malay UM PSQ (Table 1).

Malay UM PSQ

Although the overall internal consistency was acceptable for the Malay UM PSQ (Cronbach's $\alpha = 0.659$), there was poor internal consistency in the snoring and sleepiness domains (Table 2). Modifications were made for items A5, A7, B6, B7 and B9 but no changes were made in the Behavioral domain. In the English UM PSQ, acronyms A, B, C were used to separate question items of the 3 domains. We retained acronym A and removed acronym B and C in the questionnaire distributed to respondents to prevent confusion. The numbering was also changed accordingly, i.e., A1 to A22. The final Malay UM PSQ

Table 1. Baseline characteristics of the respondents in the phase 1 and 2 studies

Characteristics	Phase 1 (n=270)		Phase 2
	Malay (n=192)*	English (n=78)*	Malay (n=554)*
Gender, n (%)			
Male	21 (11.1)	10 (13.0)	286 (51.6)
Female	168 (88.9)	67 (87.0)	268 (48.4)
Race, n (%)			
Malay	175 (92.6)	69 (89.6)	550 (99.2)
Chinese	6 (3.2)	4 (5.2)	1 (0.2)
Indian	7 (3.7)	4 (5.2)	2 (0.4)
Others	1 (0.5)	0 (0.0)	1 (0.2)
Education level, n (%)			
No formal education	0 (0.0)	1 (1.3)	0 (0.0)
Primary	2 (1.1)	0 (0.0)	39 (7.1)
Secondary	49 (26.9)	14 (18.4)	353 (64.2)
Tertiary	127 (70.0)	61 (80.3)	143 (26.0)
Others	4 (2.2)	0 (0.0)	15 (2.7)

*: Numbers not corresponding to total subjects (n) because of missing values.

Table 2. Internal consistency of the Malay UM PSQ and English UM PSQ in the phase 1 and 2 studies

PSQ domains	Phase 1 (n=270)		Phase 2
	Malay (n=192)	English (n=78)	Malay (n=554)
	α	α	α
All 22 items	0.659	0.753	0.760
Snoring (9 items)	0.163	0.589	0.457
Sleepiness (7 items)	0.299	0.524	0.608
Behavioral (6 items)	0.675	0.793	0.688

was accepted after all the changes were made and used in the phase 2 study.

English UM PSQ

The questionnaire showed better and good overall internal consistency at Cronbach's $\alpha=0.753$ ranging from 0.524 to 0.793 between the domains (Table 2).

Phase 2 study

Five hundred and fifty-four parents of students from a primary school answered the Malay questionnaire. Their demographic data are shown in Table 1.

We found loud snoring in 4.9% of the students, trouble breathing during sleep in 2.3% and mouth-breathing in 2.5%. Higher percentage of respondents reported sleepiness during the day and behavioral problems, i.e., 18.2% and 25.8% respectively. There was a weak correlation between loud snoring and both sleepiness and behavioral domains ($\rho=0.221$ and 0.098 respectively). Eighty-three (15.0%) of 554 students had positive SDB symptoms.

The overall scale of internal consistency of the Malay UM PSQ improved from $\alpha = 0.659$ to 0.760 with a major improvement of the snoring domain from $\alpha = 0.163$ to 0.457 and the sleepiness domain from $\alpha = 0.299$ to 0.608. The behavioral domain remained good at $\alpha = 0.688$ (Table 2).

Percentages of correct answer in all items were $>85.0\%$. The result showed a good test-retest reliability for most items except A4 item (κ value <0.4) (Table 3).

Discussion

Our study showed that the Malay UM PSQ demonstrated a good reliability for the Malay speaking population. In phase 1 study, the socio-demographic characteristics for respondents who answered the Malay and English PSQ were almost similar. The test-retest reliability was good and comparable with that of the English UM PSQ. The Malay UM PSQ used in the phase 1 study had a lower internal consistency compared to that reported by Chervin et al^[8] because of different sample population. The sample in our study was from the general population compared to the sleep clinic-based population in their study. Generally, parents with SDB children had better awareness of SDB symptoms leading to more valid and reliable responses. In addition, a few items had ambiguous phrases that may lead to poor understanding of respondents. The internal consistency for the English UM PSQ was comparable with that reported by Chervin et al.^[8]

Cross-cultural adaptation of a questionnaire is much more than simple translation; the novel version must reflect in depth and the true significance of questions in another language.^[20,21] We experienced a long process of translating and adapting the English UM PSQ into Malay language which took us about six months to produce the final version. We found that many English words in this questionnaire required elaboration using lengthy Malay words, or otherwise conceptual equivalents were used in the translation.

Interestingly, we found a high percentage of parents

Table 3. Test-retest reliability of the Malay UM PSQ and English UM PSQ

Questions	Malay UM PSQ (n=192)				English questionnaire (n=78)			
	Correct percentage	Kappa	SD	P	Correct percentage	Kappa	SD	P
A2	92.90%	0.501	0.124	<0.001	94.50%	0.685	0.147	<0.001
A3	96.00%	0.675	0.114	<0.001	95.90%	0.747	0.140	<0.001
A4	96.00%	0.348	0.186	<0.001	98.60%	0.793	0.201	<0.001
A5	97.60%	0.489	0.219	<0.001	98.60%	0.660	0.317	<0.001
A6	99.40%	0.664	0.315	<0.001	98.60%	0.660	0.317	<0.001
A7	100.00%	-	-	-	100.00%	-	-	-
A24	97.60%	0.654	0.161	<0.001	98.60%	0.793	0.201	<0.001
A25	93.60%	0.682	0.090	<0.001	95.70%	0.776	0.124	<0.001
A32	87.60%	0.698	0.059	<0.001	95.90%	0.864	0.076	<0.001
B1	90.10%	0.608	0.086	<0.001	94.60%	0.814	0.090	<0.001
B2	94.20%	0.718	0.084	<0.001	98.60%	0.902	0.097	<0.001
B4	97.70%	0.588	0.187	<0.001	98.60%	0.850	0.147	<0.001
B6	92.70%	0.811	0.050	<0.001	94.70%	0.864	0.066	<0.001
B7	99.40%	0.664	0.315	<0.001	100.00%	-	-	-
B9	99.40%	0.664	0.315	<0.001	98.70%	0.661	0.317	<0.001
B22	96.70%	0.815	0.073	<0.001	98.70%	0.945	0.055	<0.001
C3	91.80%	0.604	0.096	<0.001	92.60%	0.738	0.111	<0.001
C5	86.20%	0.497	0.092	<0.001	92.40%	0.720	0.116	<0.001
C8	93.80%	0.785	0.065	<0.001	97.10%	0.915	0.059	<0.001
C10	95.80%	0.673	0.116	<0.001	97.00%	0.840	0.110	<0.001
C14	87.10%	0.665	0.062	<0.001	95.90%	0.883	0.066	<0.001
C18	85.70%	0.606	0.071	<0.001	93.00%	0.833	0.072	<0.001

reported symptoms of sleepiness and behavioral problems compared to the snoring domain. These symptoms may relate to SDB or signify other problems such as poor sleep hygiene, late sleeper, habit disorders or parenting style. We are currently doing the phase 2 study where randomly selected children with SDB and non-SDB symptoms are tested with PSG, a diagnostic test to discriminate children with and without SDB.

In conclusion, the Malay UM PSQ has been successfully translated and adapted for the Malay speaking population. Both the English and Malay UM PSQ have acceptable measurement properties as a screening tool for SDB in children.

Acknowledgements

We would like to thank all medical staff, teachers and students of SK Bukit Naga for their participation and co-operation. We would also like to thank the Director-General of Health Malaysia for his permission to publish this work.

Funding: This study was supported by the National Institutes of Health Malaysia Research Grant, Ministry of Health, Malaysia. This study is a project under the 9th Malaysia Plan Research Priority Area, sub-area "Letter of Intent for Respiratory Illness".

Ethical approval: This study was approved by Medical Research Ethics Committee, Ministry of Health Malaysia (NMRR code: 08-860-2015) and Ethics Committee UKM (code: FF-043-2009). Copyright permission for the use of UM PSQ was obtained from the original author and University of Michigan USA.

Competing interest: Conflicts of interest are not disclosed.

Contributors: All authors contributed to the concept of the study, analysis and interpretation of data, drafting and revision of the article, and final approval of the version for publication.

References

- 1 Ali NJ, Pitson DJ, Stradling JR. Snoring, sleep disturbance and behaviour in 4-5 year old. *Arch Dis Child* 1993;68:360-366.
- 2 Gislason T, Benediktsdottir B. Snoring, apneic episodes and nocturnal hypoxemia among children 6 months to 6 years old: an epidemiologic study of lower limit of prevalence. *Chest* 1995;107:963-966.
- 3 Carroll JL, McColley SA, Marcus CL, Curtis S, Loughin GM. Inability of clinical history to distinguish primary snoring from obstructive sleep apnea syndrome in children. *Chest* 1995;108:610-618.
- 4 American Academy of Pediatrics Section on Pediatric Pulmonology, Subcommittee on obstructive sleep apnea syndrome. Clinical Practice Guideline: diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics* 2002;109:704-712.
- 5 Schechter MS. Technical report: diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics* 2002;106:e69.
- 6 American Thoracic Society. Cardiorespiratory sleep studies in children: establishment of normative data and polysomnography predictors of morbidity. *Am J Respir Crit Care Med* 1999;160:1381-1387.
- 7 Brouillette R, Hanson D, David R, Klemka L, Szatkowski A, Fernbach S, et al. A diagnostic approach to suspected sleep apnea in children. *J Pediatr* 1984;105:10-14.
- 8 Chervin RD, Hedger KM, Dillon JE, Pituch KJ. Pediatric Sleep Questionnaire (PSQ): validity and reliability of scales for sleep-disordered breathing, snoring, sleepiness and behavioral problems. *Sleep Med* 2000;1:21-32.
- 9 O'Brien LM, Holbrook CR, Mervis CB, Klaus CJ, Bruner JL, Raffield TJ, et al. Sleep and neurobehavioral characteristics of 5- to 7-year-old children with parentally reported symptoms of attention/hyperactivity disorder. *Pediatrics* 2003;111:554-563.
- 10 Rosen CL, Larkin EK, Kirchner HL, Emancipator JL, Bivins SF, Surovec SA, et al. Prevalence and risk factors for sleep-disordered breathing in 8- to 11-year-old children: association with race and prematurity. *J Pediatr* 2003;142:383-389.
- 11 Castronovo V, Zucconi M, Nosetti L, Marazzini C, Hensley M, Veglia F, et al. Prevalence of habitual snoring and sleep-disordered breathing in preschool-aged children in an Italian community. *J Pediatr* 2003;142:377-382.
- 12 Sánchez-Armengol A, Fuentes-Pradera MA, Capote-Gil F, García-Díaz E, Cano-Gómez S, Carmona-Bernal C, et al. Sleep-related breathing disorders in adolescents aged 12 to 16 years: clinical and polysomnographic findings. *Chest* 2001;119:1393-1400.
- 13 Crystal D. *The Cambridge Encyclopedia of Language*. Cambridge: Cambridge University Press, 1987.
- 14 Kapur B. *Singapore studies: critical surveys of humanities and social sciences. Volume 2*. National University of Singapore Centre. Centre of Advance studies. Singapore: NUS Press, 1999.
- 15 Nally JC, Bernstein IH. *Psychometric Theory*, 3rd ed. New York: Mc Graw Hill, 1994.
- 16 Landis J, Koch GG. The measurement of observer agreement for categorical data. *Biometrics* 1977;33:159-174.
- 17 Feldt LS, Woodruff DJ, Salih FA. Statistical Inference for Coefficient Alpha. *Appl Psychol Measurement* 1987;11:93-103.
- 18 Bonett DG. Sample size requirements for testing and estimating coefficient Alpha. *J Educ Behav Stat* 2002;27:335-340.
- 19 Flack VF, Afifi AA, Lachenbruch PA, Schouten HJA. Sample size determinations for the two rater kappa statistic. *Psychometrika* 1988;53:321-325.
- 20 Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation and validation of health-related quality of life measures: literature review and proposed guideline. *J Clin Epidemiol* 1993;46:1417-1432.
- 21 Guillemin F. Cross-cultural adaptation and validation of health status measures. *Scand J Rheumatol* 1995;24:61-63.

Received December 14, 2010

Accepted after revision February 9, 2011