Translation and validation of the Stop-Bang Questionnaire for obstructive sleep apnoea into Danish

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ABSTRACT

INTRODUCTION: Obstructive sleep apnoea (OSA) is a growing problem as more and more consequences of the condition become unveiled owing to continued research on the subject. It is essential to establish relevant, fast and accurate screening options, both in the primary sector and for preoperative screening in hospitals if we are to diagnose and treat this condition and thereby avoid the consequences of the untreated disease.

METHODS: We have translated the Stop-Bang Questionnaire (SBQ) into Danish (SBQD) according to the guidelines presented by Guillemin et al in 1993. A validation study was performed including 43 consecutive patients.

RESULTS: Most of the patients were men (79%). The overall median age was 54 years (range: 21-83 years). The median SBQD score for the group with an Apnoea Hypopnoea Index value (AHI) > 5 SBQD was 4 (range: 2-5), AHI > 15 SBQD score 5 (range: 4-7) and AHI > 30 SBQD score 7 (range: 4-8). Setting the SBQD cut-off at three, thereby defining scores 0-2 as normal as proposed by the authors, we observed the following sensitivity (AHI > 5 = 96.6%, AHI > 15 = 100% and AHI > 30 = 100%). The area under the curve was calculated and significant p-values achieved.

CONCLUSIONS: The translation of the SBQ into Danish was validated as the results achieved were comparable to those reported from other studies and as acceptable sensitivity and specificity were observed. To avoid too many false positives, we recommend that the SBQD cut-off is set to ≥ 3 when screening pre-operative patients and to ≥ 5 at primary physicians when screening high-risk patients.

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Obstructive sleep apnoea (OSA) is a growing problem [1] as more and more consequences are unveiled through ongoing research on the subject [2]. The risk of circulatory/cardiovascular, metabolic diseases and also endocrine, infectious, nutritional, respiratory conditions and parasitic diseases, among others, were found with an increased odds ratio with the presence of OSA [3]. It is essential to establish relevant, fast, accurate and simple screening options, both in the primary sector and for preoperative screening in hospitals if we are to diagnose and treat this condition and thereby avoid the consequences of untreated disease. As previously described by Jennum et al, OSA is associated with significantly higher rates of health-related contact, medication use and unemployment, and the condition was also associated with increased socioeconomic costs [3]. With a possible underestimation of OSA patients in Denmark, the primary sector in Denmark is lacking a steady referral protocol and screening method for patients suspected of having OSA. In hospitals, a preoperative OSA assessment can help us avoid postoperative complications, such as postoperative cardiac and pulmonary complications, due to occult OSA in patients who undergo surgery for other reasons [4]. Previous research on the choice of questionnaire and pre-operative screening showed very good results in diagnosing patients with OSA using the Stop Questionnaire developed by Chung et al from 2008 [5]. The subsequently developed Stop-Bang Questionnaire (SBQ) [6] has been further revised. In the systematic review by Abrishami et al [7], the SBQ was the recommended tool and had the highest sensitivity for OSA. It has been used in many other countries with success [8, 9]. The questionnaire was previously validated in the general population [10], but the same study concluded that the SBQ was not suitable as a universal screening method due to an excessive number of false positives.

The eight questions in SBQ regard observed snoring, observed apnoea, neck size, blood pressure, gender, body mass index (BMI), age and daytime tiredness. The questions are weighted equally so that each "yes" equals one point. If the patients answer yes to two of the questions, there is a low risk of OSA; three to five affirmative answers equals an intermediate risk; and yes to more than five questions is associated with a high risk of OSA. See Appendix 1 for the original SBQ. Another well-used indicator of OSA is the Epworth Sleepiness Scale (ESS) which was introduced by Johns in 1991 [11]. It assesses eight situations with a likelihood of falling asleep and assigns scores from 0 to 3, giving a total scale ranging from 0 to 24. It is often used as a screening tool even though several reports have revealed that its value for detection OSA when used alone is low [12, 13]. The ESS primarily concerns tiredness during the day.

ORIGINAL ARTICLE

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TABLE 1

Test characteristics with medians (ranges) for the 30 patients with Apnoea Hypopnoea Index values > 5.

	AHI > 5	AHI > 15	AHI > 30	Overall
Age, yrs	55 (30-83)	58 (32-83)	60 (38-72)	54 (21-83)
BMI, kg/m^2	29 (18-41)	30 (25-41)	35 (25-41)	28 (18-48)
AHI	–	–	–	13 (1-81)
SBQD score	4 (2-5)	5 (4-7)	7 (4-8)	5 (2-8)

AHI = Apnoea Hypopnoea Index; BMI = body mass index; SBQD = Danish version of the Stop-Bang Questionnaire.

TABLE 2

Characteristics of the scores of the Danish version of the Stop-Bang Questionnaire with a test cut-off value of 3.

	AHI > 5	AHI > 15	AHI > 30
Patients, n	30	21	10
Sensitivity, %, median (95% CI)	87.1 (70.1-96.4)	100 (83.9-100)	100 (69.2-100)
Specificity, %, median (95% CI)	75.0 (53.3- 90.2)	59.1 (36.4-79.3)	39.4 (22.9-57.9)
AUC, median (95% CI)	0.84 (0.73-0.95)	0.91 (0.82-99)	0.87 (0.74-0.99)
p-value	< 0.0001	< 0.0001	0.0005

AHI = Apnoea Hypopnoea Index; AUC = area under the curve; CI = confidence interval.

Cardiorespiratory monitoring (CRM) and polysomnography are considered the two standard gold methods for detecting OSA. In our setting, we used the CRM. To the author's knowledge, there are to this date no validated OSA questionnaires in Danish. The newest technological report regarding OSA in Denmark pursues possibilities for screening and identification of patients in the primary sector [14]. The main objective of this article was to translate and validate the SBQD for future use as a screening method in a Danish population among high-risk patients where OSA is suspected. The hypothesis is that a valid translation can be made with results similar to those previously published. As a second objective, the ESS is examined to see if there is any correlation to OSA in our sleep clinic population.

METHODS

Translation

We translated the SBQ according to the guidelines presented by Guillemin et al in 1993 [15]. The process Guillemin et al propose is based on previous research in psychology and sociology and on published methodological frameworks and aims to take into account the linguistic and cross-cultural differences that may affect the outcome. Guillemin suggests a guideline comprising five stages. Stage I: Two independent translations from English into Danish made by two bilingual Masters of Arts in English and linguistics. No consensus group was needed since the two translations were a perfect match. Stage II: Two other independent Masters of Arts in English translated the Danish questionnaire back into English blinded to the initial text. Stage III: Committee review with discussion of the discrepancies in the back translation in a consensus group including the authors mentioned above. The final approval was reached and referred to as the Stop-Bang Questionnaire Danish (SBQD). The discrepancies were small and primarily related to difficulties adapting the "Stop-Bang" first letter acronym. For pretesting the questionnaire in stage IV, a probe technique was used with the first 20 patients (see validation). Stage V: Weighing the scores in stage V was done with receiver operating characteristic (ROC) curves, sensitivity, specificity and statistical analysis of the area under the curve (AUC).

Validation of the Danish version of the Stop-Bang Questionnaire

To verify the questionnaire, 43 consecutive patients referred to the sleep clinic for examination for OSA were included in the study. The patients were referred by general practitioners, other departments and by ear-nose and throat (ENT) practitioners. The inclusion criteria were patients referred to the sleep-clinic with a possible OSA diagnosis. None were excluded. All were given the SBQD/ESS and filled out standard health-related questions. From their scores they were divided into relevant classifications as the authors recommend [6]: High risk of OSA, intermediate risk of OSA and low risk of OSA according to the points given in the SBQD. The first 20 patients were personally interviewed after replying to the SBQD. After each answer, the patient was asked the probe question: "How do you understand this question?" and was then encouraged to elucidate his or her understanding of the item in an open-ended manner. None of the 20 patients had any difficulties understanding the questions. When asked to explain their understanding of the sentences, their proposed meaning was correct.

The results of a single-based, sleep-at-home CRM was used to determine the presence of OSA. CRM measures oxygen desaturations, pulse and breathing patterns and reveals the presence of OSA. The result of the CRM is shown in the Apnoea Hypopnoea Index (AHI). An AHI score in the 5-14 range is considered mild OSA, AHI from 15-29 is moderate OSA and an AHI score above 30 is severe OSA.

Statistics

The OSA risk as determined by STOP-BANG was compared with the CRM results. ROC curve analyses were performed; and specificities, sensitivities and AUC were calculated to assess the effectiveness of the SBQD -measured score against the CRM.

For comparison of the ESS scores between the AHI

> 5 group and AHI < 5 group, the Mann-Whitney U test was used with a significance level of 5%.

Trial registration: not relevant.

RESULTS

In our population, we found 79% men. The characteristics of the population are shown in **Table 1**. A total of 30 of the patients were found to have an AHI above 5. **Table 2** shows the results for specificity and sensitivity for an SBQD cut-off of ≥ 3 points, for AHI levels of > 5, > 15, and > 30, and AUC scores. Specificity and sensitivity for an SBQD cut-off ≥ 5 are shown in **Table 3** (see Appendix 2). These tables show that a cut-off value between 3 and 5 reveals most of the true positives and that it is associated with few false positives. **Figure 1** shows the correlation of AHI and SBQD scores with a trend line and a correlation coefficient. The correlation coefficient of 0.68 reveals a moderate correlation between the AHI and the SBQD. When removing the two outliers (**Figure 2**), a stronger correlation coefficient of 0.74 is produced. ROC curves for the SBQD measured (shown in **Figures 3-5**, see Appendix 2) show the threshold for optimised test characteristics.

The median ESS score in patients with an overall AHI ≥ 5 was 9, and for AHI < 5 the score was 5.5 points. This result is statistically significant (p = 0.027). The median ESS value for AHI > 5 was 6 (range: 2-24), AHI > 15 was 8 (range: 1-18) and AHI > 30 was 14 (range: 7-19).

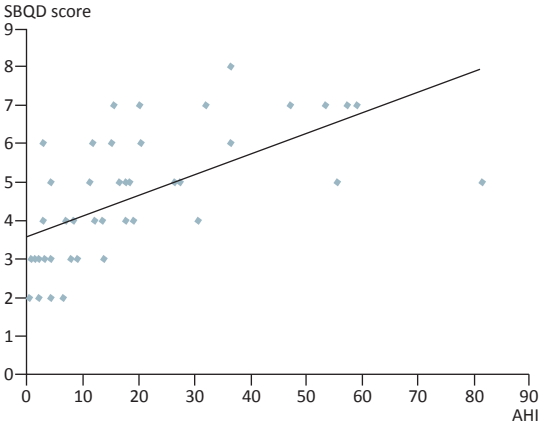
DISCUSSION

In this study, we found results for the Danish version of the SBQ that were comparable with previous examinations of the questionnaire by comparing sensitivity, specificity and AUC to previous studies of the original SBQ. We found the translation to be a success and to be accomplished according to guidelines presented by Guillemin et al. All the parameters measured were consistent with a functional and relevant questionnaire. The examined SBQD cut-off value of 3 yielded an AUC with significant p-values. We therefore find the SBQD suitable for screening of high-risk patients suspected of OSA.

Before starting this project, the Berlin Questionnaire was also considered, but it was found to yield lower sensitivity scores than the SBQ [7, 16]. The other excisting questionnaires Sleep Apnoea Scale of the Sleep Disorders Questionnaire (SA-SDQ) and Berlin were also considered harder to remember and use when calculating the risk of OSA. The SBQ was shown to have a consistently high sensitivity for detection of OSA at different AHI cut-offs and severity levels (AHI > 5: 84%, AHI > 15: 93%, AHI > 30: 100%) [7]. The same tendency was shown for our patients. Abrishami et al concluded that the SBQ had the potential to screen patients for high risk of having OSA, and this approach can raise the awareness of anaesthesiologists and surgeons to the possibility of OSA in surgical patients. On the other hand, Silva et al found that the SBQ was unsuitable for general screening in their population and recommend that multiple screening questionnaires and tools are evaluated concomitantly in various clinics and hospital settings to allow for comparison of significant differences within the same population [10].

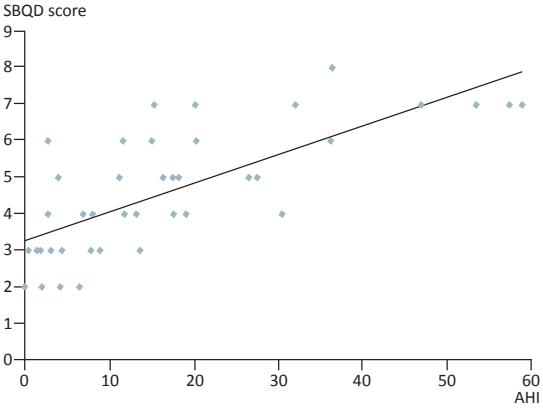
The sensitivity scores we found were better than those reported by Chung et al in their initial study [6]. The SBQ was developed by anaesthesiologists and measured on preoperative surgical patients. In this study, the patients were directed to a sleep centre and thereby already screened by another doctor, and thus we found a better sensitivity in our study. In another study, Chung et al showed that an increased serum level of bicarbonate increases the specificity of Stop-Bang screening in

FIGURE 1



Results for the Danish version of the Stop-Bang Questionnaire (SBQD) and their relation to the Apnoea Hypopnoea Index (AHI). Correlation coefficient = 0.62.

FIGURE 2



Results for the Danish version of the Stop-Bang Questionnaire (SBQD) and their relation to the Apnoea Hypopnoea Index (AHI) with two outliers removed. Correlation coefficient = 0.74.

The Danish version of the Stop-Bang Questionnaire may be used in screening of obstructive sleep apnoea patients in the primary sector.

predicting moderate/severe OSA. They therefore proposed a two-step screening process only using blood samples in patients with scores of three or above in the SBQ. In the Danish setup, the patients are currently referred by their primary physician or ENT doctors to a sleep centre. Some of the ENT doctors have already examined the patients with CRM. At the moment, a screening option that does not require drawing blood would be preferable, and the quick access to CRM confirms that this is preferable. Chung et al highlighted that an SBQ score of ≥ 3 demonstrated a high sensitivity for detection of patients with a moderate/high risk of OSA. This score was proposed as a preoperative screening. Screening the preoperative patients is important [17], especially in a "high-risk" department like the ENT department with many upper respiratory problems. Implementation of the SBQD may be one way to avoid post-operative respiratory problems in high-risk patients.

When evaluating the ESS, we found that a score above 9 involved a significant risk of having an AHI of 5 or above. No further association was established by dividing the group into three (AHI > 5, AHI > 15 and AHI > 30). So even though the results were significant, the range of the patients' scores in the three groups show no consistency with regard to AHI, as also shown earlier by Sil et al [12]. Previously, Vana et al tried to compare the predictive abilities of the ESS and the SBQ [13], and showed that the combination of the two did not increase sensitivity. In the author's opinion, the ESS gives a good impression of daily symptoms recalling that not all patients with a high AHI have many symptoms.

There is still room for new and improved screening methods, as recommended by Fedson et al [18], and further development or testing of questionnaires, especially in the primary centre, is awaiting.

If used correctly, the SBQD can be valuable in the pre-sleep clinic screening of high-risk patients – reducing time to assessment and yielding improved risk evaluations. In Canada, the time to assessment is differentiated into normal and urgent cases [19]. The SBQD could be helpful in identifying those who should be seen first on the basis of physician referrals.

CONCLUSIONS

The translation of the SBQ into Danish has been validated. The results observed herein were comparable to those reported in other studies and as the recorded sensitivity and specificity were acceptable. The SBQD can be used for preoperative screening and in the primary sector for evaluation of OSA risk upon suspicion of OSA.

To avoid too many false positives, we recommend that the SBQD cut-off is set to ≥ 3 for preoperative screening and ≥ 5 when screening high-risk patients before referring them for assessment. The ESS is recommended as a supplement to assessing the patient's symptoms. Further study and perhaps new questionnaires yielding a better specificity are recommended, but for now the SBQD and the ESS could be used for primary screening. The future repeatability of the questionnaire should be assessed in the specific population in which it will be used.

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Download **APPENDIX 1** and **APPENDIX 2** from www.danmedj.dk Dan Med J 2015;62(12):A5158

LITERATURE

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