



Translation and cultural adaptation of the Sleep Apnea Clinical Score for use in Brazil

Verônica Sobral Camara Lapas¹ , Anamelia Costa Faria¹ ,
Rogério Lopes Rufino¹ , Cláudia Henrique da Costa¹ 

1. Universidade do Estado do Rio de Janeiro, Rio de Janeiro (RJ) Brasil.

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ABSTRACT

Objective: To translate the Sleep Apnea Clinical Score (SACS) into Brazilian Portuguese and adapt it to the cultural setting, validating it for use as a screening method for polysomnography and as a tool to quantify the risk of obstructive sleep apnea syndrome in individuals in Brazil. **Methods:** The translation was performed by two professionals, with subsequent synthesis of the translations. From that version, a back-translation was prepared, revised, and compared with the original by a team of experts. As a pre-test, a consensus version was applied in 20 patients randomly selected from among those under treatment at outpatient clinics at the Piquet Carneiro Polyclinic of the State University of Rio de Janeiro, in the city of Rio de Janeiro, to assess their understanding of the questions. In the validation phase, the Brazilian-Portuguese version of the SACS was applied in 86 patients who subsequently underwent polysomnography, regardless of the SACS result. **Results:** The analyses of the pre-test phase showed that the SACS was easily understood by the patients. In the validation phase, the SACS showed a sensitivity of 45.3% (95% CI: 32.8-58.2%), a specificity of 90.9% (95% CI: 70.8-98.9%), a positive predictive value of 93.5% (95% CI: 79.0-98.2%), a negative predictive value of 36.4% (95% CI: 30.6-42.5%), and an accuracy of 57.0% (95% CI: 45.8-67.6%). **Conclusions:** The Brazilian-Portuguese version of the SACS can be used in order to assess the risk of obstructive sleep apnea syndrome.

Keywords: Sleep apnea, obstructive; Polysomnography; Surveys and questionnaires; Translations.

INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is characterized by repeated episodes of partial or complete obstruction of the upper airways during sleep, accompanied by a reduction in oxyhemoglobin saturation, together with sleep fragmentation.⁽¹⁾ According to the American Academy of Sleep Medicine, OSAS is defined as the presence of an apnea-hypopnea index ≥ 15 events per hour of sleep, regardless of the presence or absence of symptoms or comorbidities, or an apnea-hypopnea index of 5.0-14.9 events/h with at least one symptom or comorbidity.⁽²⁾ The main complaints of the patients are sleepiness, nonrestorative sleep, fatigue, insomnia, awakenings with a feeling of asphyxia, habitual snoring, witnessed apnea, mood disorders, and cognitive dysfunction. The most common comorbidities are hypertension, coronary artery disease, stroke, congestive heart failure, atrial fibrillation, and type 2 diabetes mellitus.⁽²⁾

Because of the growing recognition of OSAS and its high morbidity and mortality,⁽³⁻⁶⁾ the demand for a diagnosis has increased. The gold standard examination is overnight polysomnography, performed in a sleep laboratory under the supervision of a technician. Therefore, even in high-income countries, there are long waiting lists for this examination.^(1,7-9) In attempts to shorten the waiting period and the cost of the OSAS diagnosis, alternative methods have been devised, such methods

including the application of questionnaires,⁽¹⁰⁻¹³⁾ the use of portable polysomnography equipment for carrying out the examination at home^(1,14), and the split-night test, which consists of diagnostic polysomnography and continuous positive airway pressure titration on the same night.^(15,16)

One of the instruments developed to assess the risk of an individual having OSAS and the subsequent need to refer the patient for polysomnography is the Sleep Apnea Clinical Score (SACS).⁽¹³⁾ The SACS is an objective measure, because it is easily understood, and is rapidly applied, therefore being a useful tool for screening prior to polysomnography.⁽¹⁷⁻²⁰⁾

The objective of the present study was to translate the SACS to Brazilian Portuguese and validate it for use in Brazil, considering not only the language but also the cultural adaptation for the target population, as well as demonstrating the reproducibility of the instrument in the country.

METHODS

Ethical aspects

This project was approved by the Research Ethics Committee of the Pedro Ernesto University Hospital, operated by the State University of Rio de Janeiro, in the city of Rio de Janeiro, Brazil. All participating patients gave written informed consent.

Correspondence to:

Verônica Sobral Camara Lapas. Avenida Marechal Rondon, 381, São Francisco Xavier, CEP 20950-003, Rio de Janeiro, RJ, Brasil.
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Description of the SACS

The SACS is composed of three questions, the measurement of neck circumference, and the evaluation of the presence or absence of hypertension. The total score ranges from 0 to 110, values below 5 indicating a low likelihood of OSAS, whereas values greater than or equal to 15 indicate a high likelihood.⁽¹³⁾ The original questionnaire consists of three questions that evaluate the presence of hypertension or use of medication for blood pressure control; the presence of snoring; and the presence of choking, apnea, or sighing during sleep.⁽¹³⁾ The first question can only be answered "Yes" or "No". However, the second and third questions can be answered with the following options: "never", "rarely" (1-2 times per year), "occasionally" (4-8 times per year), "sometimes" (1-2 times per month), "often" (1-2 times per week), "almost always" (3-5 times per week), "always" (every night), and "don't know". Patients who answer "almost always" or "always" on the second question are considered positive for snoring. Those who answer "often", "almost always", or "always" on the third question are considered positive for choking, apnea, or sighing during sleep. To complete the score, it is necessary to measure the neck circumference and to know the history of hypertension. That information is entered into a chart that evaluates the score achieved (Chart 1).

Translation

We contacted the author of the SACS via e-mail and asked permission to translate the instrument into Brazilian Portuguese. After that permission had been granted, we performed a back-translation of the questionnaire. This method was chosen because it is most widely used.^(21,22) As summarized in Figure 1, the following steps were used:

1. The original SACS was translated to Brazilian Portuguese by two independent translators who were fluent in English, were specialists in the field of sleep medicine, and knew the purpose of the study so that the translation would be not only literal but also conceptual and from a clinical perspective. The two translations were designated versions 1 and 2.
2. The two versions in Portuguese were reviewed by a multidisciplinary team, composed of two physicians and a nurse, who compared the two versions and created a single consensus version (version P1).
3. The consensus version was back-translated to English by a native speaker of English who was unaware of the purpose of the study and of the original version of the SACS, to ensure that the concepts that had initially been translated into Portuguese held the same meanings as those in the original English-language questionnaire, ensuring a consistent back-translation, even if linguistic changes were needed in order to adapt the instrument for use in the target population. The author of the original article approved the back-translated version.
4. The multidisciplinary team evaluated the back-translated version and compared it with the initial Portuguese-language version (version P1) to identify any linguistic differences. Because they found no inconsistencies, the Portuguese-language version was considered suitable and was designated version P2.

Cultural adaptation

Version P2 was chosen to be submitted to cultural adaptation through the evaluation of semantic equivalence with a pre-test, as described below.

Version P2 of the SACS was presented to patients at the Pulmonology Outpatient Clinic of the Piquet Carneiro Polyclinic, with the addition of one answer option: "I did not understand the question or the answer options". The patients were instructed to answer only if they clearly understood the question and the answer options; otherwise, they should tick that additional option. Because the SACS is a self-report questionnaire, we selected adult patients who were able to understand the content. In this phase, we excluded illiterate individuals, as well as individuals with poor visual acuity or a cognitive deficit that would have prevented them from reading/understanding the questionnaire.

Validation of the SACS

The final Portuguese-language version of the SACS was tested in patients referred to the sleep outpatient clinic. The criteria for inclusion in this phase were being an adult (≥ 18 years of age) and having been referred to the sleep outpatient clinic for investigation of possible OSAS. Patients who were unable to read the SACS were excluded, as were those who had previously undergone polysomnography, those who had a confirmed the diagnosis of OSAS, those who were pregnant, those with exacerbated respiratory diseases, and those with psychiatric disorders.

All patients underwent overnight polysomnography in the Sleep Laboratory of the Piquet Carneiro Polyclinic between March 2017 and August 2019, supervised by a technician using a polysomnography system (Alice 5; Philips Respironics, Pittsburgh, PA, USA). The staging of sleep and the marking of related events were carried out by a professional specializing in sleep medicine, in accordance with the Manual of the American Academy of Sleep Medicine.⁽²⁾ The parameters recorded were the following: electroencephalography (derivations F3-M2, F4-M1, C3-M2, C4-M1, O1-M2, and O2-M1); electrooculography (derivations E1-M2 and E2-M2); electromyography of the mandible and legs; electrocardiography (modified D2 derivation); air flow through a nasal pressure cannula and oronasal thermistor; respiratory effort by thoracic and abdominal plethysmography; pulse oximetry; and body position.

Apnea was defined as a $\geq 90\%$ drop in the amplitude of the thermistor signal for a period of ≥ 10 seconds, and hypopnea was defined as a $\geq 30\%$ drop in the amplitude of the cannula pressure signal during a period ≥ 10 s, with oxygen desaturation $\geq 3\%$ of the baseline value, with or without awakenings.

RESULTS

The translation of a tool into another language must also encompass the cultural adaptation and the adaptation to the linguistic expressions of the target language that help make the context understandable. In version P2 of the SACS, the phrase “I gasp, choke or snort”, in the third question, was translated as *engasgo, paro de respirar ou suspiro* (“I choke, stop breathing, or sigh”), in order to keep the question within the clinical context of the patients with OSAS. The answer options were translated so as to represent the progression of events. Therefore, “sometimes” was translated as *algumas vezes* (“a few times”) and “usually” was translated as *quase sempre* (“almost always”).

In the pre-test phase, version P2 of the SACS was applied in 20 outpatients. The demographic data of that sample are shown in Table 1. Although all patients were able to read, some of them had had only a few years of schooling. However, none of the patients reported difficulties in understanding the questions or answer options presented in version P2. Although two patients had a complaint regarding the font size, that did not affect their comprehension of the questionnaire.

After the pre-test had been applied, we discussed and evaluated participant understanding and comprehension of the instrument, to ensure that all questions and answer options were well explained. We concluded that the instrument, as translated and revised by the multidisciplinary committee, did not require any further semantic or conceptual alterations. Therefore, we considered version P2 the final version and moved on to the next step: validation.

In this phase (the validation phase), the final version of the SACS was applied in patients who were referred to the sleep clinic for investigation of suspected OSAS. We included 86 randomly selected patients who met the inclusion criteria but not the exclusion criteria and who were scheduled to undergo polysomnography. The demographic data related to those patients are presented in Table 2.

The data obtained with the SACS were correlated with the results of the polysomnography. On the basis of the SACS result, the patients were divided into two groups: those with a low risk of OSAS (SACS < 5) and those with a high-risk (SACS ≥ 15), as shown in Table 3.

The reliability of the SACS was studied through the analysis of internal consistency. Cronbach’s alpha coefficient was calculated to be 0.82 (lower limit of the 95% CI: 0.67). The questionnaire showed a sensitivity of 45.3% (95% CI: 32.8-58.2%), a specificity of 90.9% (95% CI: 70.8-98.9%), a positive predictive value of 93.5% (95% CI: 79.0-98.2%), a negative predictive value of 36.4% (95% CI: 30.6-42.5%), and an accuracy of 57.0% (95% CI: 45.8-67.6%). The area under the ROC curve was 0.82 (SE = 0.03; 95% CI: 0.74-0.89; $p < 0.0001$), as shown in Figure 2.

DISCUSSION

The Portuguese-language version of the SACS was applied in patients in Brazil and was easily understood

by those with various levels of education. Because it is a questionnaire with just three simple, objective questions, the level of clarity was the highest possible, as evidenced by the fact that none of the patients reported difficulties in understanding the tool. In addition to the three questions that were validated, the SACS requires the measurement of neck circumference, which, in the present study, was performed by one person (i.e., was not corroborated by a second evaluator).

The SACS was chosen for the translation project because of its ease of use. In Brazil, few health care

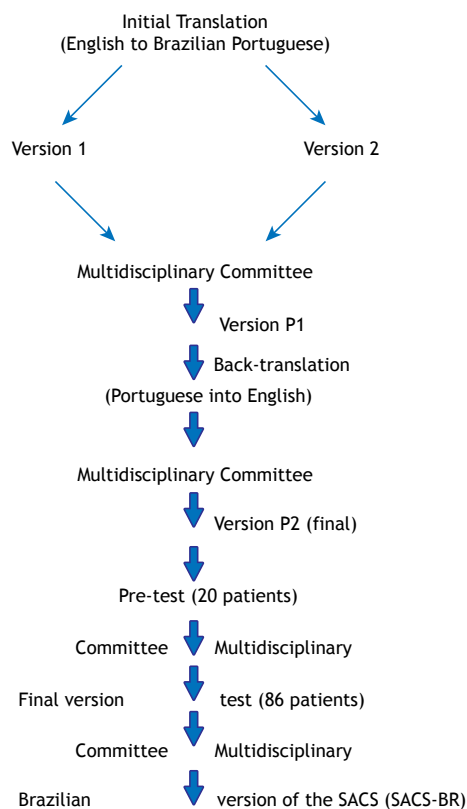


Figure 1. Stages in the process of the translation of the Sleep Apnea Clinical Score to Brazilian Portuguese and the cultural adaptation of the instrument for use in Brazil.

Table 1. Demographic data for patients who participated in the pre-test of the Sleep Apnea Clinical Score (N = 20).^a

Characteristic	Results
Male; n (%)	10 (50)
Age, years	58.25 ± 12.3
Self-reported ethnicity	
White	8 (40)
Other	12 (60)
Self-reported level of education	
< 9 years of schooling	2 (10)
9-12 years of schooling	7 (35)
≥ 12 years of schooling	9 (45)
University degree	2 (10)

^avalues expressed in n (%) or mean ± SD.

Table 2. Demographic data for the patients who participated in the validation of the Sleep Apnea Clinical Score (N = 86).^a

Characteristic	Results
Male, n (%)	41 (48)
Age, years	59.83 ± 10.3
Self-reported ethnicity	
White	41 (48)
Other	45 (52)
Self-reported level of education	
< 9 years of schooling	11 (13)
9-12 years of schooling	26 (30)
≥ 12 years of schooling	36 (41)
University degree	8 (9)
Not stated	5 (6)
Polysomnography results	
Normal	22 (25)
Light OSAS	18 (21)
Moderate OSAS	10 (12)
Severe OSAS	36 (42)

OSAS: obstructive sleep apnea syndrome. ^avalues expressed in n (%) or mean ± SD.

Table 3. Apnea-hypopnea index as measured by polysomnography in patients classified as being at low or high risk of presenting obstructive sleep apnea syndrome by the Sleep Apnea Clinical Score.^a

AHI, events/h	Low risk (n = 55)	High risk (n = 31)
< 5	20 (34)	2 (6)
5-15	10 (17)	8 (29)
16-30	6 (10)	4 (17)
> 30	19 (38)	17 (47)

AHI: apnea-hypopnea index. ^avalues expressed in n (%).

facilities offer polysomnography, and even fewer of those are within the public health care system. Therefore, it is essential to have a validated questionnaire that will help us select patients for polysomnography.

Flemons et al.⁽¹³⁾ stated that neck circumference and hypertension are the most significant independent clinical predictors of OSAS, which is why these two evaluations were included in the SACS. Those authors stated that neck circumference was the independent variable that correlated most strongly with OSAS ($r = 5.89$; $p < 0.0001$).⁽¹³⁾ Two of the three questions of the SACS evaluate the characteristics of abnormal nocturnal breathing observed by a partner, including habitual snoring and choking or asphyxia, which were also significant predictors.⁽¹³⁾ The authors concluded that, for patients in whom the likelihood of OSAS is high, additional diagnostic tests should be used; a clinical prediction rule like the one they studied can provide a reliable estimate of the likelihood of prior approval for polysomnography. In other words, as clarified by the authors, the SACS was developed to be a tool with a high positive predictive value for the diagnosis of OSAS.⁽¹³⁾ That is recognized in the literature, in which the SACS has become established as a questionnaire with high specificity for OSAS.⁽²⁰⁾

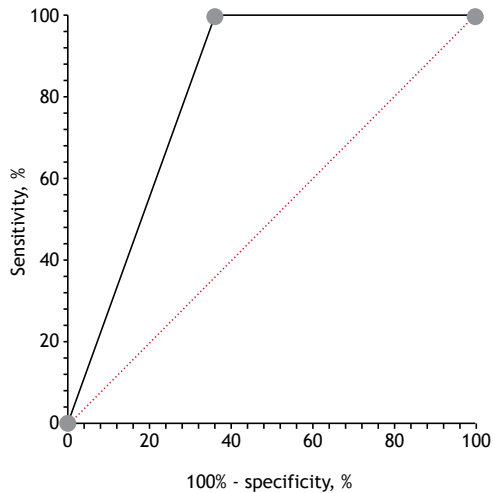


Figure 2. Relationship between sensitivity and specificity of the Sleep Apnea Clinical Score.

This means that patients with a SACS ≥ 15 have a high likelihood of actually being diagnosed with OSAS.

In a recent study, Prasad et al.⁽²⁰⁾ compared nine screening questionnaires designed to assess the likelihood of OSAS. A total of 210 patients underwent polysomnography, and 164 were thus diagnosed with OSAS. Among the various questionnaires compared, the SACS showed the highest positive predictive value (95.2%) and the highest specificity (91.3%) for the diagnosis of OSAS. The authors concluded that the SACS was the most specific tool for the diagnosis of OSAS among the tools evaluated, with values similar to those reported in the original study conducted by Flemons et al.⁽¹³⁾ However, the SACS cannot exclude patients from needing the examination when the score is below 15, because it has low sensitivity. Because two of the three questions on the SACS refer to the perception of nocturnal symptoms, individuals who sleep alone do not perceive these changes and deny the presence of snoring or choking. In contrast, patients who sleep accompanied are more likely to respond positively, because their spouses or family members often complain of these symptoms. As a result, patients who sleep alone tend to score lower on the SACS, which could be one of the reasons for the low sensitivity of the tool.

In our sample, the translated, adapted questionnaire produced results similar to those obtained with the original tool. The Portuguese-language version had a specificity of 91%, very close to that reported by Prasad et al.⁽²⁰⁾

The SACS has been now been translated to Portuguese, adapted to the cultural setting, and validated for use in Brazil. The present study could function as a reference for health professionals who monitor patients suspected of having OSAS.

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REFERENCES

- Kapur VK, Auckley DH, Chowdhuri S, Kuhlmann DC, Mehra R, Ramar K, et al. Clinical Practice Guideline for Diagnostic Testing for Adult Obstructive Sleep Apnea: An American Academy of Sleep Medicine Clinical Practice Guideline. *J Clin Sleep Med*. 2017;13(3):479-504. <https://doi.org/10.5664/jcsm.6506>
- Berry RB, Brooks R, Gamaldo C, Harding SM, Lloyd RM, Quan SF, et al. AASM Scoring Manual Updates for 2017 (Version 2.4). *J Clin Sleep Med*. 2017;13(5):665-666. <https://doi.org/10.5664/jcsm.6576>
- Jaimochariyatam N, Na-Rungsri K, Tungsanga S, Lertmaharit S, Lohsoonthorn V, Totienchai S. Obstructive sleep apnea as a risk factor for preeclampsia-eclampsia. *Sleep Breath*. 2019;23(2):687-693. <https://doi.org/10.1007/s11325-018-1758-8>
- Bonsignore M. F1000 - Post-publication peer review of the biomedical literature: Meta-Analysis of Cardiovascular Outcomes With Continuous Positive Airway Pressure Therapy in Patients With Obstructive Sleep Apnea. 2017. <https://doi.org/10.3410/f.727765283.793540146>
- Shpilsky D, Erqou S, Patel SR, Kip KE, Ajala O, Aiyer A, et al. Association of obstructive sleep apnea with microvascular endothelial dysfunction and subclinical coronary artery disease in a community-based population. *Vasc Med*. 2018;23(4):331-339. <https://doi.org/10.1177/1358863X18755003>
- Shen H, Zhao J, Liu Y, Sun G. Interactions between and Shared Molecular Mechanisms of Diabetic Peripheral Neuropathy and Obstructive Sleep Apnea in Type 2 Diabetes Patients. *J Diabetes Res*. 2018;2018:3458615. <https://doi.org/10.1155/2018/3458615>
- Franklin KA, Lindberg E. Obstructive sleep apnea is a common disorder in the population-a review on the epidemiology of sleep apnea. *J Thorac Dis*. 2015;7(8):1311-1322.
- Flemons WW, Douglas NJ, Kuna ST, Rodenstein DO, Wheatley J. Access to diagnosis and treatment of patients with suspected sleep apnea. *Am J Respir Crit Care Med*. 2004;169(6):668-672. <https://doi.org/10.1164/rccm.200308-1124PP>
- Kapur V, Strohl KP, Redline S, Iber C, O'Connor G, Nieto J. Underdiagnosis of sleep apnea syndrome in U.S. communities. *Sleep Breath*. 2002;6(2):49-54. <https://doi.org/10.1055/s-2002-32318>
- Abrishami A, Khajehdehi A, Chung F. A systematic review of screening questionnaires for obstructive sleep apnea. *Can J Anaesth*. 2010;57(5):423-438. <https://doi.org/10.1007/s12630-010-9280-x>
- Marti-Soler H, Hirotsu C, Marques-Vidal P, Vollenweider P, Waeber G, Preisig M, et al. The NoSAS score for screening of sleep-disordered breathing: a derivation and validation study. *Lancet Respir Med*. 2016;4(9):742-748. [https://doi.org/10.1016/S2213-2600\(16\)30075-3](https://doi.org/10.1016/S2213-2600(16)30075-3)
- Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. *Sleep*. 1991;14(6):540-545. <https://doi.org/10.1093/sleep/14.6.540>
- Flemons WW, Whitelaw WA, Brant R, Remmers JE. Likelihood ratios for a sleep apnea clinical prediction rule. *Am J Respir Crit Care Med*. 1994;150(5 Pt 1):1279-1285. <https://doi.org/10.1164/ajrccm.150.5.7952553>
- Collop NA. Portable monitoring for the diagnosis of obstructive sleep apnea. *Curr Opin Pulm Med*. 2008;14(6):525-529. <https://doi.org/10.1097/MCP.0b013e328312ed4a>
- Chiao W, Durr ML. Trends in sleep studies performed for Medicare beneficiaries. *Laryngoscope*. 2017;127(12):2891-2896. <https://doi.org/10.1002/lary.26736>
- Khawaja IS, Olson EJ, van der Walt C, Bukartyk J, Somers V, Dierkhisling R, et al. Diagnostic accuracy of split-night polysomnograms. *J Clin Sleep Med*. 2010;6(4):357-362. <https://doi.org/10.5664/jcsm.27877>
- Gkouskou K, Vlastos IM, Chanotis D, Markaki A, Choulakis K, Prokopakis E. Nutrigenetic genotyping study in relation to Sleep Apnea Clinical Score. *Sleep Breath*. 2019;23(2):659-663. <https://doi.org/10.1007/s11325-018-1742-3>
- Jansari M, Iyer K, Kulkarni S. The role of Sleep Apnea Clinical Score (SACS) as a pretest probability in obstructive sleep apnea. *Int J Biomed Res*. 2015;6(7):479. <https://doi.org/10.7439/ijbr.v6i7.2291>
- Faria AC, da Costa CH, Rufino R. Sleep Apnea Clinical Score, Berlin Questionnaire, or Epworth Sleepiness Scale: which is the best obstructive sleep apnea predictor in patients with COPD?. *Int J Gen Med*. 2015;8:275-281. <https://doi.org/10.2147/IJGM.S86479>
- Prasad KT, Sehgal IS, Agarwal R, Nath Aggarwal A, Behera D, Dhooria S. Assessing the likelihood of obstructive sleep apnea: a comparison of nine screening questionnaires. *Sleep Breath*. 2017;21(4):909-917. <https://doi.org/10.1007/s11325-017-1495-4>
- Guillemin F. Cross-cultural adaptation and validation of health status measures. *Scand J Rheumatol*. 1995;24(2):61-63. <https://doi.org/10.3109/03009749509099285>
- Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine (Phila Pa 1976)*. 2000;25(24):3186-3191. <https://doi.org/10.1097/00007632-200012150-00014>