STOP-Bang as a predictor of obstructive sleep apnea-hypopnea syndrome in outpatients

STOP-Bang como predictor de apnea-hipopnea obstructiva del sueño en pacientes ambulatorios

John Carlos Pedrozo-Pupo iD [1], Jorge Armando Egurrola-Pedraza iD [2], Adalberto Campo-Arias iD [3]

1. Universidad del Magdalena. Santa Marta, Colombia. Correo: jpedrozo@unimagdalena.edu.co - https://orcid.org/0000-0002-5675-7016
2. Universidad del Magdalena. Santa Marta, Colombia. Correo: jegurrola@unimagdalena.edu.co - https://orcid.org/0000-0001-5311-4229
3. Universidad del Magdalena. Santa Marta, Colombia. Correo: acampoa@unimagdalena.edu.co - https://orcid.org/0000-0003-2201-7404

ABSTRACT

Keywords:
Obstructive Sleep Apnea; Polysomnography; Outpatients; STOP-Bang index; Validation Studies.

The STOP-Bang has been promoted as a valuable tool for identifying obstructive sleep apnea-hypopnea syndrome (OSAHS) in medical and surgical patients. However, its performance in Colombian samples is unknown. The objective of this study was to determine the clinimetric performance of the STOP-Bang index versus the study of polysomnography in patients from Santa Marta, Colombia. An accuracy study of diagnostic tests with a test-based approach was designed. Seven hundred sixty-two adults referred for polysomnography to evaluate OSAHS were included in the research. They were aged between 18 and 94 years old (mean=47.2, SD=13.4), 63.3% were men, and 46.5% were classified as obese. The STOP-Bang performance was compared against the best reference criterion, the hypopnea/apnea index determined by polysomnography. The diagnosis of OSAHS was confirmed in 461 (60.5%) and corroborated in 301 (39.5%). The area under the curve was 0.70 (95%CI 0.66-0.74), and the best cut-off point was 4, with a sensitivity of 79.2%, a specificity of 53.5%, the positive predictive value of 72.2%, the negative predictive value of 62.6%, positive likelihood ratio was 1.70, negative likelihood ratio was 0.39; OR=4.08 (CI95% 2.99-5.56) and Cohen's kappa of 0.33. As conclusions, performance indicators show that STOP-Bang has little utility as a predictor of OSAHS in the evaluated population. This indicator should be abandoned.

RESUMEN

Palabras clave: apnea obstructiva del sueño; polisomnografía; pacientes ambulatorios; estudios de validación.

El STOP-Bang ha sido promocionado como una herramienta útil para identificar casos de síndrome de apnea/hipoapnea obstructiva del sueño (SAHOS) en pacientes médicos y quirúrgicos. Sin embargo, no se conoce su desempeño en muestras colombianas. El objetivo de este estudio fue determinar el desempeño clinimétrico del índice STOP-Bang frente a polisomnografía en pacientes de Santa Marta, Colombia. Se diseñó un estudio de precisión de una prueba de diagnóstico. Se contó con la participación de 762 adultos que fueron remitidos para polisomnografía. Se solicitó la participación de adultos (entre 18 y 94 años; media=47,2; DE=13,4); 63,3% hombres y 46,5% obesos. El rendimiento del STOP-Bang se comparó frente el mejor criterio de referencia, el índice de hipopnea/apnea determinado por polisomnografía. El diagnóstico de SAHOS se confirmó en 461 (60,5%) y se corroboró en 301 (39,5%). El área bajo la curva fue 0,70 (IC95% 0,66-0,74) y el mejor punto de corte fue 4, con sensibilidad de 79,2%, especificidad de 53,5%, valor predictivo positivo de 72,2%, valor predictivo negativo de 62,6%, razón de probabilidad positiva de 1,70, razón de probabilidad negativa de 0,39; *OR*=4,08 (*IC95%* 2,99-5,56) y

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kappa de Cohen de 0,33. Como conclusiones, los indicadores de desempeño en conjunto muestran que STOP-Bang tiene poca utilidad práctica como predictor de SAHOS en la población evaluada. Este indicador se debería abandonar.

INTRODUCTION

Obstructive sleep apnea-hypopnea syndrome (OSAHS) is currently diagnosed more frequently[1]. OSAHS is a condition with crucial implications given that it increases the morbidity and mortality of the people diagnosed and, consequently, with a high impact on public health[2,3]. Therefore, several clinical indicators have been designed to diagnose the syndrome; however, these indicators' performance or performance has been lower than expected for a diagnostic test[4-6].

To confront the limitations of the instruments available for the prediction of OSAHS based on clinical findings, Chun et al[7] published a decade ago the performance of the STOP-Bang index (from the acronym of snoring, tiredness, observed apnea, high blood, body mass index, age, neck circumference, gender). In a sample of 177 adults who attended for presurgical evaluation, the authors observed that a cut-off point of three STOP-Bang classified patients into two groups: high and low risk for OSAHS. For that cut-off point, the sensitivity was 83.6; the specificity, 56.4; positive predictive value, 81.0; negative predictive value, 60.8; positive likelihood ratio, 1.92; negative likelihood ratio, 0.57 (calculated as it was not reported in the article); area under the curve, 0.81 and odds ratio, 6.59. Subsequently, in three meta-analyses, it was observed that these STOP-Bang performance indicators were maintained around the initial publication values; however, a wide variation of them was evident, according to the characteristics of the population[4-6].

The STOP-Bang performance is the best compared to other available instruments against the reference criterion, polysomnography, to predict OSAHS[4-6]. However, the STOP-Bang performance findings are far from the ideal parameters for a screening instrument, that is, that it can omit the use of polysomnography with sufficient guarantees, as paraclinical to predict the diagnosis of OSAHS[8]. However, STOP-Bang has been promoted as a helpful tool for OSAHS in medical and surgical patients to predict the problem[9].

It should be considered that the performance of these indices varies widely according to the prevalence of OSAHS in the population[10,11]. In Colombia, the prevalence of OSAHS, estimated with the STOP-Bang, reached 26.9% in three Colombian cities of different altitudes above sea level[12]. Despite the limitations, the STOP-Bang can be useful for screening OSAHS in contexts with limited access to polysomnography, as is the case in many small cities and rural or remote areas in developing countries, such as Colombia[13]. Likewise, in the clinical context, STOP-Bang can be particularly useful in anesthesiology since OSAHS has often been associated with difficulty for intubation in surgery cases that need general anesthesia[14].

In the present study, the coefficients presented by Chung et al[7] are calculated in the introduction article of the STOP-Bang, and, additionally, Cohen's kappa is presented, which is a coefficient used to know the agreement between two measurements beyond what can be observed by a simple chance[15].

The research objective was to determine the STOP-Bang index's clinimetric performance versus polysomnography in a sample of outpatients from Santa Marta, Colombia.

MATERIALS AND METHODS

Type of study

An accuracy study of diagnostic tests with a test-based approach was designed. The study used the best reference criterion for the diagnosis of OSAHS.

Population and sample

Seven hundred sixty-two adults attended consecutively between January 2014 and December 2016. Patients were referred for polysomnography

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because of clinical suspicion of OSAHS to a pneumology unit in a city in the Colombian Caribbean above sea level, with an approximate population of 500,000 inhabitants. Adults' participation was requested (between 18 and 94 years old, mean=47.2, SD=13.4), 46.5% obese, 28.5% smokers, and 33.9% with some medical comorbidity (diabetes, chronic obstructive pulmonary disease, etcetera).

Instruments

Participants were evaluated for the presence of symptoms and measurements of the STOP-Bang acronym (7). The STOP-Bang is an eight-item dichotomous (yes/no) questions instrument, divided into two components of the dichotomous response. The first component in three items investigates the symptoms associated with OSAHS (snoring, feeling of daytime fatigue and apnea) and, the second of five items gather the risk factors for OSAHS (presence of hypertension, body mass index greater than 35, age over 50 years, the circumference of the neck more remarkable than 40 cm and male sex). For each question, answering "yes" scores 1, a "no" response score 0, and the total score ranges from 0 to 8. The diagnosis of OSAHS was established by the presence of a hypopnea/apnea index greater than five observed in the polysomnography. The polysomnographic finding was taken as a reference criterion[8].

Procedure

First, the patients' medical history was completed, including the measurements that are part of the STOP-Bang. This qualification was carried out by a doctor specialized in internal medicine and pneumology. Next, the participants underwent polysomnography on BWII PSG equipment by a certified technician according to more international standard specifications. The STOP-bang score and the spirometry interpretation reading are independently done.

Analysis of data

The best cut-off point was established according to the area under the curve, ROC[16]. The best cut-off point, sensitivity, specificity, predictive values, likelihood ratios, the odds ratio (OR), and Cohen's kappa (κ) were calculated[14]. The statistical analysis was performed with STATA 13.0.

Ethical issues

A research ethics board (University of Magdalena, Santa Marta, Colombia) approved the project. All patients read and signed the informed consent, according to national and international legislation.

RESULTS

The diagnosis of OSAHS was confirmed in 461 (60.5%) patients and was excluded in 301 (39.5%). The frequency of each item is presented in table 1. The ROC showed an area of 0.70 (CI95% 0.66-0.74), and the best cut-off point was 4. This cut-off point showed a sensitivity of 79.2%, a specificity of 53.5%, a positive predictive value of 72.2%, a negative predictive value of 62.6%, a positive likelihood ratio of 1.70, a negative likelihood ratio of 0.39, OR=4.08 (CI95% 2.99-5.56) and κ of 0.33 (Figure 1).

Table 1. Item frequency of STOP-Bang.

Item	Frequency	%
Snoring	666	87.4
Tiredness	266	34.9
Observed apnea	449	58.5
High blood pressure	288	37.8
Body mass index>35	149	19.6
Age>50 years	294	38.6
Neck circumference>40	371	48.7
Male gender	482	63.6
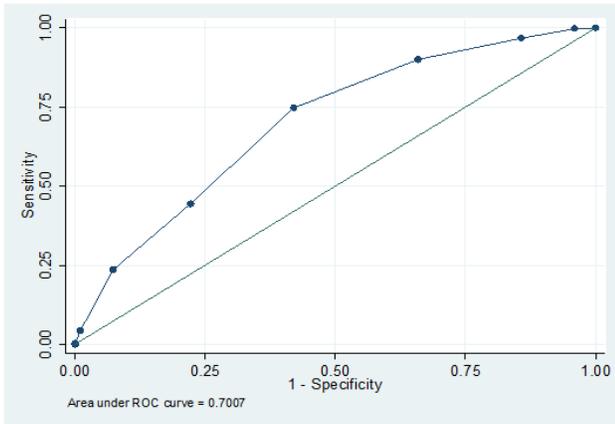
Figure 1. ROC for the STOP-Bang.

DISCUSSION

To date, the evidence to suggest the routine use of STOP-Bang for the screening of OSAHS in the general population and the clinical context, both medical and surgical patients, is questionable[4-7]. In the same direction, Cowan et al[17], in a sample of 129 patients, observed that the STOP-Bang had high sensitivity, moderate positive predictive value, and negative specificity and predictive value deficient for predicting sleep disorders related to breathing.

Under ideal conditions, it is expected that the best cut-off point for a prediction instrument will show at least a sensitivity more significant than 95%; specificity, at 80%; positive predictive value, at 90%; negative predictive value, at 80%; positive probability likelihood ratio, to 2.0; negative probability ratio, at 0.50; OR, to 10; and κ at 0.75[10,11]. Besides, it must be borne in mind that the cut-off point for the prediction of OSAHS needs to be adjusted, according to the characteristics of the population; in high-risk groups, the reduction of the cut-off point usually presents better performance; while low-risk groups for OSAHS increase the cut-off point can help better discrimination of cases and not cases[10].

Ramachandran et al[4] observed in a meta-regression that only body mass index, history of hypertension, and nocturnal asphyxia are significant components associated with greater diagnostic precision than the instrument's other measurements. Likewise, they concluded that the test's precision in the validation studies is variable, suggesting obstructive sleep apnea or that the clinical elements measured are highly heterogeneous. Therefore, there is a high probability of false negatives.

Similarly, Abrishami et al[5] completed a meta-analysis that included ten studies, 1484 patients, of several tools for identifying OSA, including STOP-Bang. They concluded that the accuracy of STOP-bang is inconsistent. Later, Chiu et al[6] designed other meta-analysis and identified 108 studies including a total of 47,989 participants; the STOP-Bang presented a pooled sensitivity of 88% and a pooled specificity of 42%; besides, the authors observed that other variables such as age, gender, body mass index, and the presence of comorbidities significantly affected the sensitivity and specificity values. The studies suggest that STOP-Bang may be helpful in a particular group of patients; however, a complete clinical evaluation can help pinpoint the diagnosis and, therefore, choose the best treatment for each patient[4-7].

Chung et al[18] and Prasad et al[19] suggested making additional adjustments according to the items, and the total score, according to the characteristics of each patient, can increase the efficacy of STOP-Bang in the diagnosis of OSAHS. It is evident that the STOP-Bang has better indicators in moderate to severe OSAHS, apnea-hypopnea index equal to or greater than 15, and in cases of greater severity, apnea-hypopnea index equal to or greater than 30[20]. Likewise, this finding may be necessary for anesthesiology since the limitations for identifying possible cases of OSAHS also extend to the instrument's possible usefulness in identifying subjects difficult to intubate[14].

This study contributes to knowing the STOP-Bang performance in ambulatory patients from a developing country like Colombia. However, it is limited by other clinimetric studies that do not allow the findings to be easily generalized. This type of study only presents internal validity[21]. It is necessary to continue research in this area to design and count an instrument with high sensitivity and specificity values and a reduced number of false positives and false negatives[22].

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It is concluded that the STOP-Bang index's overall performance has little practical utility as a predictor of OSAHS in the evaluated population. It is necessary to review or abandon the use of this indicator as a predictor of OSAHS.

DECLARATION ON CONFLICT OF INTERESTS

AUTHORS' CONTRIBUTION

John Carlos Pedrozo-Pupo contributed to the analysis's conception and interpretation, revised the manuscript critically and gave final approval.

Jorge Armando Egurrola-Pedraza contributed to the analysis's interpretation, revised the manuscript critically, and gave final approval.

Adalberto Campo-Arias contributed to the conception, analysis, draft of the manuscript and gave final approval.

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