ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

Type of Article: Original Research Article

BEST SCREENING TOOL FOR OSA IN A BUSY DAY-TO-DAY OPD

Isha Arushi[1]*, Rajat Agrawal[2], Rajesh Agrawal[3]

[1]PG Resident, Department of Respiratory Medicine, Rohilkhand Medical College and Hospital, Bareilly, UP India
[2]Professor, Department of Respiratory Medicine, Rohilkhand Medical College and Hospital Bareilly UP India
[3]Professor & Head, Department of Respiratory Medicine, Rohilkhand Medical College and Hospital Bareilly UP India
*Corresponding Author and reprint request to: Dr. Isha Arushi, PG Resident, Department of Respiratory Medicine, Rohilkhand Medical College and Hospital Bareilly UP India

Abstract

Background: The commonest form of Sleep Disordered Breathing is obstructive sleep apnea (OSA). OSA is a common disease with relative unawareness in society and is associated with significant morbidity, prompting the need for research and studies on this topic.

Objective: 1. To study the sensitivity, specificity of the STOP-BANG Score, Epworth Sleepiness Score, and Berlin Questionnaire.

2. To evaluate the ease of use of the STOP-BANG Score, Epworth Sleepiness Score, and Berlin Questionnaire.

Methods: A survey was conducted on apparently healthy adult individuals in the department of respiratory medicine at Rohilkhand Medical College & Hospital, Bareilly, Uttar Pradesh, India from 1 NOV 2022- 31 OCT 2023. Subjects were screened based on the Berlin Questionnaire, STOP-BANG score, and Epworth Sleepiness Scale. They were categorized as High-risk and low-risk groups based on questionnaires. All the high-risk patients and 30% of the low-risk group were advised for polysomnography. Subjects who consented to overnight PSG were then diagnosed as OSA on the basis of apnea and hypopnea index (AHI) ≥5. The sensitivity and specificity of the screening tool were calculated taking PSG as the gold standard diagnostic tool.

Results: Out of 2118 subjects approached, 1832 (response rate 86.49%) participated in the survey. 221 (12.06%) were found to be at high risk of OSA and rest 1611 (87.93%) subjects were at low risk of OSA as per questionnaires. 165 (74.66%) subjects from the high-risk group and 313 (19.4%) subjects from the low-risk group consented to polysomnography. The

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

sensitivity and specificity of the screening tool were calculated among these 478 subjects, taking PSG as the gold standard diagnostic tool.

Sensitivity for prediction of AHI ≥5 of ESS was found to be 81.87% (95% CI 75.49 to 87.18), BQ was 82.42% (95% CI 76.1 to 87.65) and STOP-BANG score was 90.66% (95%CI 85.47%-94.46%). And specificity of ESS was found to be 94.93% (95%CI 91.78 to 97.14), BQ was 94.59% (95% CI 91.37 to 96.88) and STOP-BANG score was and 77.70% (95% CI 72.53% - 82.32%). The positive likelihood ratio of ESS was 16.16 (95% CI 9.82 to 26.58), BQ was 15.25(95% CI 9.42 to 24.67) and STOP-BANG score was 4.07 (95% CI 3.27-5.05). Negative Likelihood Ratio OF ESS was 0.19 (95% CI 0.14 to 0.26), BQ was 0.19 (95%CI 0.14 to 0.25) and STOP-BANG score was 0.12 (95%CI 0.08 to 0.19).

Conclusion: We found the STOP-BANG score, the Epworth sleepiness scale, and Berlin Questionnaire to be reliable for screening of OSA. For evaluating the risk of OSA, the STOP-BANG score was found to be more sensitive while the Berlin questionnaire and the Epworth sleepiness scale were more specific. Given that the STOP-BANG score has fewer variables than other scores and is both subjective and objective, estimating a person's risk for OSA takes less time. Taking into account the relatively poorer specificity of the STOP-BANG score, we advise a two-step screening method. First, to segregate the high and intermediate-risk groups using the STOP-BANG score and then, lengthier scores, the Berlin Questionnaire and the Epworth sleepiness scale, can be applied to these groups only, making the screening more efficient. On the other hand, only individuals at high risk of OSA, excluding those at intermediate risk, could be recommended for polysomnography to maximize the specificity of the STOP-BANG score. Hence, it is concluded that the STOP-BANG score is the best screening tool in a busy day-to-day OPD.

Keywords: STOP-BANG score, Epworth sleepiness scale, Berlin Questionnaire, Obstructive Sleep Apnea.

Introduction:

The most common form of sleep disordered breathing is obstructive sleep apnea (OSA)[1]. A study summarized the prevalence of obstructive sleep apnea data from 17 studies available from 16 countries[2], Using AASM-2012 diagnostic criteria[3] and AHI threshold values of ≥5 events/hour and ≥ 15 events/hour. The study estimated that adults. aged 30–69 years around

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

936 million have mild to severe obstructive sleep apneas and 425 million adults have moderate to severe obstructive sleep apneas globally. The number of affected individuals was highest in China, followed by the USA., Brazil, and India[2]. Another study has estimated OSAS prevalence of 3.6% in an Indian community-based sample rendering to over 36 million affected individuals and that when extrapolated to the overall population of over one billion in India, that carries a substantive public health significance.[4]

Obstructive sleep apnea syndrome(OSAS)[4],“ a disorder of breathing during sleep characterized by prolonged partial upper airway obstruction or intermittent complete obstruction that disrupts normal sleep patterns and is often associated with arousals, sleep fragmentation, intermittent hypoxia and hypercapnia along with serious neurobehavioral and cardio-respiratory consequences, along with excessive daytime sleepiness (EDS), growth failure, school failure, behavioral problems or cor-pulmonale, automobile accidents or even sudden death”[4].

Obstructive sleep apnea has been associated with a reduced-caliber upper airway, which, despite an increase in compensatory pharyngeal dilator muscle electromyographic output, is vulnerable to further narrowing or collapse.[5] With the availability of treatment options, the correct diagnosis of OSA has become more significant and fruitful for the community.

In the past decade, researchers in resource-constrained settings such as India have made concerted attempts, although OSA is still primarily unrecognized and undiagnosed. The current study was conducted to determine the best screening tool for OSA in a busy day-to-day OPD.

Materials and Methods: The present cross-sectional study was carried out among patients, who come under inclusion criteria, in the Department of Respiratory Medicine, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh. Duration of study was 1 NOV 2022- 31 OCT 2023

Subjects: Sample Size: The minimum sample size of the study is 76. By applying the formula $\mathbf{n= (4\times pq)\div l^2}$, where- n=sample size [4]

Inclusion Criteria:

1. Patients willing to give informed consent.
2. Age more than 18yrs.
3. All are apparently healthy attendants of patients.

Exclusion Criteria:

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

1. Subjects not willing to participate in the study.
2. Age <18ys.

Methodology:

A single-center cross-sectional study was conducted on consecutive and apparently healthy adult attendants with no complaints, who were attending Rohilkhand Medical College, and Hospital, Bareilly, Uttar Pradesh, India.

The attendants were interviewed face to face using screening tools (STOP-BANG score, Epworth-sleepiness scale, and Berlin Questionnaire), between 1st November 2022 to 31st October, 2023.

Body mass index (BMI) in kg/m^2 was calculated from height and weight recorded on proforma. Obesity was defined by the calculation of body-mass index according to classification (≥30 kg/m2) recommended by the World-Health-Organization (WHO)

The subjects were interviewed based on the Berlin Questionnaire (BQ) to elicit information from the subjects themselves and their partners about the occurrence. of snoring, cessation of breathing during sleep, tiredness, sleepiness while driving or any history of hypertension.

Some subjects and their partners were interviewed on the telephone to get appropriate information regarding snoring habits.

The excessive daytime sleepiness was also assessed by the Epworth sleepiness scale (ESS).

Categorization of the subjects into two groups (high-risk and low-risk) was done with the help of the questionnaires. Risk grouping for high-risk and low-risk for OSAS was based on responses grouped into three categories. Frequent symptoms (i.e., "more than three to four times per week or almost every day") in two or more questions about snoring and observed apneas were considered a positive score for high-risk in category 1. A positive score for high-risk in category 2 was obtained by answering "yes" to two or more questions about wake-time sleepiness, driving while drowsy, or waking up tired or sleepy after sleeping. In category-3, a positive score for high-risk was defined as the presence of hypertension and/or obesity (BMI 30 kg/m2).

To score “high-risk” for OSAS, an individual’s questionnaire should have had positive scores in two of the three categories, or in all three.

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

Those patients who denied having symptoms with such frequency or who qualified in only one category were placed into a lower-risk group. Neck size (in inches) was measured at the level of the cricoid cartilage.

Blood pressure measurement (in mm of Hg) was recorded in sitting and standing position after at least ten minutes of rest according to Joint National Committee (JNC)-7 criteria. Another recording was done further after ten minutes along with any previous history of any anti-hypertensive medication in case of first recording was found to be abnormal.

A specialized otorhinolaryngologist additionally checked each participant for upper airway anomalies, such as macroglossia, pharyngeal crowding, bulky uvula, retrognathia, tonsillar enlargement, and deviated nasal septum.

History regarding co-morbidities was asked for.

Informed written consent will be taken.

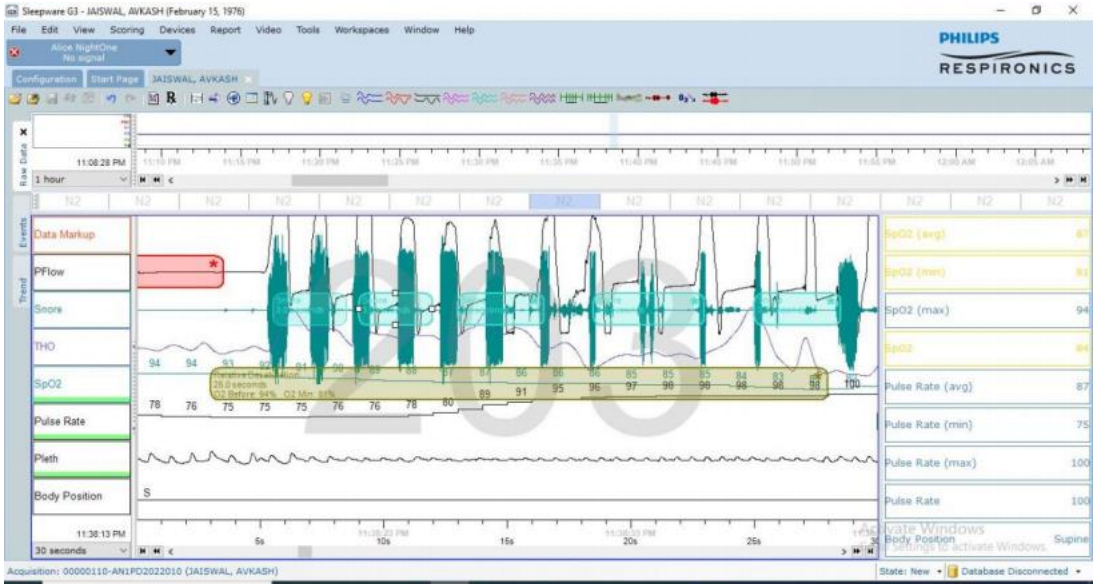
All the positive patients will be offered for polysomnography.

All consented subjects underwent overnight PSG within one week of screening by estimation of AHI scores.

And 30% of patients from low-risk were invited for PSG.

PSG was done using Alice NightOne device, Phillips.

Sleep study reports were recorded according to the latest AASM Guideline.



ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

Figure 1-A

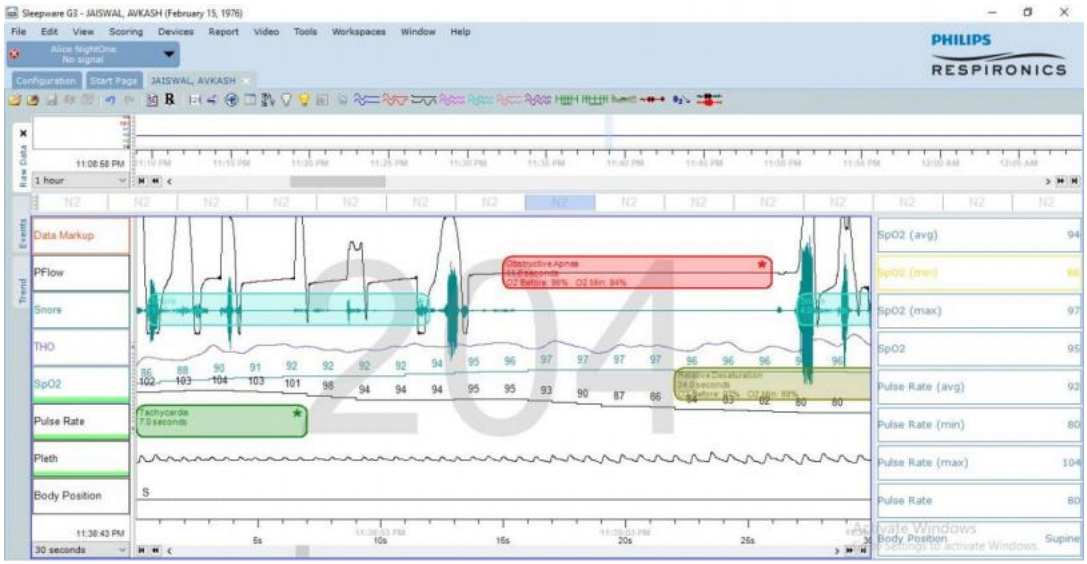


Figure 1-B

Figure 1-A & B: Epoch of a patient with OSA showing snoring and apneic episodes.

Statistical Analysis:

The data will be coded and entered, its clearing and compiling will be done on a Microsoft Excel spreadsheet and then it will be imported into Statistical Package for social sciences (SPSS) version 23 for statistical analysis. Data will be analyzed by applying frequency, percentage, mean, and standard deviation.

Results:

Out of 2118 subjects approached, 1832 participated for the screening of OSA (response rate 86.49%). Of them 12.06% were found to be at high risk and clinically significant OSA as per BQ. 166 (74.66%) of the subjects who consented for PSG, 90.36% were diagnosed- with OSA. During screening subjects categorised as low risk according to BQ and PSG was done on 313 consenting adult subjects, out of which 10.26% were diagnosed as OSA.

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

TABLE 1: BERLIN QUESTIONNARIE V/S OSA					
BERLIN QUESTIONNARIE	**OSA**	**Percentage (%)**	**NOT-OSA**	**Percentage (%)**	**TOTAL**
High Risk	150	90.36%	16	9.64%	166
Low Risk	32	10.26%	280	89.94%	312
Total	182	38.08%	296	61.92%	478
The p-value is less than 0.05, hence there is a significant association.					

BQ was found- to be more specific (S_P= 94.6%) than sensitive (S_N= 82.41%), with high PPV (90.36%) and NPV (89.75%).

Among 478 Polysomnography, 231 belonged to either High risk of PSG or, intermediate risk of PSG and were cumulatively grouped as high risk for calculation purposes, and among this group, 165 (71.43%) were found to have OSA. And 247 of the low-risk group participated in PSG, 17 (6.88%) were diagnosed as OSA.

TABLE 2: STOP-BANG SCORE V/S OSA					
STOP-BANG SCORE	**OSA**	**Percentage (%)**	**NOT-OSA**	**Percentage (%)**	**TOTAL**
High and Intermediate Risk	165	71.43%	66	28.57%	231
Low Risk	17	6.88%	230	93.12%	247
Total	182	38.08%	296	61.92%	478
The p-value is less than 0.05, hence there is a significant association.					

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

STOP-BANG score was found to be more sensitive (S_N= 90.66%) and specific (S_P= 77.7%). with higher NPV (93.12%) than PPV (71.42%).

Whereas, according to Epworth sleepiness score 164 subjects grouped as high risk 149 (90.85%) were found to have OSA with false positive in 15 (9.15%). And among the 314 categorised as low risk 33 subjects (10.51%) were found to have OSA. Hence, the Epworth sleepiness scale was found to be more specific (S_P= 94.6%) than sensitive (S_N=82.41%). with high PPV (90.85%) and NPV (89.49%).

TABLE 3: EPWORTH SLEEPINESS SCALE(ESS) V/S OSA

ESS	OSA	Percentage (%)	NOT-OSA	Percentage (%)	TOTAL
High Risk	149	90.85%	15	9.15%	164
Low Risk	33	10.51%	281	89.49%	314
Total	182	38.08%	296	61.92%	478

The p-value is less than 0.05, hence there is a significant association.

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

TABLE 4: Statistical analysis of questionnaire						
	EPWORTH SLEEPINESS SCALE		BERLIN QUESTIONNARIE		STOP-BANG SCORE	
Statistic	**Value**	**95% CI**	**Value**	**95% CI**	**Value**	**95% CI**
Sensitivity	81.87%	75.49% to 87.18%	82.42%	76.10% to 87.65%	90.66%	85.47%- 94.46%
Specificity	94.93%	91.78% to 97.14%	94.59%	91.37% to 96.88%	77.70 %	72.53% - 82.32%
Positive Likelihood Ratio	16.16	9.82 to 26.58	15.25	9.42 to 24.67	4.07	3.27-5.05
Negative Likelihood Ratio	0.19	0.14 to 0.26	0.19	0.14 to 0.25	0.12	0.08 to 0.19
Disease prevalence (*)	38.08%	33.70% to 42.60%	38.08%	33.70% to 42.60%	38.04%	33.24% to 43.01%
Positive Predictive Value (*)	90.85%	85.79% to 94.23%	90.36%	85.28% to 93.82%	71.42%	66.79% - 75.66%
Negative Predictive Value (*)	89.49%	86.20% to 92.07%	89.74%	86.45% to 92.31%	93.12%	89.55% to 95.53%

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

Discussion: Although OSA is a common disease[4] with multiple comorbidities[6], still primarily remains unacknowledged. The current study was conducted to know the best screening tool for OSA in a busy day-to-day OPD.

The Epworth sleepiness score was proven to be an effective tool for OSA by **Morsy N et al. (2017)[7]**, and the Berlin questionnaires and the STOP-BANG score were found to be the most effective measures for predicting moderate to severe OSA by **Miller JN et al. (2016) [8]**. **Nagappa M et al. (2015)[9] & Xiong M et al. (2017)[10]** concluded STOP-BANG score to be the better screening tool than ESS and BQ for OSA**. Zheng Z et al. (2011)[11] concluded** BQ can be considered a priority for the screening and stratifying of hypertensive patients suspected of OSA. Showing the conflict between the efficiency and efficacy of these screening systems. Therefore, these three scoring methods (ESS, STOP-BANG score, and BQ) were applied to each participant in the index research to determine the most ef fective and convenient OSA screening technique in a busy OPD.

In our study conducted over 1832 subjects, 12.06% were found to be at high risk and clinically significant OSA as per BQ. 164 (74.66%) subjects who consented to PSG among the high-risk category, 90.36% were diagnosed with OSA. During screening 87.93% were categorized as low risk according to BQ and PSG was done on 312 consenting adult subjects, out of which 10.25% were diagnosed as OSA. **Singh A et al., (2017)[4]** in a study on the semi-urban population found High-risk category as per BQ predicted an AHI ≥5/hr with a sensitivity of 86.3%, specificity of 93.1%, positive and negative predictive values of 70.9% and 97.2%, respectively**.** Similarly in the index study we concluded, BQ was found to be more specific (S_P= 94.6%) than sensitive (S_N= 82.41%), with high PPV (90.36%) and NPV (89.75%). Similarly, a meta-analysis by **Amra B et al**. **(2018)[13]** concluded that the PPV of BQ ranged from 11.5% to 91% at AHI ≥ 5 events/hour.

Among ESS-classified high-risk subjects, 90.85 % were diagnosed with OSA, and out of low-risk category, 10.5% were found to have OSA. ESS was found to be more specific (S_P= 94.93%) than sensitive ($S_{N=}$ 81.86%), with PPV = 90.85% and NPV =89.49%. ESS was found to be more specific similar to BQ and in contrast to the STOP-BANG score, which was found to be more sensitive but specific.

STOP-BANG score grouped high risk subjects who went through PSG, 89.33% were diagnosed to have OSA and among intermediate group 38.27% had OSA. Those in low risk

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

group only 6.88% were diagnosed. with OSA. Contradictory to ESS, STOP-BANG score was found to be more sensitive (S_N=90.66%) but, specific (S_P=77.7%), with PPV=71.42% and high NPV= 93.12%. Similarly in a research conducted by **Amra B et.al. (2018)[13]** concluded that STOP-BANG score had the highest sensitivity (range from 81.08% to 97.55%) among the three screening systems discussed above.

All the three scoring systems were found to have strong diagnostic correlation with OSA (p-value 0.000) in our study.

Conclusion:

We found the STOP-BANG score, Epworth score, and Berlin Questionnaire to be reliable for screening of OSA and were found to be highly sensitive and specific. Keeping in consideration the lesser number of parameters in the STOP-BANG score, hence, less time is taken to predict the risk for OSA. Also, the STOP-BANG score has more objective parameters than ESS and BQ. We found the STOP-BANG score to be more sensitive than the Epworth score and Berlin Questionnaire in evaluating the risk of OSA. Hence, it was concluded that the STOP-BANG score is the best screening tool in a busy day-to-day OPD.

As OSA significantly increases mortality and morbidity in the general population which can be reduced to a reasonable extent by just lifestyle modification[11]. Hence making the need for awareness campaigns more rational.

As most of the subjects are patient attendants there by not represent the actual proportion of the community and the findings had to be generalized by conducting the community-based survey. Therefore, further studies are still needed on a larger sample size and from different regions of India.

References:

1. Young T, Palta M, Dempsey J, Peppard PE, Nieto FJ, Hla KM. Burden of sleep apnea: rationale, design, and major findings of the Wisconsin Sleep Cohort study. WMJ: official publication of the State Medical Society of Wisconsin. 2009;108(5):246-9.
2. Benjafield AV, Ayas NT, Eastwood PR, Heinzer R, Ip MS, Morrell MJ, Nunez CM, Patel SR, Penzel T, Pépin JL, Peppard PE. Estimation of the global prevalence and

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

burden of obstructive sleep apnoea: a literature-based analysis. The Lancet Respiratory Medicine. 2019;7(8):687-98

3. Duce B, Milosavljevic J, Hukins C. The 2012 AASM respiratory event criteria increase the incidence of hypopneas in an adult sleep center population. Journal of clinical sleep medicine. 2015;11(12):1425-31.
4. Singh A, Prasad R, Garg R, Kant S, Hosmane GB, Dubey A, Agarwal A, Verma RK. A study to estimate prevalence and risk factors of obstructive sleep apnoea syndrome in a semi-urban Indian population. Monaldi Archives for Chest Disease. 2017 May 18;87(1).
5. Ausiello DA, Benos DJ, Abboud F, Koopman W, Epstein P. Obstructive Sleep Apnea. Ann Intern Med. 2005;142:187-97.
6. Testelmans D, Spruit MA, Vrijsen B, Sastry M, Belge C, Kalkanis A, Gaffron S, Wouters EF, Buyse B. Comorbidity clusters in patients with moderate-to-severe OSA. Sleep and Breathing. 2022 Mar;26(1):195-204.
7. Morsy N, Badawy A, Abdelhafeez S, El-Gilany AH, ELshafey M. Predictors of sleep disordered breathing in commercial drivers, a study from Egypt.2017;3(1)1-7.
8. Nagappa M, Liao P, Wong J, Auckley D, Ramachandran SK, Memtsoudis S, Mokhlesi B, Chung F. Validation of the STOP-Bang questionnaire as a screening tool for obstructive sleep apnea among different populations: a systematic review and meta-analysis. PloS one. 2015 Dec 14;10(12):e0143697.
9. Xiong M, Hu W, Dong M, Wang M, Chen J, Xiong H, Zhong M, Jiang Y, Liu D, Hu K. The screening value of ESS, SACS, BQ, and SBQ on obstructive sleep apnea in patients with chronic obstructive pulmonary disease. International Journal of Chronic Obstructive Pulmonary Disease. 2019 Nov 13:2497-505
10. Zheng Z, Sun X, Chen R, Lei W, Peng M, Li X, Zhang N, Cheng J. Comparison of six assessment tools to screen for obstructive sleep apnea in patients with hypertension. Clinical Cardiology. 2021 Nov;44(11):1526-34.

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 09, 2024

11. Gamaldo C, Buenaver L, Chernyshev O, Derose S, Mehra R, Vana K, Walia HK, Gonzalez V, Gurubhagavatula I, OSA Assessment Tools Task Force of the American Academy of Sleep Medicine. Evaluation of clinical tools to screen and assess for obstructive sleep apnea. Journal of Clinical Sleep Medicine. 2018 Jul 15;14(7):1239-44.
12. Amra B, Rahmati B, Soltaninejad F, Feizi A. Screening questionnaires for obstructive sleep apnea: an updated systematic review. Oman medical journal. 2018 May;33(3):184.