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Prevalence of high risk for obstructive sleep apnea using STOP-Bang questionnaire in urban Thai population: A pilot study

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Background : *The STOP-Bang is a widely used simple questionnaire that was validated to screen obstructive sleep apnea (OSA) in many groups of patients. It can be beneficial for determining the prevalence of high risk for OSA in urban Thai population.*

Objective : *To determine the prevalence of high risk for obstructive sleep apnea (OSA) in urban Thai population by utilizing the STOP-Bang questionnaire.*

Material and Method : *Anonymous survey on adult at least 18 years of age was conducted at Health & Wellness exhibition, Bangkok, Thailand. The STOP-Bang questionnaire was utilized in the survey. The questionnaire consists of four simple yes/no questions including snoring, tiredness, observed apneas, blood pressure, and four clinical characteristics which were dichotomized according to specified cutoffs; BMI > 35, age > 50 years, neck circumference >40cm, and gender = male. Score at least 3 were considered as high risk for OSA. Epworth sleepiness scale (ESS) as well as detailed demographic information related to several aspects of sleep was also obtained.*

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Results : *The study included 414 Thai adults. The mean ± SD age of the participants was 51.6 ± 11.6 years old. Of the 414 participants, 305 participants (76%) were classified as high risk for OSA. High risk for OSA group was observed to have more male (88%). The STOP-Bang group yielded a mean score of 3.65. One hundred and seventy-two participants (41%) were noted to have excessive daytime sleepiness (ESS score ≥ 10). There was a significant correlation between STOP-Bang questionnaire score and Epworth sleepiness scale score (p <0.05, r = 0.267). Over 70% of the participants were identified as having high risk for OSA based on the STOP-Bang questionnaire.*

Conclusion : *High prevalence was observed in urban Thai population using STOP-Bang questionnaire. Considering the serious adverse health and quality of life consequences of OSA, screening for OSA in general populations should be attempted.*

Keywords : *STOP-Bang questionnaires, obstructive sleep apnea, sleep apnea screening, sleepiness.*

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เหตุผลของการทำวิจัย : *แบบสอบถาม STOP-Bang เป็นแบบสอบถามที่ใช้ง่าย และแพร่หลาย และมีที่ใช้ในการหาความเสี่ยงต่อภาวะนอนหยุดหายใจแบบอุดกั้นในผู้ป่วยกลุ่มต่าง ๆ แบบสอบถามนี้น่าจะสามารถใช้เพื่อหาความชุกของผู้มีความเสี่ยงสูงต่อภาวะนอนหยุดหายใจแบบอุดกั้น ในประชากรไทยเขตเมือง*

วัตถุประสงค์ : *เพื่อหาความชุกของภาวะความเสี่ยงสูงต่อโรคนอนหยุดหายใจแบบอุดกั้น (OSA) ในประชากรในเขตเมืองขาวไทย โดยใช้แบบสอบถาม STOP-Bang*

วัสดุและวิธีการ : *เก็บข้อมูลจากอาสาสมัครที่มาร่วมงานนิทรรศการ Health & Wellness Exhibition ที่กรุงเทพมหานคร ประเทศไทย โดยใช้แบบสอบถาม STOP-Bang ซึ่งประกอบด้วยคำถาม 4 ข้อ และการประเมินทางคลินิกอีก 4 ข้อ ซึ่งต้องการคำตอบว่าใช่ หรือ ไม่ หากตอบว่าใช่ เท่ากับ 1 คะแนน สามคะแนนขึ้นไป ถือว่ามีภาวะเสี่ยงสูงต่อโรค OSA นอกจากนี้ มีการใช้แบบสอบถามเพื่อทดสอบความง่วงนอน Epworth Sleepiness Scale (ESS) และลักษณะทางคลินิกต่าง ๆ ร่วมประเมินด้วย*

ผลการศึกษา : *การศึกษาประกอบด้วยอาสาสมัครชาวไทย 414 คน อายุเฉลี่ย เท่ากับ 51.6 ± 11.6 ปี มีอาสาสมัครจำนวน 305 คน (76%) ที่จัดอยู่ในกลุ่มมีภาวะเสี่ยงสูงต่อ OSA ส่วนใหญ่เป็นเพศชาย (88%) คะแนนเฉลี่ยของแบบสอบถาม เท่ากับ 3.65 มีอาสาสมัครจำนวน 172 ราย (41%) ที่มีภาวะง่วงนอนมากกว่าปกติ จากการตอบแบบสอบถาม ESS พบความสัมพันธ์ระหว่างคะแนนจากแบบสอบถาม STOP-Bang และแบบสอบถาม ESS ($p < 0.001$, $r = 0.267$)*

สรุป : *พบภาวะเสี่ยงต่อ OSA ในชาวไทยเขตเมืองสูงถึง 70% เนื่องจากโรคนี้ส่งผลกระทบต่อสุขภาพอย่างมาก การคัดกรองโรค OSA ในประชากรกลุ่มนี้จึงมีความสำคัญ*

คำสำคัญ : *แบบสอบถาม STOP-Bang, ภาวะนอนหยุดหายใจแบบอุดกั้น, การคัดกรองภาวะนอนหยุดหายใจแบบอุดกั้น, ภาวะง่วงนอนมากผิดปกติ.*

Obstructive sleep apnea (OSA) is a common sleep disorder. The prevalence of OSA was estimated up to 18% in the Sleep Heart Health study; one of the largest population based study. [1] The untreated severe OSA can cause a significant increase in cardiovascular mortality [2], as well as a decrease in the quality of life.[3] Currently, so far there has been only one publication on the prevalence of OSA in Thailand which has an estimated overall prevalence of 11.4%. [4] One of the difficulties of assessing the prevalence is that the gold standard for diagnosis of OSA remains the in-laboratory attended polysomnography (PSG).[5] In-laboratory attended PSG is expensive and its availability is limited due to long waiting time. Unattended portable monitoring (PM) has been utilized as an alternative diagnostic test for OSA. However, there are multiple drawbacks of PM use include the need for qualified personnel, transportation problems, and high failure rate from signal loss resulting in the need to repeat the study. The cost of PM may be nearly as expensive as in-laboratory attended PSG in Thailand. [6]

The STOP-Bang is a widely used simple questionnaire. It was initially validated to screen OSA in preoperative patients[7], multiple sclerosis patients[8], the patients presenting to a sleep disorders unit [9], and recently in preoperative obese patients. [10] In a systematic review of screening questionnaires for OSA, this questionnaire had the highest methodological quality and sensitivity.[11] A score of 3 or more has been shown to have a high sensitivity for detecting OSA [7] and a score of 5 - 8 predicted moderate/severe OSA with high probability.[12] The questionnaire is also easy to be interpreted and remembered.

Because of the profound consequences resulting from OSA, initiating early diagnosis and treatment by early screening is important. Early OSA treatment may improve overall health status and quality of life. The main objective of our study was to identify the prevalence of high risk for OSA in Thai population using the STOP-Bang questionnaire.

Material and Method

This study was performed at the Thailand Health and Wellness Exhibitionat Impact, Muang Thong Thani, Nonthaburi, Thailand between 26th July and 29th July 2012.The exhibition was held yearly, providing general health knowledge to the general Thai participants. The study was conducted as a pilot study. Random sample was obtained from participants who aged more than 18 years old, were in the exhibition and consented to participate in the study after the invitation. Patients' demographic data, Epworth sleepiness scales (ESS), and STOP Bang score were obtained. The study has been approved by the Institutional Review Board (IRB), Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand.

Demographics

Participant's characteristics such as age and gender were recorded. The participant's height and weight were also measured and recorded so that the body mass index (BMI) (weight in kilograms divided by height in meters squared) could be calculated. The participant's neck circumference (measured at the level of cricoid cartilage) was also measured in centimeters and recorded by one of the research assistants.

Epworth sleepiness scale

The ESS is a commonly-used eight-item questionnaire that measures subjective daytime sleepiness. [13] The Thai version of ESS, which was validated, was permitted to use in our study.[14] The subjects were asked to rate how likely they are to fall asleep in different situations. Every question was answered on a scale of 0 - 3. ESS values range from 0 (unlikely to fall asleep in any situation) to 24 (high chance of falling sleep in all eight situations). ESS values of at least 10 indicate excessive daytime sleepiness.[15, 16]

STOP-Bang questionnaire[7]

The questionnaire consisted of four simple yes/no questions; snoring, tiredness, observed apneas, high blood pressure in which one point awarded for each 'yes' answer, and four clinical characteristics which were dichotomized according to specified cutoffs; BMI > 35, age > 50 years, neck circumference >40cm, gender = male. Participants who could understand English language were invited to complete the questionnaire by themselves. On the other hand, participants who could not understand English were assisted by our research assistance to complete the questionnaire. The clinical characteristics portion of the questionnaire was completed by one of the research assistants. High risk for sleep disorder breathing was defined as three or more 'yes' answers to the eight STOP-Bang items. Low risk was denied as two or fewer 'yes' answers. In the original study, the sensitivities of this questionnaire for detecting different severities of OSA defined by AHI>5, >15, and >30 were 83.6%, 92.9%, and 100%; respectively.

Statistics

The participants' characteristic data are presented with descriptive statistics as mean +/- standard deviation for normally distributed variables or median (interquartile ranges) for non-normally distributed variables. To identify the correlation between STOP-Bang scores and ESS scores, the data were evaluated by Pearson's correlation test, which were analyzed as continuous scores. All statistical analyses were conducted using Minitab® Statistical Software (Minitab 16, Minitab Inc, State College, Pennsylvania, USA).

Results

A total of 428 participants participated in the study. Thirteen participants did not answer all the questions in the questionnaire and one participant was excluded because of age less than 18 years old. Total of 414 adults were included in the study. One hundred and eighty (43.5%) were female and 234 (56.5%) were male. The participants' age ranged between 18 - 82 years old. The mean age of the participants was 51.6 ± 11.6 years old. The clinical characteristic of the participants are described in Table 1.

The positive response for each question in STOP Bang is described in details in Table 2. The use of STOP-Bang screening questionnaire identified 305 participants (76%) as high risk for OSA. The STOP-Bang yields a mean score of 3.65 ± 1.62. Of the 414 participants, 288 (69%) reported snoring. Witnessed apneas were common, with 134 participants (32%) reporting observed breathing pauses during sleep by their bed partner. Sleepiness symptoms were also common, with a total of 299 (72%) reported tired, fatigue or sleepy feeling during daytime. However, only

172 (41%) participants scored ESS at least 10. For gender difference analysis, 88% of male participants were screened as at high risk on the STOP-Bang questionnaire versus 55% of female participants, with males having a higher overall mean score of 4.38 versus 3.3 in females.

Table 1. Patient Characteristics.

Variable	Mean ± SD
Age	51.6 ± 11.6
BMI	25.9 ± 4.1
Epworth sleepiness scale	9 ± 4.5
Neck circumference (cm)	37.3 ± 3.9

Variable	No. (%)
Age (years)	
18-30	28 (6.7)
31-45	88 (21.3)
45-60	201 (48.6)
> 60	97 (23.4)
Male gender	234 (56.5)
Female gender	180 (43.5)
BMI	
Underweight (BMI < 18.5)	5(1.2)
Normal (BMI 18.5-22.9)	96 (23.2)
Overweight : at risk (BMI 23-24.9)	89 (21.5)
Overweight : Obese I (BMI 25-29.9)	170 (41.1)
Overweight : Obese II (BMI ≥ 30)	54(13)

Table 1. legend
Numbers represent Mean ± S.D.
BMI = body mass index

Table 2. Questionnaire characteristics.

Questionnaire	No./ (%) of patients answering yes	
S: Do you snore loudly	288	(69%)
T: Do you often feel tired, fatigued, or sleepy during daytime?	299	(72%)
O: Has anyone observed you stop breathing during your sleep	134	(32%)
P: Do you have high blood pressure?	144	(34%)
B: BMI>35?	41	(10%)
A: Age>50?	253	(61%)
N: Neck circumference >40 cm?	115	(27%)
G: Gender male?	238	(57%)

Table 2. legend
Numbers represent numbers and percentages in each question that the patients answered yes.
BMI = body mass index

The risk of OSA as determined by STOP-Bang score increased linearly with increasing age, as shown in Figure1.

Mean ESS in our sample was 9 with 41% of subjects scored at least 10, suggestive of excessive daytime sleepiness. Significant correlation between STOP-Bang score and Epworth sleepiness scale has been shown (r = 0.267, p < 0.001, Figure 2).

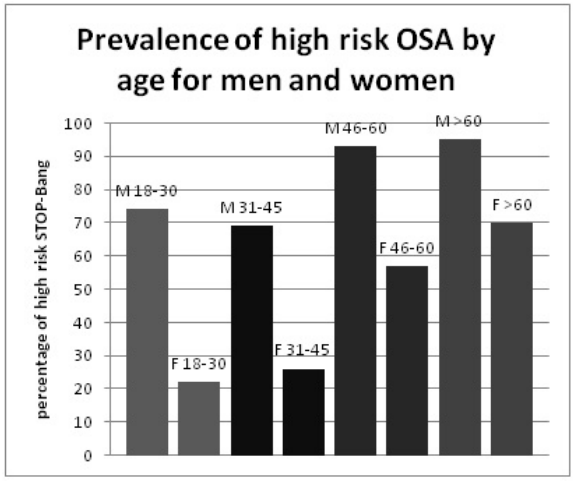

Figure 1. Prevalence of high risk for obstructive sleep apnea (OSA) by age for men and women.

M 18 - 30 = Male aged between 18 - 30 years old
F 18 - 30 = Female aged beween 18 - 30 years old
M 31 - 45 = Male aged between 31 - 45 years old
F 31 - 45 = Female aged between 31 - 45 years old
M 46 - 60 = Male aged between 46 - 60 years old
F 46 - 60 = Female aged between 46 - 60 years old
M >60 = Male aged more than 60 years old
F >60 = Female aged more than 60 years old

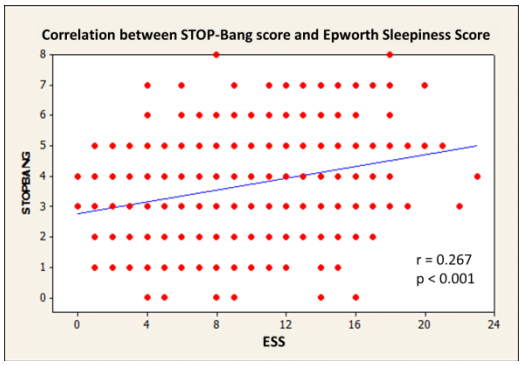

Figure 2. Correlation between STOP-Bang score and Epworth Sleepiness Scale score (ESS).

Discussion

STOP-Bang is a well-known validated screening tool for OSA. The clinical utility of STOP-Bang screening tool has been confirmed in many studies.[7-10] This screening tool has high sensitivity and high negative predictive value, and also easy to remember and score. A recent systemic review by Abrishami *et al* demonstrated superiority of this questionnaire among the use of other questionnaires such as the Berlin questionnaire, the Wisconsin questionnaire, and the Sleep Apnea scale of the Sleep Disorders questionnaire.[11]

Our study demonstrates that Thai urban population may have a large proportion (76%) of high risk for OSA based on the STOP-Bang questionnaire. The study reflects that OSA may be under diagnosed in our urban Thai population. An effort for OSA screening in this adult population might be essential. The Thailand Health & Wellness fair is an exhibition which aimed to promote good health for Thai people. Most of the participants are generally healthy Thai people. However, subjects who participated in the study might be at higher risk than general population indicated by relatively high BMI, which is common in urban population. Most of participants in our study were obese indicated by BMI at least 25 according to Asia Pacific criteria.[17] Mean BMI observed in our study was relatively high (25.94 ± 4.15). Participants who snore may also be easier to be invited than participants who do not. Additionally, it should be noted that a positive STOP-Bang score does not translate to OSA diagnosis since polysomnography was not performed in our study. However if we were to use higher cut off STOP Bang score of 5; in order to improve the specificity of STOP Bang questionnaire[12]; we still reported a high prevalence for OSA at 49% (46% in male and 6% in female). Our result demonstrates higher percentage of high risk for OSA than most previous studies. Using Berlin questionnaire, 26% of 1,506 community based respondents met the criteria indicating high risk for OSA. [18] Using STOP-Bang, Vasu found 41.5% to be at high risk for OSA in 135 pre-operative patients undergoing elective operation.[19] Dias demonstrated 42% of high risk for OSA in 103 multiple sclerosis patients.[8] Ong reported 77.3% of high risk for OSA by the STOP-Bang questionnaire in 319 patients undergoing diagnostic polysomnography.[9] Despite our study reported comparable result to Ong's study; however Ong's study was conducted in patients undergoing diagnostic polysomnography indicated that those patients were already suspected to have OSA, unlike our study which was conducted in urban population and represented truly high prevalence of OSA among this group.

Besides higher BMI demonstrated in our study population, there was also slightly higher number of males in our study (56.5%). More males were classified as high risk for OSA on the STOP-Bang questionnaire when compared to female (88% versus 55%). This finding is consistent with the previous population-based studies, which reported a two-to three fold greater risk for OSA in males compared to females. [3, 20] The gender difference may be explained by several factors including location of body fat distribution and anatomical airway differences.[3, 20]

Sleepiness is common in our study; with 41% scoring at least 10 on the ESS and 72% reported feeling tired, fatigued, or sleepy on the STOP-Bang

questionnaire. We also demonstrate significant correlation between STOP-Bang questionnaire and ESS. However, the correlation was rather weak with r value of only 0.2. Findings from most previous studies showed that the ESS scores were poor predictors of OSA diagnosis in terms of AHI.[8, 21, 22] The ESS has been found to be relatively insensitive with reported sensitivity of 66% using cut off value of 10.[22] Clinicians should not overlook the possibility of having OSA in patients who do not report excessive daytime sleepiness as indicated by the ESS.

Our major limitation of this study is that the scores on STOP-Bang questionnaire were not validated with polysomnography to determine the sensitivity and specificity of these screening instruments. The aim of the study was to determine whether OSA was a potential problem in our Thai urban population. Although this STOP-Bang questionnaire has already been validated in Singaporean with relatively similar characteristics to urban Thais [9], without further validation, it cannot be concluded that a positive STOP-Bang score is equivalent to OSA diagnosis. Further validation of the results of this survey with polysomnography should be performed in the future.

Conclusion

In summary, our study demonstrates that over 70% of Thai urban populations may be at high risk for OSA based on the STOP-Bang questionnaire. Given the negative health impact of untreated OSA; it is important to screen for OSA in urban population and provide early diagnosis and treatment to improve their overall health status and quality of life.

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Potential Conflicts of Interest

The authors, hereby, declare no conflict of interest in the study.

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