ORIGINAL ARTICLE

Proportion and Factors Associated Obstructive Sleep Apnoea (OSA) Risk Among Adults in Sepang: A Cross-sectional Study

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ABSTRACT

Introduction: Sleep is often viewed by the general public as a "perceptual hole in time" where it is the period in which nothing productive occurs. However, sleep is an important part of health which affects mental and physical health. Sleep-disordered breathing (SDB) encompasses a range of respiratory disorders that are distinguished by intermittent pauses in breathing during the sleep cycle. This includes obstructive sleep apnoea (OSA), a global disease with a rising incidence along with its comorbidity. OSA creates an impact on the quality of life as it is associated with multiple negative implications which include neurocognitive problems and increases the risk of cardiometabolic diseases. This article illustrates the importance to determine the proportion of patients in the district of Sepang who are at high risk of obstructive sleep apnoea (OSA) and its determinants. **Method:** A cross-sectional study was carried out among individuals aged 18 years and above in Sepang district Malaysia. Using systematic random sampling, 521 participants were recruited. The questionnaire given gathered respondents information regarding their socio-demography, clinical profiles, and the STOP-BANG questionnaire was used to screen for OSA. **Result:** Almost a third of the participants (30.3%) were at risk of having OSA. It is found that the predictors for having OSA are menopausal women (AOR: 2.46; 95% CI: 1.22, 4.93; p = 0.011) and having large waist circumference measurement (AOR: 1.07; 95% CI: 1.04,1.10; p <0.001). **Conclusion:** The findings in this study will help healthcare workers to detect early patients at risk of OSA with the aid of STOP-BANG questionnaire.
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Keywords: OSA, sleep-disordered breathing, primary care, the risk factor of OSA, apnoea

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INTRODUCTION

Sleep is an important part of human health. It can affect mental and physical health if there is insufficient sleep or poor sleep quality (1). Sleep-disordered breathing (SDB) encompasses a range of respiratory disorders that are distinguished by intermittent pauses in breathing during the sleep cycle. Obstructive sleep apnoea (OSA) is one form of SDB and it is a global disease with a rising incidence along with its comorbidity. The American Academy of Sleep Medicine (AASM) had defined OSA as a sleep-related breathing disorder that has partial (hypopnea) or complete (apnoea) cessation of airflow even with one's own effort to breathe (2). The disruption in airflow lasts commonly between 10 and 30 seconds and may even persist for 1 minute or longer during sleep (3). In OSA, the collapsing of the upper airway repetitively leads to snoring, frequent episode

of sleep interruption, hypoxemia, hypercapnia, swings in intrathoracic pressure, and increase sympathetic activity (4). Multiple risk factors are found to be associated with OSA such as male gender, age, larger neck circumference, comorbidities such as diabetes mellitus and hypertension, and most importantly obesity (5). Those who are either symptomatic and asymptomatic with OSA found to be at risk of increased in morbidity and mortality (6). The gold standard for diagnosing OSA is polysomnography (PSG), which is both time-consuming and costly (7). OSA screening tool is important to be used for assessing a patient who is at risk of OSA and referring them for further diagnostic tests and treatment. The failure to diagnose and treat OSA can have a significant impact on an individual's quality of life, as this condition has been linked to various negative outcomes, including neurocognitive impairment and an increased risk of developing cardiovascular and metabolic disorders (8). Primary care as the first point of contact plays an important role in providing screening and preventive measures especially in diseases related to cardiovascular health. OSA has been described as a serious issue in public health due to

its significant impact on healthcare systems and society. In patients with OSA, morbid obesity is commonly the clinical feature. However, this feature is not seen in the general population with undiagnosed OSA. Primary care screening and assessment of OSA is reported to be ineffective and fragmented (9). This study aims to determine the number of attendees in the outpatient department of Klinik Kesihatan (KK) Salak, who were at risk of having obstructive sleep apnoea (OSA), and it's related factors using the STOP-BANG questionnaire. Comparatively to other local studies, this study had used a readily available screening tool with high sensitivity and specificity and focused more to those who attended the primary health care clinic.

MATERIALS AND METHODS

Study design
From January to March 2022, a cross-sectional study was conducted in a primary care clinic located in Sepang District. Klinik Kesihatan (KK) Salak is the largest health clinic in the district of Sepang and receives the highest number of patient visits in a month compared to other health clinics within the district.

Participants
All Malaysians aged 18 years old and above who attended to the primary care clinic were eligible to participate. Those with underlying psychiatric illness, known to have OSA and documented medical illness such as acromegaly, hypothyroid disease and other sleep disorder were excluded.

Sample size and sampling
The sample size of 548 was determined using a 2 sample proportion formula for comparing means between two independent groups, while also accounting for the potential impact of non-responders. This calculation was based on a study by Mathiyalagen et al in 2019. (10). In this study, a systematic random sampling method was used to ensure appropriate population distribution and have a higher level of precision. Every 13th patient attending the clinic were selected systematically everyday over 60 working days.

Data collection
Participants were selected by the site researcher and provided with written information about the study after being briefed on its purpose. Both written and verbal consent were obtained from participants prior to recruitment. A pre-tested questionnaire was then distributed, and all completed questionnaires were reviewed for completeness. To maintain anonymity, no personal information was collected through the questionnaire. Consent forms containing personal information were stored separately.

Study instrument
A self-administered questionnaire which consisted of 3 sections: 1) socio-demographic profile, 2) clinical profile and examination for risk, and 3) the STOP-BANG questionnaire to screen for OSA was used. Other information needed such as measurement of neck circumference, waist circumference, height, and weight were measured by a trained researcher. The questionnaire was translated and back translated to produce a Bahasa Malaysia version. The STOP-BANG questionnaire in Bahasa Malaysia has been validated by Abdullah et al in 2018.(11) This version has a 61.42% sensitivity, 71.05% specificity, 84.06% positive predictive value, and a 41.54% negative predictive value. It is found to a validated and helpful tool in aiding to identify those at risk for OSA needing further assessments and management. Prior to the start of the study, 40 health care providers from Hospital Pengajar Universiti Putra Malaysia (HPUPM) were enrolled into a pilot study. This was to assess the translated version's face validity, where some wordings were changed without changing its meaning based on the feedbacks given. The complete questionnaire given to the participants was in both English and Bahasa Malaysia.

Data analysis
The data collected was carefully reviewed and then entered into Statistical Package for Social Sciences (SPSS) version 26.0 for analysis. Normality testing was conducted on all continuous data, which was found to be non-normally distributed. Therefore, all results were reported as median and interquartile range (IQR). Factors that exhibited a p-value of less than 0.25 in the bivariate analysis were included in the multiple logistic regression (MLR). Results from the MLR were presented as coefficients and 95% confidence intervals, with a significance level of $p < 0.05$.

Ethical approval
The Medical Research Ethics Committee granted ethical approval for this study (NMRR-21-68-58202). Written informed consent were obtained from each participants.

RESULTS

A total of 548 patients were approached. However, 521 patients were recruited. Those who were not recruited either disagreed to participate or were told to have OSA, giving a response rate of 95%.

The median age of the participants was 52 (21.50) years old. Majority of them were female (59.5%), Malay (88.7%), married (75.4%) and at least had secondary education (64.3%). According to STOP-BANG questionnaire, 30.3% indicated were at high risk of OSA while 69.7% were at low risk of OSA. Table I describes the sociodemographic of respondents.

Factor associated with obstructive sleep apnoea (OSA)
Bivariate analysis demonstrated male (crude OR= 4.07, 95% confidence interval [CI]: 2.75, 6.05, p<0.001),

Table I: Sociodemographic and clinical profiles of participants at risk of developing OSA in KK Salak. (N=521)

Characteristics (N=521)	n (%)	Median (IQR)	Mean (SD)
Age		52.00 (21.50)	
Gender			
Male	211 (40.5)		
Female	310 (59.5)		
Ethnicity			
Malay	462 (88.7)		
Chinese	15 (2.9)		
Indian	44 (8.4)		
Highest education			
None	8 (1.5)		
Primary school	57 (10.9)		
Secondary school	335 (64.3)		
College/university	121 (23.2)		
Marital status			
Single	68 (13.1)		
Married	393 (75.4)		
Widow	60 (11.5)		
Occupational status			
Unemployed	199 (38.2)		
Employed	251 (48.2)		
retiree	71 (13.6)		
Monthly household income			
Less than equal to RM 4360	426 (81.8)		
Between RM4361 to RM 9619	71 (13.6)		
More than equal to RM 9620	24 (4.6)		
Smoking status			
yes/once	91 (17.5)		
no	430 (82.5)		
Alcohol usage status			
yes/ once	14 (2.7)		
no	507 (97.3)		
Menopausal status			
yes	172 (33)		
no	139 (26.7)		
not applicable	210 (40.3)		
Diabetes Mellitus			
yes	170 (32.6)		
no	351 (67.4)		
Hypertension			
yes	295 (56.6)		
no	226 (43.4)		
Asthma			
yes	21 (4.0)		
no	500 (96.0)		
Allergic rhinitis			
yes	25 (4.8)		
no	496 (95.2)		
Height		158.00 (11.75)	
Weight		70.00 (21.75)	
BMI		28.00 (7.65)	
BMI categories			
Underweight & Normal weight	76 (14.6)		
Overweight	170 (32.6)		
Obese	275 (52.8)		
Systolic Blood Pressure		136.00 (22)	
Diastolic Blood Pressure			81.00 (±11.26)
Neck circumference		39.00 (3.50)	
Waist circumference		88.00 (15.00)	

married (crude OR= 3.43, CI: 1.65, 7.13, p<0.001), older age (crude OR= 1.04, CI: 1.03, 1.06, p<0.001), smokers (crude OR= 2.19, CI: 1.38, 3.49, p<0.010), alcohol user (crude OR= 4.33, CI: 1.43,13.12, p=0.010), being menopause (crude OR= 1.97, CI: 1.08, 3.59, p= 0.025) and having hypertension (crude OR= 5.57, CI: 3.53, 8.81, p<0.001) were associated with having a high risk of OSA. It was also supported that being in the obese category (crude OR= 6.88, CI: 3.05, 15.5, p<0.001), having wider neck circumference (crude OR= 1.43, CI: 1.31, 1.56, p<0.001), and wider waist circumference (crude OR= 1.07, CI: 1.05, 1.09, p<0.001) were also associated with having a high risk of OSA.

Multiple logistic regression revealed that menopausal women had 2.46 times odd of developing high risk of OSA (adjusted OR 2.46, CI: 1.22, 4.93, p= 0.011) and those larger waist circumference had 1.07 times the odds to develop high risk of OSA (Table II). One-unit increase in waist circumference is seen to increase the odds 1 times for having high risk of OSA (adjusted OR = 1.07, CI: 1.04, 1.10, p<0.001).

DISCUSSION

The present study revealed that nearly one-third (30.3%) of respondents were identified as having a high risk of OSA. This contrasts with the study conducted by Ramli et al. in Kuantan which Berlin questionnaires was used as a screening tools, in which only 18.5% of respondents were found to be at high risk of OSA.(12) The variation in results might be attributed to the use of different screening assessments.

OSA is known to be influenced by unmodifiable and modifiable risk factors. From this study, 10 variables are found to have significantly associated with having a high risk of OSA. These included age, gender, marital status, smoking, alcohol, menopausal status, underlying HPT, BMI in a category, neck circumference, and waist circumference. A few of the variables that were associated are the components assessment tools used and thus were not proceeded with multivariate analysis to avoid redundancy. Ethnicity, marital status, smoking, menopausal status, underlying diabetes mellitus, and waist circumference were further analysed. Significant determinants for high risk of OSA were seen in post-menopausal women and those larger waist circumferences.

The relationship between sexual hormones and OSA pathogenesis has been observed in several studies, with a higher prevalence of OSA noted in postmenopausal women compared to premenopausal women worldwide. (13) During menopausal transition, the gradual decline of progesterone and oestrogen levels may contribute to sleep disturbances. Progesterone, in particular, is known to stimulate ventilation drive and expand the upper airway tract, hence, the reduction in its level in post-

Table II: Factors associated with obstructive sleep apnoea (OSA) (bivariate and multivariate analysis)

Variables		Bivariate analysis					Multivariate					
	B	SE	Crude OR	95% CI		P value	B	SE	Crude OR	95% CI		P value
Age	0.04	0.00	1.04	1.03	1.06	**<0.001**						
Gender												
- Male	1.41	0.20	4.07	2.75	6.05	**<0.001**						
- Female			1.00									
Race												
- Malay									1.00			
- Chinese	0.74	0.53	2.09	0.75	5.89	0.160	-0.33	1.19	0.77	0.06	7.44	0.698
- Indian	0.21	0.33	1.24	0.64	2.38	0.520	-0.33	0.53	0.53	0.24	2.05	0.550
Highest education												
- None	1.25	1.10	3.50	0.40	30.54	0.257						
- Primary school	1.16	1.07	3.19	0.38	26.30	0.280						
- Secondary school	0.96	1.08	2.62	0.31	22.15	0.375						
- College/ university												
Marital status												
- Single			1.00						1.00			
- Married	1.23	0.37	3.43	1.65	7.13	**0.001**	-0.33	0.64	0.71	0.20	2.50	0.598
- Widow/widower	0.69	0.47	1.99	0.79	5.02	0.142	-0.99	0.77	0.36	0.08	1.67	0.196
Smoking status												
- yes/once	0.79	0.24	2.19	1.38	3.49	**0.001**	0.43	1.26	1.53	0.13	18.19	0.999
- no			1.00						1.00			
Alcohol usage												
- yes/once	1.46	0.57	4.33	1.43	13.12	**0.010**						
- no			1.00									
Menopausal status (n=310)												
- yes	0.68	0.30	1.97	1.08	3.59	**0.025**	0.90	0.35	2.46	1.22	4.93	**0.011**
- no			1.00						1.00			
Diabetes Mellitus												
- yes	0.26	0.20	1.30	0.88	1.93	0.191	-0.57	0.34	0.56	0.28	1.09	0.092
- no			1.00						1.00			
Hypertension												
- yes	1.72	0.23	5.57	3.53	8.81	**<0.001**						
- no			1.00									
Asthma												
- yes	0.14	0.47	1.15	0.45	2.57	0.760						
- no			1.00									
Allergic Rhinitis												
- yes	0.08	0.44	1.08	0.45	2.57	0.852						
- no			1.00									
BMI categories												
- underweight & normal weight			1.00									
- overweight	1.04	0.44	2.84	1.20	6.69	**0.017**						
- obese	1.93	0.42	6.88	3.05	15.50	**<0.001**						
Neck circumference	0.36	0.04	1.43	1.31	1.56	**<0.001**						
Waist circumference	0.07	0.01	1.07	1.05	1.09	**<0.001**	0.07	0.01	1.07	1.04	1.10	**<0.001**

SE=standard error, CI= confidence interval, B=coefficient, OR=odds ratio. * There is a significant association if p<0.05

menopausal women may increase their apnoea risk.(14) Corresponding findings have been reported in similar studies conducted in Europe and the United States (15, 16).

Waist circumference was also found to be associated with high risk of OSA. This study found that respondents with higher waist circumference (median 96.5, 19.63) have a high risk of OSA compared to a low risk of OSA (median 86,12.00). Every one-unit increase in waist circumference is expected to see about 1 times increase in the odds of getting a high risk of OSA. It was predicted that waist circumference for females at 76.5cm and males at 88.5cm have risk of OSA. (17) Similar results was reported in Bali, where the increase in waist circumference correlates to the development OSA (18).

Multiple studies had reported that Asian population particularly the Chinese ethnicity had a significantly increased risk of OSA. (19, 20) This was also comparing between Europeans with South Asians. However, this study did not find any significance of ethnicity and race, which could be contributed by a major difference in the ethnicity in this study.

Being married was reported to be one of the risk factors for OSA (21, 22). This was not seen in this study. The difference in the findings might be due to the different screening tools being used.

Smoking and OSA are widely associated with significant morbidity and mortality due to the effects of smoking on the pathophysiology of OSA (23). Many studies supported that smoking was significantly at risk of OSA (24, 25). On the contrary, we could not prove this in this study. A Persian study echoed similarly (26). This probably could be due to uneven numbers between non-smokers and smokers.

OSA has a bidirectional association with diabetes mellitus (27). Globally, as many as 83% of individuals

with type 2 diabetes have undiagnosed OSA, and more severe OSA has been linked to worse glucose management independent of other factors (28). In Chicago, among 60 diabetes patients attending the outpatient clinic reported prevalence of 77% among type 2 DM patients with OSA (27). However, this study failed to show a statistically significant correlation between DM and an increased risk of OSA. This further justifies a study that recommends the unnecessary need to screen every diabetic patient for OSA (29). However, undetected OSA might be a reason for the ineffective treatment of type 2 DM as CPAP therapy might improve glucose metabolism by improving insulin sensitivity.(30) Detecting OSA in primary care is vital, as there are modifiable risk factors that could be addressed at this level. Nonetheless, a review revealed that current screening and evaluation methods for OSA in primary care are disorganized and inadequate. Primary care providers are said to come across patients with OSA symptoms but often miss the opportunity to regularly screen, evaluate, or refer them to a sleep specialist (9). This is also reported among primary care doctors in Malaysia (31). Thus by advocating standardize use of STOP-BANG questionnaire as a OSA screening tools in primary care setting especially among those with risk factors such as among adults with larger waist circumference or post-menopausal women can help in early detection and intervention to avoid morbidity and mortality.

This study has its limitations. From a cross-sectional study, the findings cannot be concluded as a cause or an effect. With the use of a self-administered questionnaire, the results may be affected by recall bias and misunderstandings of the respondents. This is especially with regards question on tiredness, which reduces the accuracy of reported symptoms. It could be underreported especially when respondents depend on their spouse's report. Also, since this study was only done in one single health care center, the results does not reflect the result of the primary care in total.

To address the issue of the increasing prevalence of undiagnosed OSA, assessing the risk of developing OSA among patients during routine health check-ups or while evaluating high-risk patients is very important for early detection and in preventing complications. Higher suspicion of OSA among patients who are post-menopause and with a larger waist circumference measurement are recommended to be screened for OSA. STOP-BANG questionnaire is a simple, reliable, and validated screening tool for OSA with high sensitivity and is recommended to be used in the primary care settings.

CONCLUSION

Almost a third (30.3%) of the respondents at the outpatient department of KK Salak, Sepang were at risk of OSA. Post-menopausal women and those with larger waist circumference are the one at risk. STOP-BANG questionnaire is a simple, reliable with high sensitivity for OSA screening. It can be used as a screening tool at primary care setting. Knowing the risk factors will help healthcare providers to detect early patients at high risk of OSA with the aid of STOP-BANG questionnaire. It is also recommended to study in larger population to further emphasize the important of OSA screening in primary care setting.

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