

Questionnaire for diagnosing Obstructive Sleep Apnoea in Indians

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Objective To construct a questionnaire for estimation of sleep related breathing disorders in Indians.

Methodology To assess the inter-observer reliability, a specialist and a trained health worker administered the questionnaire to 135 adult individuals, who presented in the outpatient department of V.P. Chest Institute. Taking the specialist's opinion as the reference, various parameters of reliability were calculated. The test-retest reliability was calculated by questioning 50 individuals twice after an interval of one week by the same observer. The questionnaire was validated by performing polysomnography on 11 normal and 11 individuals with sleep related symptoms suggestive of obstructive sleep apnoea (based on the questionnaire).

Results The sensitivity, specificity and predictive values were calculated for each question. While sensitivity ranged from 42 - 55% (questions on snoring and daytime sleepiness with a sensitivity of 87% and 93% respectively), specificity was found to be 94 - 96% with an efficiency of 0.899. The kappa value for intra-observer reliability was found to be 0.815. With polysomnography as the gold standard for diagnosing sleep-related breathing disorders, the questionnaire had a sensitivity of and specificity of 82%.

Discussion Our questionnaire compares favourably with other standard questionnaires like the Berlin Questionnaire.

Conclusion This short questionnaire with good reliability is suitable for Indian population studies.

Keywords : sleep related breathing disorders, reliability, validity, polysomnography.

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Introduction

Sleep related breathing disorders are characterized by repeated pauses in breathing during sleep and decreases in oxyhaemoglobin saturation¹. This condition is a cause of significant morbidity and mortality²⁻¹⁵. But surprisingly, there is no epidemiological data on this group of disorders in the Indian population and till date no population studies have been done to determine the magnitude of this problem and its impact on Indians. This is probably due to lack of awareness

about the symptoms and the consequences of obstructive sleep apnoea both among the medical practitioners as well as the patients.

Obstructive sleep apnoea (OSA) can be diagnosed definitively by an overnight polysomnography (PSG)¹⁶⁻¹⁸. Since this is an expensive and inconvenient test, investigators use questionnaires¹⁹⁻²² for screening and population studies to identify the high risk individuals. Before we can embark on a population-based study in India, we need a questionnaire designed for the Indian population to detect the individuals suspected of

suffering from sleep-related breathing disorders to avoid subjecting everyone to a polysomnography.

This study was undertaken at Vallabhbhai Patel Chest Institute (VPCI), University of Delhi, Delhi, to develop a compact and concise questionnaire which would be easy and convenient to use for detection of sleep-related breathing disorders in the adult Indian population. The objective was to design a questionnaire with acceptable reliability²³ and validity²⁴.

Methods

The VPCI questionnaire

The VPCI questionnaire (See Appendix) was adapted from the Janson et al²⁵ questionnaire. It was first constructed in English, translated into Hindi (local language) and then back into English so that any problems of comprehension and translation could be identified and rectified. This questionnaire consists of three parts. The first part records personal details of the individual like the name, age, sex, height, weight and body mass index as well as previous history of any illness especially hypertension and diabetes mellitus. The second part enquires about sleep habits of the individual namely the usual sleeping time, time taken to fall asleep after switching off the lights and the number of times the individual wakes up during the night (1 to more than 7). The third part consists of fifteen multiple choice closed questions dealing with sleep disturbances and daytime symptoms. Each question was scored depending on the severity of symptoms. Every subject had to choose one of five possible alternatives for each question: 1- "never", 2- "less than a week", 3- "once once or twice a week", 4- "three to five nights/days a week" or 5- "almost everyday/night". The responders were classified as having sleep-related symptoms if they had loud snoring (scores 4 or 5), and/or daytime sleepiness (scores 4 or 5), and/or appreciable apnoea (scores 4 or 5).

Study subjects

The questionnaire was approved by the institutional ethical committee of Vallabhbhai Patel Chest Institute, University of Delhi, Delhi. It was then tested at Vallabhbhai Patel Chest Institute, University of Delhi, Delhi, which is a tertiary level respiratory diseases hospital with a fully equipped polysomnography laboratory. Before putting any questionnaire to use its

reliability or reproducibility (both inter-observer and test-retest) along with its validity have to be determined. 135 adult (above 18 years of age) individuals, patients and their contacts, who presented to the outpatient department of our institute were used to assess the inter-observer reliability. A specialist and a trained health worker administered the same questionnaire to all of these 135 individuals. The specialist's opinion was taken as the reference for all the calculations.

To assess the test-retest reliability, 50 adult individuals (both patients and their contacts) were questioned twice after an interval of one week by the same observer. During this period the health status of these individuals remained unchanged. For estimating the validity, 11 adult normal subjects and 11 subjects who had sleep-related symptoms and were thus diagnosed as Obstructive Sleep Apnoea patients on the basis of VPCI questionnaire were subjected to a full night PSG using a 16-channel polygraph (Model Datalab Artisan Rembrandt Version7). Two channels of electroencephalography (C_4/A_1 and C_3/A_2), two channels of electrooculography and one channel of submental electromyography and electrocardiography were used to monitor sleep. Other variables measured included nasal and oral airflow by thermistor, rib-cage and abdominal-wall motion with a respiratory inductive plethysmograph, oxygen saturation (SaO_2) by pulse oximeter. Apnoea was defined as a cessation of airflow of 10 seconds or longer. A hypopnoea was defined as a decrease in oral or nasal airflow associated with a decrease in oxygen saturation of more than 3% that lasted for 10 seconds or more. The measurements were manually scored for an apnoea-hypopnoea index (AHI), measured as the number of apnoea and hypopnoea per hour in bed.

Statistical analysis

The data was entered into excel worksheets. Mean, standard deviation and range were calculated for quantitative variables such as age, height, weight and body mass index.

To assess the inter-observer reliability, the specialist's opinion was taken as the standard. Sensitivity, specificity and predictive values were calculated for each question based on symptoms of Obstructive Sleep Apnoea. Finally the parameters of reliability were calculated for the whole questionnaire.

Intra-observer reliability was estimated using the

kappa coefficient²⁶, first for each question separately and then for the overall questionnaire.

The questionnaire was validated by taking an AHI of greater than five on the polysomnogram as the reference. Sensitivity, specificity and predictive values of the questionnaire compared to the polysomnogram were calculated.

RESULTS

Inter-observer reliability

The questionnaire was administered to 135 adult individuals (96 males and 39 females) who presented at V.P. Chest Institute by the expert and the trained health worker. Out of these, 68 were registered in the outpatient department while 67 were contacts of the above mentioned patients. 60 patients were identified as suffering from Sleep related symptoms on the basis of the questionnaire. The physical characteristics and other history of these individuals is given in Tables 1 and 2. The distribution of symptoms among the two sets of individuals is given in Table 3.

Table 4 lists the measures of inter-observer reliability for each question as well as the overall questionnaire. The response to the question on snoring by the health worker has a good sensitivity (86.7%) and high specificity (97.1%) as compared to the expert. The health worker was 90% as efficient as the expert.

Intra-observer reliability

The same observer questioned 50 individuals (an equal number of males and females) again after a period of

one week to determine the intra-observer reliability. There was no change in the health status of the individuals during this period. The mean age of the individuals was 35.8 years (\pm SD 10.9) with a mean height of 1.6 metres (\pm SD 0.07), weight mean \pm SD of 61.9 kilograms \pm 12.5 and body mass index mean \pm SD of 23.3 kg/m² \pm 3.7.

Bias index for the questions varied from 0 to 0.06 (Table 5). The kappa coefficient which is a measure of agreement between two observations varied from 0.634 to 1. The question on snoring again had a kappa value of 0.921. Kappa value of questions on daytime sleepiness was also high. The overall questionnaire had a kappa value of 0.815.

Validity

An equal number of adult normal individuals and those with symptoms of sleep-related breathing disorders as identified by the questionnaire were taken up for overnight PSG. 18 males & 4 females underwent PSG with a mean age of 37.6 years (\pm SD 13.6). Out of these 22 individuals, 11 had an AHI of greater than 5 and were thus diagnosed with sleep-related Breathing disorders (Flow Chart).

The questionnaire identified individuals at risk of obstructive sleep Apnea with a sensitivity and specificity of 81.8%. The predictive value of the questionnaire was 81.8% with a likelihood ratio of 4.5.

DISCUSSION

The VPCI questionnaire exhibited good with observer reliability (efficiency of 0.899). Administration of the

Table 1. Physical characteristics of individuals assessed for inter-observer reliability

S.No.	Parameter	With sleep related symptoms (n=60)	Without sleep related symptoms (n=75)	Total (n=135)
1.	Age (years)	40.73 \pm 13.92 (18-82)	36.20 \pm 13.86 (18-76)	38.21 \pm 14.02 (18-82)
2.	Height (m)	1.63 \pm 0.08 (1.49-1.81)	1.64 \pm 0.08 (1.52-1.85)	1.64 \pm 0.08 (1.49-1.85)
3.	Weight (kg)	62.78 \pm 11.80 (38-90)	59.15 \pm 13.90 (25-100)	60.80 \pm 13.06 (25-100)
4.	BMI (kg/m ²)	23.55 \pm 4.60 (13.30-35.60)	21.97 \pm 4.74 (9.89-34.63)	22.69 \pm 4.72 (9.89-35.60)

* All the physical characteristics are expressed as Mean \pm standard deviation and (minimum –maximum)

Table 2: Characteristics of individuals assessed for inter-observer reliability

Characteristic		Total (n=135)	With Sleep related symptoms(n=60)	Without Sleep related symptoms(n=75)
Sex	Male	96	44	52
	Female	39	16	23
Patient	Yes	68	33	35
	No	67	27	40
Illness	None	44	17	27
	HT	5	3	2
	DM	5	0	5
	Both	2	1	1
	Others	79	39	40
Smoking	Yes	21	10	11
	No	99	39	60
	Ex	9	7	2
	Passive	6	4	2
Smoke years	Mean \pm SD	15.25 \pm 9.95	17.50 \pm 9.69	12.25 \pm 9.89
	Range	1-40	2-40	1-30
	Mode	20	20	15
Alcohol	Yes	126	56	70
	No	9	4	5
Marital	Single	27	10	17
	Married	101	45	56
	Divorced	1	1	0
	Widowed	6	4	2
Children	Mean	2	3	2
	Range	0-10	0-10	0-10
Social history		17	8	9
Duration of sleep(hours)				
	Mean	7	7	7
	Range	3-11	4-11	3-10
	Mode	7	8	7
Exercise	No	96	44	52
	Regular	39	16	23
Accident		6	5	1
Nap		49	36	13
Sleep position	Lateral	44	21	23
	Supine	29	14	15
	Prone	4	3	1
	Variable	40	18	22
Consumption of health resources		67	35	32

Table 4. Measures of interobserver reliability (n=135)

Question	Sensitivity	Specificity	Predictive value		Efficiency
			Positive	Negative	
Main symptoms of sleep related breathing disorders					
1. Snoring	86.7	97.1	89.6	96.2	.948
2. Stoppage of breathing	-	94.1	-	100.0	-
3. Daytime sleepiness-					
work related activities	93.3	50.0	93.3	50.0	.881
leisure activities	30.4	96.6	82.3	72.9	.741
4. Awakening due to difficulty in breathing	0.0	97.7	0.0	97.7	.956
Other night time symptoms					
1. Sweating during night	50.0	97.5	70.0	94.4	.926
2. Nightmare	66.7	95.4	25.0	99.2	.948
3. Difficulty in falling asleep	20.0	98.3	66.7	87.6	.867
4. Early morning awakening	23.1	98.4	60.0	92.3	.911
5. Awakening due to choking sensation	0.0	99.2	0.0	98.5	.978
6. Leg movements	25.0	97.7	25.0	97.7	.956
Other daytime symptoms					
1. Early morning headache	54.4	90.3	52.2	91.1	.844
2. Physical tiredness	74.3	85.0	63.4	90.4	.822
3. Memory lapses	50.0	92.6	40.0	94.9	.888
4. Mood changes	45.0	95.6	64.3	90.9	.881
Overall questionnaire	49.2	95.4	59.0	93.3	.899

questions on snoring and daytime sleepiness during work by the health worker had a high sensitivity compared to the expert (86.7% & 93.3% respectively). Health worker's administration of the questions on snoring and daytime sleepiness during leisure activities were also very specific (specificity of 97.1% & 96.6% respectively). The questions on apnea, stoppage of breathing during sleep and awakening due to difficulty in breathing, could not be assessed as the number of patients answering them in the affirmative was 0 (0%) and 3 (2.2%) respectively.

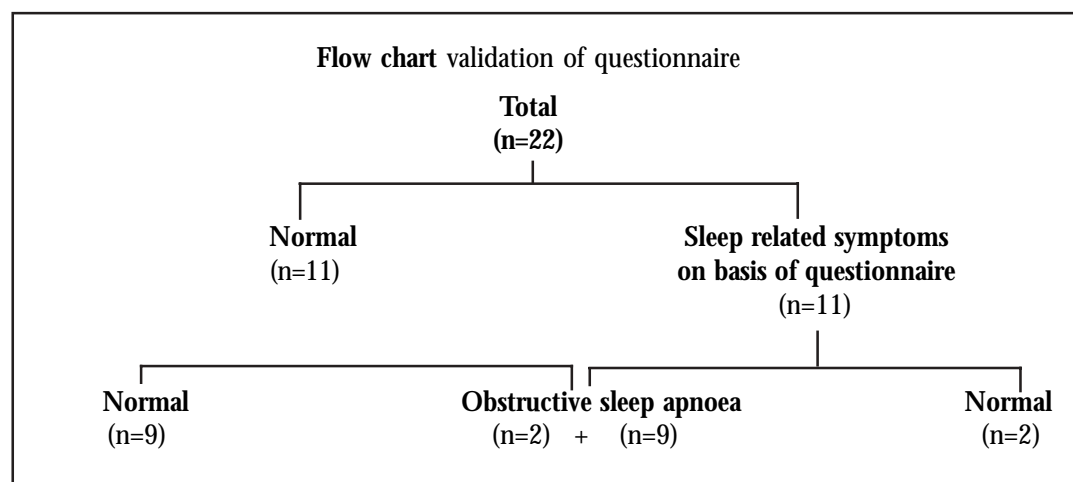
Test-Retest reliability of the whole of the questionnaire was very good (kappa value of 0.815) with a negligible bias index of 0.01. The questions on snoring and daytime sleepiness exhibited good reproducibility.

The VPCI questionnaire was 82% sensitive and 82% specific as compared to overnight PSG and was able to predict Obstructive Sleep Apnea (with AHI > 5) in 82% of cases. These values are very similar to those of the Berlin Questionnaire²⁰, which predicts AHI greater than 5 with a sensitivity of 86%, a specificity of 77% and a positive predictive value of 89%.

This questionnaire is short, simple and easy to administer. More importantly, it has good reliability and validity. Therefore, it is very suitable for epidemiological studies on sleep-related breathing disorders in our population. Also since the VPCI questionnaire is concise and can be administered by a trained health worker in about

Table 5. Measures of intraobserver reliability (n=50)

Question	Bias index	Kappa value
Main symptoms of sleep related breathing disorders		
1. Snoring	-0.02	0.921
2. Stoppage of breathing	0.0	1.0
3. Daytime sleepiness- work related activities	0.02	0.878
leisure activities	0.06	0.758
4. Awakening due to difficulty in breathing	0.0	1.0
Other night time symptoms		
1. Sweating during night	0.0	-
2. Nightmare	0.02	0.657
3. Difficulty in falling asleep	0.02	0.634
4. Early morning awakening	0.0	-
5. Awakening due to choking sensation	0.0	1.0
6. Leg movements	0.0	1.0
Other daytime symptoms		
1. Early morning headache	0.04	0.778
2. Physical tiredness	0.02	0.846
3. Memory lapses	0.02	0.846
4. Mood changes	0.0	0.846
Overall questionnaire	0.01	0.815



10 minutes, it can be used in the Outpatient Departments to identify patients at high risk of OSA and thereby avoiding unnecessary PSG. Thus it can be effectively used in primary care settings as well as to screen

preoperative patients.

In conclusion, the VPCI questionnaire is a useful and effective tool for determining the burden of sleep-related breathing disorders in India.

VALLABHBHAI PATEL CHEST INSTITUTE	
PROJECT ON SLEEP APNOEA SYNDROME	
QUESTIONNAIRE	
PERSONAL DATA	
1. Name:
2. Address :	Telephone No. :
3. Age :	Sex :
4. Height :	Weight :
5. BMI (Wt in Kg/Ht. in Cm ²):	
6. Any illness (e.g. Hypertension, diabetes) :	
QUESTION ON SLEEP AND DAYTIME SYMPTOMS	
1. At what time do you go to sleep?	
2. How long it takes you to go to sleep after putting off the lights?	
3. How many times do you wake up in the night	
0 1 2 3 4 5 6 7 more than 7	
FOR REMAINING QUESTIONS THE NUMBER MEANS	
1. Never	
2. Less than once a week	
3. Once or twice a week	
4. Three to five nights / days a week	
5. Almost everyday or night	
4. How often do you snore (noticed by spouse or close relative)?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
5. How often do you stop breathing during your sleep (noticed by spouse or close relative)?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
6. How often do you fall asleep immediately during the day time while doing work (driving vehicle, writing, etc.)?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
7. How often do you fall asleep immediately during the day time while watching TV, reading, etc.?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
8. How often do you wake up because of difficulty in breathing?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
9. How often do you trouble by sweating during night?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
10. How often do you have nightmares?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
11. How often do you wake up with headache?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
12. How often do you feel physically tired during day time?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
13. How often do you have difficult in getting to sleep at night?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
14. How often do you wake up too early and have difficulty in getting sleep again?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
15. How often do you have memory lapses?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
16. How often do you have choking sensation with abrupt awakening from the sleep?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
17. How often do you to have mood changes?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	
18. How often you have leg movements during the sleep (noticed by spouse or close relative)?	
(1) <input type="checkbox"/> (2) <input type="checkbox"/> (3) <input type="checkbox"/> (4) <input type="checkbox"/> (5) <input type="checkbox"/>	

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