

TELEPHONE INTERVIEW SURVEY: ESTIMATION OF SNORING AND BREATHING PAUSES IN ADULT POPULATION OF YEREVAN (ARMENIA)**ZELVEIAN P.H.^{1,2}, MATEVOSYAN A.K.^{1*}, PODOSYAN G.A.^{1,2}, USTYAN T.D.¹, PETROSYAN A.A.¹, KHANDANYAN G.L.³, SHUKURYAN A.K.³, SOGHOYAN A.F.⁴**¹ Center of Preventive Cardiology, Yerevan, Armenia² National Institute of Health after S.Kh. Avdالبekyan, Yerevan, Armenia³ Department of ENT diseases, Yerevan State Medical University, Yerevan, Armenia⁴ Department of Psychiatry, Yerevan State Medical University, Yerevan, Armenia*Received 1/12/2013; accepted in final form 8/30/2013***ABSTRACT**

Obstructive sleep apnea is a common medical condition with significant consequences; however, it remains undiagnosed in Yerevan. Hence, a survey was carried out to study apnea prevalence among adult population of Yerevan. At the "Center of Preventive Cardiology" the survey was conducted through telephone interviews. The Berlin Questionnaire was applied as a validated tool to identify people at high risk for obstructive sleep apnea. It was used to assess the risk level for obstructive apnea syndrome development.

The random selection method was used to sample 2000 phone numbers from all administrative districts of Yerevan. Only correctly filled survey questionnaires were kept for statistical analysis: overall 1503 observations. The survey embraced participants of the age group 18-88 years old (mean age 45.1±15.8 years).

According to our data, the high risk of developing obstructive sleep apnea syndrome was identified in 32.7% adult population of Yerevan; the risk increased in the age group of 45-54 years. Male gender, obesity and arterial hypertension were positively associated with the high risk of sleep apnea.

Thus, in a significant cohort of population (one in three adult citizens of Yerevan) high risk of developing obstructive sleep apnea syndrome was revealed. The research findings are important for awareness raising among both the general population and, more importantly, among physicians. The use of Berlin Questionnaire will facilitate in identifying people with high risk to develop obstructive sleep apnea and will allow conducting further targeted polysomnographic studies.

Keywords: *obstructive sleep apnea, Berlin Questionnaire, polysomnographic study, snoring, daytime sleepiness.***INTRODUCTION**

Obstructive sleep apnea/hypopnea syndrome (OSAS) and its manifestations have been known for many centuries. It is one of the most common breathing disorders during sleep. Due to its significant association with morbidity and mortality OSAS is an important health problem [Bradley T., 1992; Ferguson K., Fleetham J., 1995]. It is characterized by excessive daytime sleepiness, disruptive snoring, repeated episodes of upper airway obstruction during sleep and intermittent arterial oxygen desaturation.

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As considered, OSAS is a cause of arterial hypertension (AH), cerebrovascular accidents and coronary artery disease [Okabe S. et al., 1995; Gottlieb D. et al., 1999; Young T., Peppard P., 2000; Duran J. et al., 2001; Young T. et al., 2002; Gus M. et al., 2008]. Habitual snoring as such was shown to be an independent risk factor for hypertension and *angina pectoris* [Koskenvuo M. et al., 1985; Okabe S. et al., 1995; Young T., Peppard P., 2000; Duran J. et al., 2001]. However, no epidemiological studies on the prevalence of snoring and apnea episodes in adult population of Armenia have been carried out.

For easier evaluation of snoring and apnea episodes prevalence during sleep in general population, the screening methods and such tools as Berlin

Questionnaire (BQ) are used. The BQ application is more convenient and less costly than having the clinician screen by interview during the patient encounter. Researchers demonstrated that in predicting the existence of sleep apnea BQ had the highest specificity compared to others [Abrishami A. et al., 2010]. The BQ was also validated as a screening tool in primary care, where it demonstrated a high internal validity and performed accurately with a higher sensitivity and specificity in OSAS determination (86 and 77%, respectively) [Netzer N. et al., 1999]. On the basis of this and several other studies we can assume that BQ is a powerful and effective instrument for identifying OSAS in general population [Ohayon M. et al., 1997; Netzer N. et al., 1999; Sharma S. et al., 2006; Abrishami A. et al., 2010; Vaz A. et al., 2011]. The BQ can identify high risk subjects and thus avoid unnecessary polysomnographic studies, especially in resource-limited countries.

Hence, the BQ-based study was aimed to determine the prevalence of snoring and breathing pauses during sleep and to assess the risk for development of sleep-related breathing disorders in the adult population of Yerevan.

MATERIAL AND METHODS

The adult inhabitants (aged 18 and over) of Yerevan city made the target population, and the survey was conducted by telephone interview. The number of participants was designed to be 2000. For even distribution in our study we divided the pre-planned number of survey participants by the 11 administrative districts of Yerevan and got representative sample from every district of the city. The telephone numbers were selected randomly (Beeline reverse telephone directories were used to identify a random set of telephone numbers).

Telephone interviews were conducted between January 15 and April 1, 2012. Telephone calls were made in all selected districts of Yerevan. Interviews were directed by trained nurses and post-graduate medical students. After a brief explanation about the study goals and trainings, the interviewers read each question to the subject and then wrote down the responses. The interviews averaged 25 minutes in duration.

During the phone conversation the staff inquired, whether there were any residents above 18 years of age and, if so, asked to conduct brief telephone in-

terviews with them. Once a particular phone number was selected, calls were made at least three times, if necessary, during weekdays, weekday evenings, and weekends, so as not to exclude working persons. Among 2000 dialed numbers 175 were unreachable or the numbers that we called did not exist. So, 1825 (91.3%) telephone numbers were actually called, of which 322 were discarded, because the resulting questionnaires were insufficient or telephone subscribers refused to take part in the interviews. Overall, 1503 participants actively responded to telephone interviews.

For survey purposes, the BQ was translated into Armenian by bilingual translators. Taking into account that the cardinal symptom of OSAS is daytime sleepiness [Ferguson F., Fleetham J., 1995], an extra question about the existence of daytime sleepiness with the answers “yes” and “no” was added to the BQ. The modified BQ was used to assess the presence of snoring and apnea episodes. Thus, the applied instrument – modified BQ – had 11 questions (Table 1). The questionnaire was divided into three categories. In category I there were 5 questions; respondents were asked about snoring behavior (one introductory question and four follow-up questions concerning snoring) and whether anyone had ever noticed the cessation of breathing during sleep. In category II, they were asked about tiredness after sleeping and during wake time, sleepiness behind the wheel and existence of daytime sleepiness. In category III, subjects were asked about existence of AH, as well as about their height, weight, age, and gender. Obesity was evaluated by calculating body mass index (BMI) using information from category III.

Categories I and II were considered positive, if there were two or more positive responses in each of them. Category III was defined positive, when there was a history of high blood pressure or when the BMI was equal to 30 kg/m^2 or more. Accordingly, people were classified as “high risk” subjects, if there were two or more categories with positive scores.

The statistical analysis was performed using SPSS v17.0 statistical software. To evaluate the association between breathing pauses episodes and other qualitative indices (snoring, daytime sleepiness, fatigue, obesity or hypertension) the Fisher’s exact test was used. Univariate and multivariate analyses were performed using χ^2 tests. Odds ra-

TABLE 1.

Comparison of Berlin Questionnaire-based data

	Total: n, (%)	Male: n, (%)	Female: n, (%)	<i>p</i>
Do you snore?				
Yes	559 (37.2)	262 (50.3)	297 (30.2)	< 0.0001
No	873 (58.1)	229 (44.0)	644 (65.6)	
Do not know	71 (4.7)	30 (5.8)	41 (4.2)	
How loud is your snoring?				
As loud as breathing	272 (48.7)	106 (40.5)	166 (55.9)	< 0.0001
As loud as speech	104 (18.6)	44 (16.8)	60 (20.2)	
Louder than speech	71 (12.7)	38 (14.5)	33 (11.1)	
Very loud	112 (20.0)	74 (28.2)	38 (12.8)	
How frequently do you snore?				
Almost every day	242 (43.3)	136 (51.9)	106 (35.7)	< 0.0001
3-4 times/week	102 (18.2)	39 (14.9)	63 (21.2)	
1-2 times/week	132 (23.6)	44 (16.8)	88 (29.6)	
1-2 times/month	69 (12.3)	33 (12.6)	36 (12.1)	
Never or almost never	14 (2.5)	10 (3.8)	4 (1.3)	
Does your snoring bother other people?				
Yes	334 (59.7)	176 (67.2)	158 (53.2)	0.001*
No	225 (40.3)	86 (32.8)	139 (46.8)	
How often have your breathing pauses been noticed?				
Almost every day	82 (5.5)	71 (13.6)	11 (1.1)	< 0.0001
3-4 times/week	30 (2.0)	13 (2.7)	16 (1.6)	
1-2 times/week	28 (1.9)	17 (3.3)	11 (1.1)	
1-2 times/month	58 (3.9)	28 (5.4)	30 (3.1)	
Never or almost never	1305(86.8)	391 (75.0)	914 (93.1)	
Are you tired after sleeping?				
Almost every day	394 (26.2)	114 (21.9)	280 (28.5)	< 0.0001
3-4 times/week	158 (10.5)	40 (7.7)	118 (12.0)	
1-2 times/week	217 (14.4)	66 (12.7)	151 (15.4)	
1-2 times/month	260 (17.3)	103 (19.8)	157 (16.0)	
Never or almost never	474 (31.5)	198 (38.0)	276 (28.1)	
Are you tired during waketime?				
Almost every day	388 (25.8)	111 (21.3)	277 (28.2)	< 0.0001
3-4 times/week	218 (14.5)	48 (9.2)	170 (17.3)	
1-2 times/week	270 (18.0)	95 (18.2)	175 (17.8)	
1-2 times/month	238 (15.8)	92 (17.7)	146 (14.9)	
Never or almost never	389 (25.9)	175 (33.6)	214 (21.8)	
Do you have daytime sleepiness				
Yes	571 (38.0)	226 (43.4)	345 (35.1)	< 0.0001*
No	932 (62.0)	295 (56.6)	637 (64.9)	
Have you ever fallen asleep behind the wheel?				
Yes	80 (17.2)	71 (22.6)	9 (6.0)	< 0.0001*
No	384 (82.8)	243 (77.4)	141 (94.0)	
Body Mass Index				
Normal weight	639 (42.5)	167 (32.1)	472 (48.1)	< 0.0001
Overweight	486 (32.3)	183 (35.1)	303 (30.9)	
Obesity	378 (25.1)	171 (32.8)	207 (21.1)	
Do you have high blood pressure?				
Yes	486 (32.3)	168 (32.2)	318 (32.4)	< 0.0001
No	935 (62.2)	296 (56.8)	639 (65.1)	
Do not know	82 (5.5)	57 (10.9)	25 (2.5)	

NOTES: * Fisher's exact test, positive results are underlined

tios (OR) with 95% confidence intervals (CI) were calculated. The results were presented by mean values, including standard deviations.

RESULTS

A total of 1825 questionnaires were filled out. From them, 322 phone subscribers either refused to answer or their questionnaires were insufficient. One thousand five hundred and three individuals were evaluated, female respondents were more often (n=982; 65.3%). The age ranged between 18 and 88 years, mean age was 45.1 ± 15.8 and BMI was $26.8 \pm 5.7 \text{ kg/m}^2$.

Figures 1 and 2 present the distribution of questionnaire respondents according to their age and BMI.

In our sample 32.7% of respondents met the study criteria of high risk for OSAS. Among the

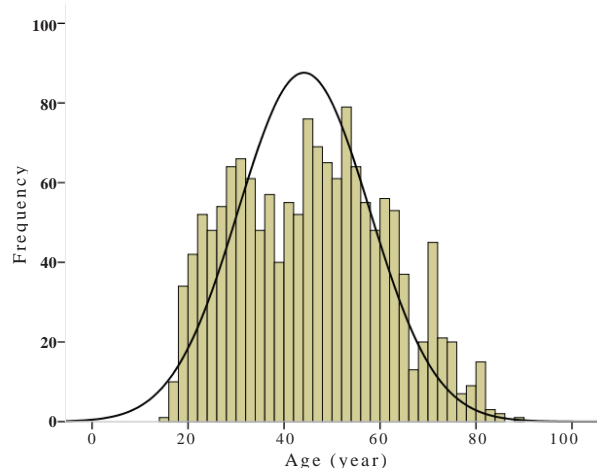


FIGURE 1. Distribution of respondents according to their age.

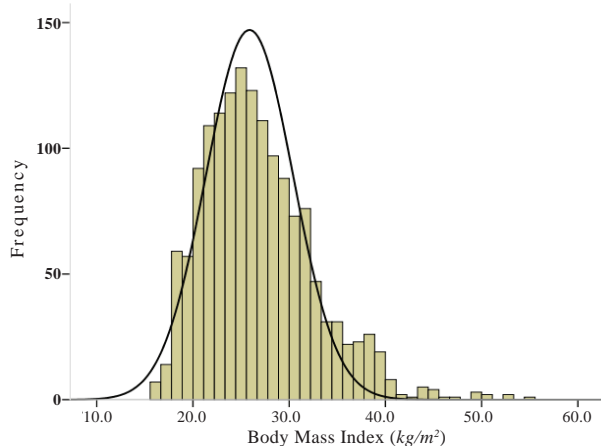


FIGURE 2. Distribution of respondents according to their BMI.

1503 respondents, 559 (37.2%) reported they snored, 873 (58.1%) denied snoring, while 71 (4.7%) did not know, whether they snored or not. One hundred and eighty three (32.7%) of respondents mentioned snoring louder than speech and 376 (67.3%) did not snore as loud as normal speech. Three hundred forty four (61.5%) respondents reported snoring at least 3-4 times per week and 215 (38.5%) stated that they did not snore more often than 1-2 times per week. Three hundred thirty four (59.7%) subjects mentioned that their snoring bothered other people and 225 (40.3%) did not. One hundred and twelve (7.5%) respondents reported that breathing pauses were observed more than 3-4 times per week, and 1391 (92.5%) did not have breathing pauses more often than 1-2 times per week. Five hundred and fifty two (36.7%) respondents mentioned that they did not feel rested after a night sleep at least 3-4 times per week and 951 (63.3%) felt this way 1-2 times per week or at all. From all respondents 604 (40.3%) mentioned wake time tiredness or fatigue more often than 3-4 times per week and 897 (59.7%) experienced that condition less often than 1-2 times per week. The number of respondents, who had daytime sleepiness, was 571 (38%); 932 (62.0%) subjects gave negative responses.

Among 1503 respondents only 464 were driving cars. From all drivers only 80 (17.2%) mentioned drowsiness behind the wheel. Amongst all the respondents 486 (32.3%) mentioned having high blood pressure, 935 (62.2%) denied and 82 (5.5%) did not know, whether they had high blood pressure or not.

The comparison of questionnaire-based data between men and women is presented as Table 1.

Male gender was positively associated with high sleep apnea risk $\chi^2_{(df=1)}=103.48$, $p<0.0001$ [OR = 13.96 (95% CI: 7.33, 26.60)], but for the age group of 45 years and older this association was not significant $\chi^2_{(df=1)}=0.493$, $p=0.497$ [OR=0.85 (95% CI: 0.54, 1.33)]. Results of the multivariable model are presented in Table 2.

Respondents with obesity were also positively associated with a high sleep apnea risk [OR=11.05 (95% CI: 7.07, 17.27)]. The association of AH and high risk of OSAS was also significant [OR=4.74 (95% CI: 3.05, 7.37)].

The distribution of individuals at high risk of

TABLE 2.

Results of the analysis for predicting a high risk of OSAS based on the Berlin Questionnaire

Categories	Variables	χ^2 test value*	Odds Ratio	95% Confidence Interval
I	Snoring	151.050	28.28	13.05 - 61.30
	Tiredness after sleeping	47.615	3.88	2.58 - 5.85
II	Tiredness during wake time	33.352	3.14	2.10 - 4.72
	Daytime sleepiness	50.562	4.14	2.73 - 6.29
	Sleepiness behind the wheel	69.436	8.14	4.73 - 14.01
III	Overweight	157.652	11.05	7.07 - 17.27
	Hypertension	56.236	4.74	3.05 - 7.37

NOTE: * Fisher's exact test significant for all variables (2-sided); $p < 0.0001$.

OSAS by age and gender is presented in Figure 3. For females the risk of having OSAS syndrome is gradually increasing up to 45-54 years and remaining high for the later period. In males the risk of having apnea-hypopnea syndrome after 45-54 years is decreased in comparison with females.

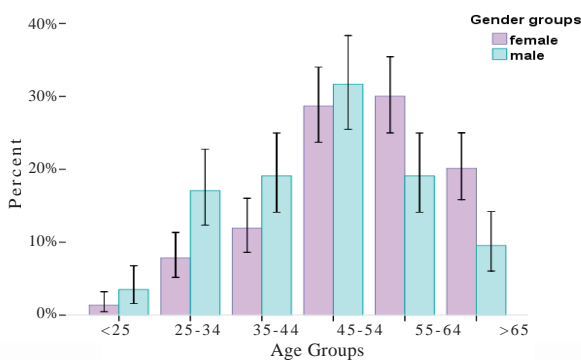


FIGURE 3. Distribution of individuals at high risk of OSAS by age and gender (Error bars: 95% CI).

Figure 4 presents the subdivision of the surveyed population into 6 age groups with 10-year intervals and the corresponding risk distribution. As obvious, the risk level is abruptly jumping for the age group of 45-54 years old.

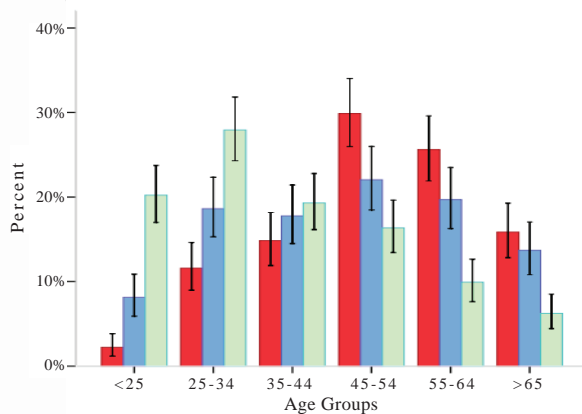


FIGURE 4. Distribution of risk level according to age (■ high, ■ low and ■ none) according to age (Error bars: 95% CI).

DISCUSSION

A number of epidemiological studies have been performed to evaluate the prevalence of OSAS in various ethnic and racial groups; nevertheless, this is the first epidemiological study to estimate the prevalence of sleep disorders in adult population of Yerevan (Armenia). In the surveyed sample 37.2% subjects reported snoring, while 5.5% of respondents reported that they had breathing pauses. Some findings were expected based on our knowledge of the OSAS pathophysiology. For example, our study also showed a clear association between obesity, high blood pressure, and snoring with the high risk for OSAS. In our study among all the respondents 486 (32.3%) mentioned having high blood pressure. It is a typical parameter for our population, which is very close to the outcomes of the screening done among adult population in Yerevan city in 2004, when the researchers showed high prevalence (27.4%) of AH [Zelveian P., Podosyan G., 2011]. This fact can be estimated as the additional proof in favor of BQ screening methods high relevance.

A population-based study using the same instrument was done in United Kingdom [Ohayon M. et al., 1997]. The results of investigation in our sample were almost similar with those obtained by M. Ohayon and associates, who found that the prevalence of snoring and breathing pauses made 40.3% and 5.5%, respectively, meanwhile in our study we obtained 37.2% and 3.8%. However, data from Iran presented by H. Khazaie and colleagues reported higher prevalence of snoring (49.5%) and apnea (10%) [Khazaie H. et al., 2011].

Epidemiological and clinic-based studies indicate that OSAS is more common in men than in women. Similar association is found in Pakistani [Taj F. et al., 2008] and Hong Kong [Ip M. et al.,

2001; 2004] studies. Another study was done in India. They used a set of screening questions and validation of the BQ with certain modifications in Indian setting. Modifications were done to suit questions to their population. After responding to questions, subjects with positive results (high and low risk groups) performed overnight polysomnography. Indian researchers found that overweight and AH (53%) were associated with habitual snoring and OSAS. Furthermore, they found similar associations in subjects, for whom only BQ was filled out [Sharma S. et al., 2006].

In 2005 the US National Sleep Foundation performed an annual study, using BQ derived from telephone survey. The study reported that 26% (one in four American adults) of the respondents are at the high risk for OSAS [Hiestand D. et al., 2006].

In our survey, using BQ as an instrument for investigation, we found that 32.7% of our sample was at high risk for having OSAS. As known, the possibility of having sleep apnea is increasing with the increase of BMI and age [Hoffstein B., Mateika S., 1992; Shinohara E. et al., 1997]. In US among obese individuals 57% were at high risk, and the risk of having possible breathing pauses increased up to age of 65 years. In our study the risk level was increasing up to 45-54 years and was strongly associated with obesity.

The study in Iran showed that 144 (27.3%) from 527 participants were categorized as high risk for having sleep apnea. In addition, they were also more likely to have higher BMI [Khazaie H. et al., 2011]. Meanwhile, results of a study in Pakistan showed lower prevalence of high risk – 10% [Taj F. et al.,

2008]. Different methodology might be the possible reason for this disparity: in category III they defined BMI above 27 kg/m² as a positive score for risk; ethnic differences can be another explanation.

In our study 17.2% of respondents reported that they had nodded off to sleep at least once while driving. It is an important health hazard, because patients with OSAS have the great risk for traffic accidents [Teran-Santos J. et al., 1999]. Our reported rate is higher than in a study from Pakistani population, as they reported that 10.8% had nodded off to sleep while driving at least once in their life [Taj F. et al., 2008]. However, in Indian study 26.4% of the cases mentioned drowsiness during driving. Data from US were alarming: 32% of respondents reported driving drowsy one or more times per month [Hiestand D. et al., 2006]. The prevalence of “ever fallen asleep behind the wheel” in our sample was much higher in men than the prevalence reported in women (22.6% versus 6.0%). It can be explained by the prevalence of breathing pauses in men.

CONCLUSION

High prevalence of snoring, daytime sleepiness, hypertension, tiredness during wake time, and possible apnea episodes were found in Yerevan adult population. The prevalence of daytime sleepiness and OSAS high risk are noteworthy. Approximately more than 1 in 3 individuals in Yerevan adult citizens is at high risk for having OSAS. Considering the effects of this condition on quality of life, morbidity and mortality, further research in an effort towards early diagnosis and treatment is needed.

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