Malaysian Sports Journal (MSJ)

***DOI** : http://doi.org/10.26480/msj.02.2019.01.05*

E-ISSN: 2710-5964 (Online)

RESEARCH ARTICLE

SNORING CHARACTERISTICS INVENTORY AND BLOOD PRESSURE: WINDOW ASSESSMENT TOOL FOR OBSTRUCTIVE SLEEP APNEA AND CARDIOVASCULAR RISK

Rose Ann Z. Masa*

Laguna State Polytechnic University, Laguna, Philippines.
Corresponding Author Email: roseannzmasa@gmail.com

ARTICLE DETAILS

Article History:

Received 16 August 2019
Accepted 20 September 2019
Available online 01 November 2019

ABSTRACT

This study utilized Modified Berlin Snoring Inventory in determining characteristics and post wake up functional condition and its relationship with blood pressure. Respondents are frequent snorers, mostly males, 46 years old and above, with 130-150 systolic and diastolic of 80-100 mmHg blood pressure with only 12.5% who experienced choking and apnea. There is no significant difference in systolic, diastolic blood pressure, snoring characteristics as to frequency, loudness, apnea, choking, feeling of tiredness and fallen asleep while watching TV when grouped according to age and sex. There is a significant difference in disturbing effects and post wake up condition as to fallen asleep while waiting for turns when grouped according to sex. Males have more disturbing effects and fallen asleep than female. The loudness predict significantly with systolic blood pressure. Disturbing effects predict significantly with diastolic blood pressure. There is no significant relationship between the post wake up condition and systolic and diastolic blood pressure. There is a significant relationship in the loudness snore characteristics with the systolic blood pressure. There is a significant relationship in the snoring inventory post wake up condition as to feeling of tiredness and the diastolic blood pressure.

KEYWORDS

snoring characteristics, post wake up functional condition, systolic BP, diastolic BP

1. INTRODUCTION

Among Filipinos, snoring is a sign of good quality of deep sleep. However, people who snore are actually possibly suffering from a serious condition although not all episodes indicate trouble. Snoring comes in three varieties namely occasional, habitual, and serious or obstructive. There are various causative factors for the condition that includes obstructive nasal airway, poor muscle tone in the throat and tongue, bulky throat tissue, and too soft palate. Sleep disorder like Obstructive Sleep Apnea (OSA), is a condition known to be the most common and often undiagnosed sleep disorder worldwide. Snorers usually stop breathing repeatedly brought about by airway collapse due various factors such as extra tissue in the airway, decreased muscle tone holding the airway open and even larger tongue that prevents air to enter into the lungs. This pause in breathing can happen for more than 30 times per hour and recurrent snoring is linked to developing cardiovascular or heart disease [1].

Moreover, there are documented findings among snoring patients who have experienced a rise in both systolic and diastolic blood pressure values. While sleeping, they experienced apnea. With the temporary stopping of breathing brought about by an imbalance in the oxygen and carbon dioxide in the brain, thus, sleep apnea is a primary risk factor for hypertension. Systolic blood pressure rises at the end of apnea while the diastolic pressure rises during onset of apnea. The greater the hypoxemia or the inadequate oxygen supply in the blood, the greater the hypertensive response to sleep. It should also be noted that cases of sudden death in sleep have been reported in untreated sleep apnea patients with known arrhythmias [2]. The risk for arrhythmias or having irregular heartbeat is associated with factors like snoring and hypertension.

There is an estimated 4 to 6 percent of the Filipino population who suffers from sleep disorder without them knowing the condition that they really stop breathing while sleeping. These episodes subsequently could lead to post waking up problems such as sleepiness, inability to perform on the optimum level in workplace as well as physiological effects like increase blood pressure. Inability to undergo polysomnography due to limited resources, this study aimed to identify high risk subjects.

This is the reason why there is a need for this research and subsequently begins with an earlier interventions for the affected snoring individual. Moreover, by means of this study, sleeping disorder assessment could be obtained with the use of the Modified Berlin Snoring Inventory to the snoring employee and their relatives who lives on the same house. Systolic and diastolic Blood Pressure and profile were also gathered in order to determine the relationship of these factors with OSA. Prevention is better than cure, thus, the need to educate the people about OSA, its harmful effects and health risk after the conduct of the assessment and consequently with the attainment of optimum health could be achieved.

2. LITERATURE REVIEW

The prevalence of cardiovascular ailment has reached alarming levels and most often than not, the condition is associated with hypertension. There are documented findings on patients who have experienced a rise in both systolic and diastolic values. While sleeping, a person experience apnea, a condition wherein there is a temporary stopping of breathing brought about by an imbalance in the oxygen and carbon dioxide in the brain. Sleep apnea is a primary risk factor for hypertension. Systolic blood pressure rises at the end of apnea and diastolic pressure rises during apnea. The greater the hypoxemia, the greater the hypertensive response to sleep. It

should also be noted that cases of sudden death in sleep have been reported in untreated sleep apnea patients with known arrhythmias. The risk to this condition is associated with factors like snoring and hypertension [2].

Heavy snoring is a sign of OSA. When people with this condition sleep, the soft tissues in the back of their throats relax and close off the airway—they simply stop breathing. Usually associated with snoring, sleep apnea means the involuntary cessation of breathing during sleep, which deprives the individual of valuable oxygen during the episodes. This breath-holding initially lasts for 10 seconds and progresses to 20 to 30 seconds, and each episode is immediately followed by gasping for air. This cycle could repeat itself several times (20 to 100 times per hour) the whole night long. The snorer is totally oblivious of all this and only the roommate is aware of this bothersome snoring and scary sleep apnea. Furthermore, the condition is aggravated by the post effect since the snoring person could not have the normal sleeping pattern. Sleepiness occurs as a post effect of the snoring activity. The person wakes up with a dry mouth and throat, headache, fatigue and sleepiness throughout the day, together with some memory deficiency, poor attention and concentration, lack of sleep, due to sleep apnea [3]. Moreover, daytime sleepiness could be symptomatic of insufficient sleep, disturbed sleep, and/or circadian disruption that in turn increase the risk of vascular events. It could also be due to an underlying medical illness that is a risk factor for cardiovascular disease and could be an independent risk factor for stroke and Congestive Heart Disease [4].

However, a study revealed that administration of modified Berlin questionnaire prior to a polysomnography study can identify high risk subjects [5]. These factors are window assessment of cardiovascular conditions. The Berlin sleep questionnaire is applied to bed partners and used in screening apneic patients [6]. Furthermore, this questionnaire was considered as reliable and practical tool in screening OSA [7].

3. CONCEPTUAL FRAMEWORK

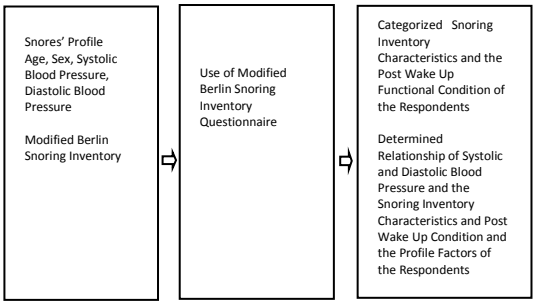

Figure 1: Research Paradigm

Figure 1 shows the conceptual framework of the study. Under the Input is the profile of the respondent, age, sex, systolic and diastolic blood pressure. With the Process is the use of modified berlin snoring inventory questionnaire. Under the Output are the respondents' Categorized Snoring Inventory Characteristics and the Snoring Inventory Post Wake up condition. Moreover, assessment of respondent 's obstructive apnea was also determined. Furthermore, the Relationship of Systolic and Diastolic Blood Pressure and the Snoring Inventory Characteristics and Post wake up condition the respondents is also part of the dependent variable. This study aimed to make an assessment of the snoring inventory characteristics which includes snoring inventory post wake up functional condition and established an assessment of respondent's obstructive apnea condition, as a window assessment for cardiovascular ailment. Moreover, it also deals with the relationship of the systolic and diastolic blood pressure and snoring inventory of the selected employees of the Laguna State Polytechnic University, San Pablo City Campus and their relatives who live within the same house.

Specifically, it sought to answer the following questions:

1. What is the profile of the respondents in terms of age and sex?
2. What is the systolic and diastolic Blood Pressure of the respondents?
3. What is the snoring inventory characteristics of the respondents as to frequency; loudness; disturbing effect; occurrence of apnea; and occurrence of choking while sleeping?
4. What is the snoring inventory post wake up functional condition of the respondents as to: feeling of tiredness; fallen asleep while waiting for their turn; and fallen asleep while watching television during daytime?
5. Is there a significant difference in the systolic and diastolic blood pressure of the respondents when grouped according to profile factors?
6. Is there a significant difference in the snoring inventory characteristics of the respondents when grouped according to their profile factors?
7. Is there a significant difference in the snoring inventory post wake up functional condition of the respondents when grouped according to their profile factors?
8. Is there a significant relationship between the snoring inventory characteristics and the systolic and diastolic blood pressure of the respondents?
9. Is there a significant relationship between the snoring inventory post wake up condition and the systolic and diastolic blood pressure of the respondents?

The following null hypotheses were tested at 0.05 level of significance:

1. There is no significant difference in the systolic and diastolic blood pressure of the respondents when grouped according to profile factors.
2. There is no significant difference in the snoring inventory characteristics of the respondents when grouped according to their profile factors.
3. There is no significant difference in the snoring inventory post wake up functional condition of the respondents when grouped according to their profile factors.
4. There is no significant relationship between the snoring inventory characteristics and the systolic and diastolic blood pressure of the respondent.
5. There is no significant relationship between the snoring inventory post wake up functional condition and the systolic and diastolic blood pressure of the respondents.

4. PRESENTATION, ANALYSES AND INTERPRETATION OF DATA

Table 1 shows the age of respondents. It indicates that the dominant population of the respondents' age ranges from 46 and above with 23 out of 40 or 57.5 percent, while there are 17 out of 40 or 42.5 percent whose age ranges from 45 and below. The dominant population of the snoring respondents is above 46 years old.

Table 1: Age Profile of the Respondents

Age of the Respondents	Frequency	Percentage
45 and below	17	42.5%
46 and above	23	57.5%
Total	40	100%

Table 2 presents the sex of the respondents. It indicates that the dominant sex is male with 22 out of 40 or 55 percent of the total number of respondents, while there are only 18 out of 40 or 45 percent who are female. It shows that the snoring population is dominated by male.

Table 2: Sex Profile of the Respondents

Sex of the Respondents	Frequency	Percentage
Female	18	45%
Male	22	55%
Total	40	100%

Table 3 shows the systolic blood pressure results of the respondents. There are 24 out of 40 or 60 percent of the respondents who have the result of 130mmHg whereas the lowest percentage of 2.5 percent or 1 out of 40 respondents got the result of 150mmHg. It indicates that all the

respondents' systolic blood pressure is above normal, the value of which must be 120 mmHg.

Table 3: Systolic Blood Pressure results of the Respondents

Results in mmHg	Frequency	Percentage
150	1	2.5%
140	15	37.5%
130	24	60.00%
Total	40	100.00%

Table 4 shows the diastolic blood pressure results of the respondents. There are 22 out of 40 or 55 percent of the respondents who have the result of 80mmHg whereas the lowest percentage of 2.5 percent or 2 out of 40 respondents got the result of 100mmHg. There are 16 out of 40 or 40 percent who have a diastolic blood pressure. This clearly indicates that the dominant population of the respondents' diastolic blood pressure is within normal level which is 80 mmHg. It also implies that 45 percent of the respondents have a diastolic blood pressure that ranges from 90-100mmHg which is categorized as hypertensive diastolic blood pressure. The diastolic blood pressure is a window indicator for the functional ability of the heart. The higher the value, the more prone to cardiovascular ailment since both systolic and diastolic blood pressure have strong associations with all cardiovascular disease [8].

Table 4: Diastolic blood pressure result of the Respondents

Results in mmHg	Frequency	Percentage
100	2	5.00%
90	16	40.00%
80	22	55.00%
Total	40	100%

Table 5 shows the snoring frequency results of the respondents. It revealed that 20 out of 40 or 50 percent always snore and there are 18 out of 40 or 18 percent snores when they are tired. As to occasional snorer, there are only 2 out of 40 or 10 percent. The result clearly indicates that the dominant population of the respondents is snorer, especially when they were tired.

Table5: Snoring Inventory Frequency result

Characteristics	Occurence	Frequency	Percentage
Frequency	Always	20	50.00%
	When Tired	18	40.00%
	Occasionally	2	10.00%
Total		40	100%

Table 6 shows the snoring inventory loudness results of the respondents. There are 16 out of 40 or 40 percent of the respondents whose snoring were slightly louder than breathing, 11 out of 40 or 27.5 percent whose snoring are as loud as breathing while 7 out of 40 or 17.5 percent whose snoring are louder than talking and 6 out of 40 or 15 percent whose snoring are very loud.

Table 6: Snoring Inventory Loudness result

Snoring inventory	Characteristics	Frequency	Percentage
Loudness	Very loud	6	15.00%
	Louder than talking	7	17.50%
	As loud as talking	11	27.50%
	Slightly louder than breathing	16	40.00%
Total		40	100%

Table 7 shows the snoring inventory disturbing effects results of the respondents. There are 12 out of 40 or 30 percent of the respondents whose snoring were Nearly never disturbing effects, 11 out of 40 or 27.5 percent with Seldom disturbing effects, 9 out of 40 or 22.5 percent who have occasional disturbing effects and 8 out of 40 or 20 percent whose snoring always have a disturbing effects.

Table 7: Snoring Inventory Disturbing Effects result

Characteristics	Occurence	Frequency	Percentage
Disturbing Effects	Always	8	20%
	Occassionally	9	22.5%
	Seldom	11	27.5%
	Nearly never	12	30%
Total		40	100%

Table 8 shows the snoring inventory occurrence of apnea results of the respondents. There are 35 out of 40 or 87.5 percent of the respondents whose snoring does not coincide and perceive "nearly never" with the occurrence of apnea whereas 5 out of 40 or 12.5 percent seldom experience the occurrence of apnea. This clearly implies that the dominant population of the respondents is not yet experiencing apnea usually associated with snoring; sleep apnea means that there is an involuntary cessation of breathing during sleep, which deprives the individual of valuable oxygen during the episodes. This breath-holding initially lasts for 10 seconds and progresses to 20 to 30 seconds, and each episode is immediately followed by gasping for air. Because of the interruptions in breathing, sleep apnea can also place a strain on the heart, in turn potentially causing hypertension, arrhythmia and other heart problems.

Table 8: Snoring Inventory Occurrence of Apnea result

Snoring Characteristics	Occurence	Frequency	Percentage
Occurence of Apnea	Always	0	0%
	Occassionally	0	0%
	Seldom	5	12.5 %
	Nearly never	35	87.5 %
Total		40	100%

Table 9 shows the snoring inventory occurrence of choking results of the respondents. There are 35 out of 40 or 87.5 percent of the respondents whose snoring does not coincide and perceive "nearly never" with the occurrence of choking whereas 5 out of 40 or 12.5 percent seldom experience the occurrence of choking. This clearly implies that the dominant population of the respondents is not yet experiencing choking.

Table 9: Snoring Inventory occurrence of Choking while sleeping

Snoring Characteristics	Occurence	Frequency	Percentage
Choking	Always	0	0%
	Occassionally	0	0%
	Seldom	5	12.5%
	Nearly never	35	87.5 %
Total		40	100%

Table 10 shows the snoring inventory as to post wake up condition as to feeling of tiredness. There are 28 out of 40 or 70 percent who answered "nearly never" in terms of feeling of tiredness while 8 out of 40 or 20 percent answered "seldom", 3 out of 40 or 7.5 percent and 1 out of 40 or 2.5 percent always experienced feeling of tiredness after waking up. This clearly implies that less than half of the population of the respondent experienced post waking up tiredness. The feeling of tiredness.is attributed to the inability to have a continuous sleep.

Table 10: Post Wake up condition as to feeling of tiredness result

Snoring Characteristics	Occurence	Frequency	Percentage
Feeling of tiredness	Always	1	2.5%
	Occassionally	3	7.5%
	Seldom	8	20%
	Nearly never	28	70%
Total		40	100%

Table 11 shows the snoring inventory as to post wake up condition as to falling asleep while waiting for a turn. There are 14 out of 40 or 35 percent who occasionally fall asleep while waiting for a turn, 13 out of 40 or 32.5 percent who nearly never experienced fallen asleep while waiting for a turn, 11 out of 40 or 27.5 percent who seldom experienced and 2 out of 40 or 5 percent always fall asleep while waiting for their turn. The result clearly implies that the dominant population of the respondents is fallen asleep as a post effect of snoring.

Table 11: Snoring Inventory Post wake up condition as to Fallen asleep while waiting for turn

Snoring Characteristics	Occurence	Frequency	Percentage
Fallen Asleep while waiting for turn	Always	2	5%
	Occassionally	14	35%
	Seldom	11	27.5%
	Nearly never	13	32.5%
Total		40	100%

Table 12 shows the snoring inventory post wake up condition as to falling asleep while waiting TV during daytime. There are 16 out of 40 or 40 percent who seldom fall asleep while waiting TV during daytime, 11 out of 40 or 27.5 percent who occasionally fallen asleep, 9 out of 40 or 22.5 percent always experienced fallen asleep , whereas only 4 out of 40 or 10 percent nearly never fall asleep while waiting for their turn. The result clearly implies that the dominant population of the respondents is fallen asleep as a post effect of snoring.

Table 12: Snoring Inventory Post Wake up condition as to Fallen asleep while watching TV during daytime

Snoring Characteristics	Occurence	Frequency	Percentage
Fallen Asleep	Always	9	22.5%
While watching TV	Occassionally	11	27.5%
	Seldom	16	40%
	Nearly never	4	10%
Total		40	100%

Table 13 shows the relationship of Systolic Blood Pressure to the profile factors. It shows that as to age, the p value obtained is .549 with the t value of .604 and as to sex, the p value obtained is .532 with t value of .628. The statistical value obtained clearly indicates that there is no significant difference in the systolic blood pressure of the respondents when grouped according to the age and sex profiles. The respondent's systolic blood pressure ranges from 130 to 150 mmHg.

Table 13: Systolic BP vs. Profile Factors

Variables	t value	p-value	Interpretation
Age	.604	.549	NS
Sex	.628	.532	NS

**NS – Not Significant S- Significant*

Table 14 shows the relationship of Systolic Blood Pressure to the profile factors. It shows that as to age, the p value obtained is .975 with the t value of .032 and as to sex, the p value obtained is .534 with t value of .628. The statistical value obtained clearly indicates that there is no significant difference in the diastolic blood pressure of the respondents when grouped according to the age and sex profiles. The diastolic blood pressure ranges from 80-100mmHg.

Table 14: Diastolic BP vs. Profile Factors

Variables	t-value	p-value	Interpretation
Age	.032	.975	NS
Sex	.628	.534	NS

Table 15 shows the relationship of Snoring Inventory Characteristics and snoring post wake up effect with the Age profile of the respondents. It clearly indicates that all the five (5) snoring characteristics and the three (3) snoring post wake up effects do not predict significantly with the age factor of the respondents. It can be implied that regardless of age, may it be 45 and below or above 45 years old, the snoring characteristics such as frequency, loudness, effects to others, apnea choking as well as the post wake up effect of feeling of tiredness, fall asleep while waiting and fall asleep while watching TV are all the same.

Table 15: Snoring Inventory Characteristics and post effect vs. Age

Characteristics	t-value	p-value	Interpretation
Frequency	-.958	.355	NS
Loudness	-1.590	.120	NS
Disturbing effects	.366	.716	NS
Apnea	-.392	.697	NS
Choke	-.392	.697	NS
Post wake up effect	t-value	p-value	Interpretation
Feeling of tiredness	-.023	.982	NS
Fall asleep while waiting	-.392	.109	NS
Fall asleep watch TV	-1.259	.219	NS

Table 16 shows the relationship of Snoring Inventory Characteristics and snoring post wake up effect with the sex profile of the respondents. It clearly indicates that with the five (5) snoring characteristics, only the disturbing effect of snoring to other people predict significantly with sex with the p value of .024 with the t value of 2.353. With the three (3) snoring post wake up effects, the post wake up effects of falling asleep while waiting for their turn also predict significantly with the sex factor having a p value of .021 with the t value of -2.455. All the remaining factors do not predict significantly with sex of the respondents. Male snorer seems to have a characteristic of snoring with a more disturbing effect as compared to their female counterpart. As to the Post wake up condition, males also have the tendency to fall asleep while waiting for their turn like in the case of paying bills etc.

Table 16: Snoring Inventory Characteristics and post effect vs. Sex Profile

Snore Characteristics	t-value	p-value	Interpretation
Frequency	-1.012	.318	NS
Loudness	-1.667	.102	NS
Disturbing effects	2.353	.024	S
Apnea	-.707	.484	NS
Choke	-.707	.484	NS
Post tiredness	-1.693	.099	NS
Fall asleep waiting	-.2.455	.021	S
Fall asleep watch TV	-1.571	.126	NS

Table 17 indicates the relationship of snoring characteristics with Blood pressure. This clearly indicates that the snoring characteristics namely frequency, disturbing effects, apnea and choking does not predict significantly with the systolic blood pressure. However, snore loudness characteristics predict significantly with systolic blood pressure, with the r value of -.312 and a p value of .050. The higher the systolic BP, the louder the snore characteristics. With the Diastolic blood pressure, all the snore characteristics such as frequency, loudness, and disturbing effect, occurrence of apnea and occurrence of choking do not predict significantly.

Table 17: Snoring Inventory Characteristics vs. BP

Snore Characteristics	Systolic BP			Diastolic BP		Interpretation
	r value	p value	Interpretation	r value	p value	
Frequency	-.086	.60	NS	.148	.363	NS
Loudness	-.312	.050	S	-.269	.093	NS
Disturb effect	.308	.053	NS	.013	.938	NS
Snore-apnea	-.104	.523	NS	.104	.523	NS
Snore-choke	-.104	.523	NS	.104	.523	NS

Table 18 indicates the relationship of snoring post wake up characteristics with Blood pressure. This clearly indicates that only the characteristics indicator post feeling of tiredness predict significantly with the diastolic blood pressure with the obtained r value of .365 with the p value of .020 ,whereas all the indicators do not predict significantly. There is a significant relationship in the feeling of tiredness as the snorer woke up in the morning. Diastolic BP reflects the cardiovascular condition of the respondents.

Table 18: Snoring Post Wake up Characteristic vs. BP

Post wake up characteristics	Systolic BP		Interpretation	Diastolic BP		Interpretation
	r value	p value		r value	p value	
Feeling of tiredness	.242	.133	NS	.365	.020	S
Fallen asleep while waiting for turn	-.087	.592	NS	.058	.721	NS
Fallen asleep while watching TV	-.210	.193	NS	-.113	.489	NS

5. CONCLUSIONS

1. There is no significant difference in the systolic (130-150mmHg) and diastolic (80-100mmHg) blood pressure of the respondents when grouped according to profile factors.
2. There is no significant difference in the snoring inventory characteristics of the respondents as to frequency, loudness, apnea and choking when grouped according to their profile factors. There is a significant difference in the snoring inventory characteristics as to disturbing effects of the respondents when grouped according to sex profile, male snorer shows more disturbing effects. Respondents are not yet high risk to cardiovascular disease due to absence of apnea and choking.
3. There is no significant difference in the snoring inventory post wake up condition of the respondents as to feeling of tiredness and fallen asleep while watching TV when grouped according to their profile factors. There is a significant difference in the snoring post wake up condition of the respondents as to fallen asleep while waiting for their turns when grouped according to sex profile. Male respondents have the tendency to fall asleep while waiting for their turns as post snoring effect which could eventually lead to a work related problems due to inefficiency.
4. There is no significant relationship between the snoring inventory characteristics and the systolic and diastolic blood pressure of the respondent.
5. There is a significant relationship in the loudness snore characteristics with the systolic blood pressure. The higher the systolic BP, the louder the snoring characteristics.
6. There is no significant relationship between the snoring inventory post wake up condition such as feeling of tiredness, fallen asleep while waiting and fallen asleep while watching TV and the Systolic BP. There is no significant relationship in the snoring inventory post wake up condition such fallen asleep while waiting and fallen asleep while watching TV Diastolic BP of the respondents. There is a significant relationship in the snoring inventory post wake up condition as to feeling of tiredness and the Diastolic BP. The higher the diastolic BP, the higher the occurrence of feeling of tiredness of the snorer despite the sleep during the night.

REFERENCES

[1] de los Reyes, V.S., Ojascastro, E.B., Ceniza, R.B., Dizon, R.V., Banzon, A.G., Jocson, M.C., Jorge, M.C., Remulla, A.T., Zaraspe, A.C. 2016. Phil- ippine Clinical Practice Guidelines on the Diagnosis and Management of Obstructive Sleep Apnea in Adults, Philippine College of Physicians. Retrieved from: http://philchest.org/v3/wp-content/uploads/2013/05/09_May_-final-draft-cpg- osa.pdf.

[2] Endeshaw, Y., Rice, T.B., Schwartz, A.V., Stone, K.L., Manini, T.M., Satterfield, S., Cummings, S., Harris, T., Pahor, M. 2013. Snoring, daytime sleepiness, and incident cardiovascular disease in the health, aging, and body composition study. SLEEP Research Society, 36 (11), pp. 1737-1745. Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3792392/.

[3] Gangwisch, J.E., Rexrode, K., Forman, J.P., Muk- amal, K., Malaspina, D., Feskanich, D. 2014. Daytime sleepiness and risk of coronary heart disease and stroke: results from the Nurses' Health Study II||. Sleep medicine, 15 (7), pp. 782–788. doi: 10.1016/j.sleep.2014.04.001.

[4] Lombardi, C., Castiglioni, P., Lugaresi, E., Cortelli, P., Montagna, P., Parati, G. 2009. Autonomic arousals in sleep related breathing disorders: a link be- tween daytime somnolence and hypertension? Sleep, 32 (7), 843–844. doi:10.1093/sleep/32.7.843

[5] Preidt, R. 2014. Health Risk may depend on which BP number is high. Health Daily Report. Retrieved from: https://www.webmd.com.

[6] Sagaspe, P., Leger, D., Taillard, J., Bayon, V., Chau- met, G., Philip, P. 2010. Might the Berlin Sleep Questionnaire applied to bed partners be used to screen apneic patients? Sleep Medicine, 11 (5), Pp. 479-483. Retrieved from: https://www.ncbi.nlm.nih.gov.

[7] Sharma, S.K., Vasudev, C., Sinha, S., Banga, A., Pan- dey, R.M., Handa, K.K. 2006. Validation of modified Berlin questionnaire to identify patients at risk for obstructive sleep apnea syndrome.

[8] The Indian Journal of Medical Research, 124 (3), Pp. 281-90. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/17085831.

[9] Srijithesh, P.R, Shukla, G., Srivastav, A., Goyal, V., Singh, S., Behari, M. 2011. Validity of the Questionnaire in identifying obstructive sleep apnea when administered to the informants of stroke patients. J. Clin. Neurosci., 18 (3), 34D- 3. doi: 1D1016/j.jocn.2010.04.048. Retrieved from: https://www.ncbi.nlm.nih.gov/pubmed/21237648