Systemic Hypertension and Risk of Obstructive Sleep Apnea Syndrome: a Case- Control Study in Yerevan, Armenia

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LIST OF ABBREVIATIONS

AHI	Apnea-Hypopnea Index
ArMA	Armenian Medical Association
BMI	Body Mass Index
BP	Blood Pressure
BQ	Berlin Questionnaire
CI	Confidence Interval
cm	centimeter
CVD	Cardiovascular Disease
DBP	Diastolic Blood Pressure
HESA	Hypertension Extended Study in Armenia
HTN	Hypertension
IPAQ	International Physical Activity Questionnaire
mm Hg	millimeters of mercury
nCPAP	nasal Continuous Positive Airway Pressure
OR	Odds Ratio
OSA	Obstructive Sleep Apnea
OSAS	Obstructive Sleep Apnea Syndrome
SBP	Systolic Blood Pressure
US	United States
WHO	World Health Organization

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ABSTRACT

Introduction: Systemic hypertension (HTN) and obstructive sleep apnea syndrome (OSAS) are common conditions affecting middle-aged and elderly adults, and both conditions are associated with significant morbidity and mortality. HTN is very prevalent in Armenia. OSAS has been recognized in the Western world as a public health burden, but there have been no OSAS related epidemiological studies conducted in Armenia.

*Objective***:** To measure the independent association between risk of OSAS and systemic HTN in adult people living in Yerevan considering all known confounders.

Methods: The study utilized a case-control design. The main outcome measure was the HTN status; the independent variable was the risk of OSAS. The study population (108 cases and 157 unmatched controls) came from the sample population (170 hypertensives and 578 normotensives) of Hypertension Extended Study in Armenia (HESA) conducted in 2004 by the Armenian Medical Association in Yerevan. The study utilized questionnaires and measurements of blood pressure and body habitus. The study measured the OSAS risk through the Berlin Questionnaire. Data analysis was performed using SPSS and STATA software.

Results: The odds of HTN in people with high risk of OSAS was 2.17 times greater (95% CI: 1.02, 4.63) than odds of HTN in people with low risk of OSAS after adjusting for age, neck circumference and co-morbidities (diabetes and/or renal disease).

Conclusions: This case-control study found an independent positive association between OSAS risk and HTN. The study identified fat deposition in the neck as an influential determinant of HTN and OSAS risk, and indicated that development of diabetes and renal disease were important risk factors for HTN. It also showed that the risk of developing HTN increases with age.

1. INTRODUCTION

1.1. Hypertension

Hypertension (HTN) is a disorder with chronically high blood pressure (BP); it is measured in millimeters of mercury (mm Hg) and is described with 2 numbers: systolic blood pressure (SBP) and diastolic blood pressure (DBP) (1). HTN is diagnosed when the average of 2 or more DBP measurements is ≥90 mm Hg or when the average of multiple SBP readings is ≥140 mm Hg (1-5) (see Appendix 1). The higher the BP, the greater is the probability of heart attack, heart failure, stroke, myocardial infarction, and renal (kidney) disease (2-4). Beginning at 115/75 mm Hg, cardiovascular (CVD) risk doubles for every 20 mm Hg systolic or 10 mm Hg diastolic increase in BP (3). According to the World Health Organization (WHO), 62% of cerebrovascular disease and 49% of ischemic heart disease are due to suboptimal BP (>115 mm Hg SBP) (3). About 1 billion individuals suffer from HTN throughout the world, and approximately 7.1 million deaths per year may be attributable to HTN (3).

Thus, HTN is an important medical and public health issue, and its prevention and management are major public health challenges (3). To be able to prevent and control HTN, it is necessary to better understand the problem and all associated factors/conditions.
A number of risk factors have been identified for HTN, including age, gender, obesity, dietary habits, lack of physical activity, excess alcohol intake, stress, smoking, family history of HTN, certain drugs, hormonal disorders, diabetes, renal disease and obstructive sleep apnea syndrome (OSAS) (2-4;6;7).

The current study focused on exploration of one of the risk factors, namely OSAS.

1.2. Obstructive Sleep Apnea Syndrome

Clinical and public health importance of the OSAS, identified about 40 years ago, is

increasingly recognized (8). The word syndrome implies that several disorders may produce similar symptoms (9). OSAS may include obstructive sleep apnea (OSA), sleep hypopnea, or abnormal upper airway resistance during sleep, which differ in the degree of airway blockage or obstruction (9).

OSA is a life-threatening condition and the most common form of sleep apnea (10). OSA is defined as complete collapse of the upper airway lasting 10 seconds or more with persistent effort to breathe (11-14). People suffering from it stop breathing repeatedly while sleeping due to the episodes of upper airways blockage caused by relaxation of the muscles at the base of the throat (15). As a result, air does not get into the lungs and the airway collapse causes excessively loud snoring, followed by silent periods of stopped breathing and patients make persistent efforts to breathe against the occluded upper airway (14;16). Apnea episodes result in abnormal sleep and low blood oxygen during sleep (16).

The episodes of partial airway collapse while sleeping lasting more than 10 seconds are called hypopnea (11-13;17). Abnormal upper airway resistance during sleep is characterized by abnormal respiratory-related arousals that do not meet the accepted definition of apnea or hypopnea (14;18).

Traditionally, the severity of OSAS has been assessed by the apnea-hypopnea index (AHI- the number of apneic and hypopneic episodes per hour of sleep), which is a semi-quantitative method and can be influenced by many factors, including variability in the severity of sleep apnea from night to night, especially in the mid range of disease severity (19). A certain threshold level of AHI is used to diagnose OSAS, and the cutoff points of ≥5, ≥10, and ≥15 are widely used in studies to describe sleep apnea though the clinical importance of cutoff points is not identified (12;13). AHI <5 per hour is considered as normal; an AHI of 5 to 15 is a mild disease, 15 to 30 is a moderate disease, and greater than 30 is a severe disease (14).

Screening studies conducted in the United States (US), Europe, and Australia have demonstrated that OSAS is prevalent in the adult population, occurs in approximately 5% to 15% of the population, and there is an opinion that up to 93% of women and 82% of men with moderate to severe OSAS remain undiagnosed (14;20;21). The prevalence of OSAS among hypertensive people has also been studied and ranges from 12% to 83% (22). Differences in studied populations as well as application of different definitions of the OSAS and HTN could explain significant variations in prevalence estimates (18;22).

Many people with OSAS complain of snoring, gasping and choking for breath, frequent awakening at night, excessive daytime sleepiness or fatigue, morning headaches, limited attention, memory loss, depression, anxiety and general mood disorders (8;12;13;16;23-25). Very often people do not know that the above-mentioned symptoms are a result of the OSAS and majority of affected people remain undiagnosed and untreated (8;16). These symptoms can have a large social and economic burden on the society (8). For example, due to sleepiness people may have impaired social functioning, work performance and driving ability (8). Drivers with untreated OSAS have 3-7-fold higher prevalence of motor vehicle accidents (25;26).

Health care costs related to the diagnosis and treatment of OSAS are substantial. Sleep studies are expensive (a cost of a polysomnography procedure, which is a gold standard for diagnosis, is approximately $1,100 in the US) and inconvenient as the patient has to spend a night in a special sleep laboratory, and the use of diagnostic equipment requires significant training of personnel (13;24). Therefore, primary care doctors often fail to detect OSAS in their patients (16).

1.3. Previous Research

Several studies suggested that OSAS increases the risk of developing HTN and CVD and can be as a serious risk factor as diabetes (15;27;28). Patients with untreated severe

OSAS have a higher incidence of fatal and non-fatal cardiovascular events compared with untreated patients with mild–moderate OSAS, patients treated with nasal continuous positive airway pressure (nCPAP), and healthy subjects (29;30).

The mechanism by which OSAS can lead to HTN is not fully understood (31). The most popular hypothesis is that apnea and hypopnea lead to decreased oxyhemoglobin saturation, this stimulates peripheral chemoreceptors, which activate sympathetic nervous system during the night to increase cardiac output, systemic vascular resistance and BP, and nightly recurrent temporary elevations in systemic BP may also lead to elevated BP during the daytime and, eventually, if untreated, to sustained HTN (11;28;32).

The relationship between OSAS and HTN is complex and may be bidirectional (27). Some authors suggest that OSAS potentially worsens HTN, and HTN can influence the severity of OSAS. Until recently it was not clear whether this relationship is etiological or due to confounders, including obesity and especially upper body obesity (19). Upper body obesity could influence OSAS through deposition of fat in the neck, narrowing the pharyngeal airway (19). For example, higher prevalence of the OSAS in men could be due to upper body obesity, more typical male fat deposition (19).

There were numerous epidemiological studies of OSAS and HTN (population-based and sleep clinic-based) and none have precluded the existence of a moderate association (15;27;28;30;32;33). Some studies came to conflicting conclusions probably not only because of differences in study populations, diagnostic procedures, sample size, but also due to inappropriate consideration of confounding variables (15;33;34). Therefore, it is important to investigate the association between OSAS and BP after adjusting for important confounding factors (15;34).

It is known that OSAS and HTN share a remarkable plethora of risk factors (34). Both HTN and OSAS are known to be related to obesity, particularly upper body obesity,

age, alcohol consumption and smoking (3;4;12;13;18;19;21;23;35-49). Moreover, HTN is associated with exercise levels and caffeine consumption, and OSAS patients can have excessive daytime sleepiness or fatigue and are likely to do less exercise and drink about three times more coffee (3;34;50-55).

1.4. Situation in Armenia

Nearly 50% of men and women aged 45 and more are suffering from HTN, though 82% of hypertensive women and 81% of hypertensive men do not know that they have HTN, and 11% of men and 5% of women are aware of their condition but do not get any treatment for it (56). The rates of HTN are high even in the younger age category: for the age range 35-44 the rates are significantly higher for both women and men compared to the rates in the US (31% of women and 36% of men in Armenia vs. 15% and 17% in the US) (56). Moreover, CVD is the leading cause of death in Armenia, accounting for 58% of all deaths in 2003 (56).

No epidemiologic survey was conducted in Armenia to assess the prevalence and magnitude of the OSAS and its association with risk factors and HTN. The OSAS as a serious health issue is under recognized in Armenia. There is no guideline on diagnosis and treatment of OSAS (57).

1.5. Description of the Current Study

The research question addressed by this study is the following: is there an independent association between HTN and the risk of OSAS in adult people living in Yerevan? The subquestion of interest is: is there an independent association between CVDs (stroke, myocardial infarction and heart failure) and the risk of OSAS in adult people living in Yerevan? It was hypothesized that high risk of OSAS significantly increases the risk of developing HTN and CVD in adult people living in Yerevan.

2. METHODS

2.1. Study design

A case-control study of the risk of OSAS among participants with and without HTN was conducted. This study design is appropriate to examine an association between exposure to a factor and development of a disease and strength of the association (58). It was impossible to carry out a cohort study due to time constraint, absence of appropriate financial and human resources. Although case-control studies have some limitations, as they are susceptible to bias, especially selection bias and recall bias, the design has several advantages compared with other types of epidemiological research: informativeness, efficiency, applicability to rare and common diseases, and ability to study rare exposure (59). Besides, a case-control study is suitable for exploring diseases of long induction period (59).

2.2. Study Population

The target population was adult people aged 18 and more, living in Yerevan. The sampling frame was the sample population of the Hypertension Extended Study in Armenia (HESA) conducted in 2004 by the Armenian Medical Association (ArMA) in Yerevan. The dataset included 748 participants consisting of 170 hypertensives and 578 normotensives. BP measurements of HESA were performed using guidelines adopted by the European Society of Hypertension (2).

2.2.1. Definition of Cases

Cases were adult men and women aged 18 and more who participated in the HESA study and had HTN. The participants were classified as hypertensive if they were told by a physician that they had HTN, were using antihypertensive medication independent of the actual measurement of BP, and/or if they had resting SBP reading equal or greater than

140 mm Hg and/or a DBP reading equal or greater than 90 mm Hg (2;3;5). The same cut-off points were used in the HESA study (57).

2.2.2. Definition of Controls

Controls were adult men and women who participated in the HESA study and did not have HTN or symptoms of HTN at the time of the study.

2.2.3. Exclusion criteria

Exclusion criteria for both cases and controls were: pregnancy, upper-airway surgery during the last one year, and tracheostomy. Tracheostomy and some upper airway surgeries are interventions to treat OSAS (12;26).

2.3. Sample size

Sample size calculation was based on formula for proportions difference assuming equal number of cases and controls with the level of significance 0.05 and power 0.8, and was performed using Stata-8 statistical software: sampsi 0.30 0.15, a(0.05) p(0.8). Considering the proportion of people with OSAS in hypertensive population, estimated as 30% (22;23), and the proportion of people with OSAS in normotensive population, estimated as 15% (14), sample size was estimated to be 134 cases and 134 controls. The expected response rate was 80%; therefore, the actual sample size was calculated to be 168 cases and 168 controls.

2.4. Study instruments

2.4.1. Questionnaires

The interviewers used two questionnaires during the face-to-face interviews. The first one was on socio-demographic data (age, gender, marital status, education and employment), social habits (smoking, alcohol use, consumption of caffeine containing drinks and physical

activity) and medical history (co-morbidities and medications use). The research team developed this questionnaire based on existing ones (28;57;60-62). The study measured physical activity by the International Physical Activity Questionnaire (IPAQ) and used the scoring protocol for the IPAQ short form (63).

The second questionnaire was the Berlin questionnaire (BQ) to measure the risk of OSAS. It was developed in 1996 and was the outcome of a Conference on Sleep in Primary Care (64). The questionnaire consists of 3 categories and includes a series of questions about the presence and frequency of snoring behavior, daytime sleepiness or fatigue, and history of obesity and HTN (16;24). Based on BQ patients can be classified into high risk (when 2 or more categories have a positive score) or low risk (when only one or no category has a positive score) groups depending on the responses to the individual items and their overall scores in the symptom categories (16;64). Being in the high-risk group predicted an AHI greater than 5 with a sensitivity of 0.86, a specificity of 0.77, and a positive predictive value of 0.89 (16). Questions about symptoms demonstrated internal consistency (Cronbach correlations, 0.86 to 0.92) (16).

2.4.2. Blood Pressure Recording

Blood pressure was measured in a standardized fashion using conventional mercury sphygmomanometer (2). Interviewers performed three measurements in both arms to detect possible differences due to peripheral vascular disease. The student investigator computed and compared an average of the second and third measurements from both arms and took the higher value as the reference one to classify participants according to the internationally acceptable definitions (2). When a respondent's systolic and diastolic blood pressures fell into different categories, the study team considered the higher category (2).

2.4.3. Anthropometric Measurements

Interviewers took the following anthropometric measurements: height and weight measurements, neck circumference at the level of the cricothyroid membrane, and waist circumference at the level of the umbilicus. Measures of body habitus were recorded by standard anthropometric methods: a portable scale and a tape measure. The student investigator calculated body mass index (BMI) as the weight in kilograms divided by the square of the height in meters and defined BMI categories using the established clinical guidelines for normal weight ($\leq$ 24.9 kg/m^2), overweight (25 to 29.9 kg/m^2), and obesity ($\geq$ 30 kg/m^2) (65). The current study measured the upper body obesity calculating the waist: height ratio, and a higher ratio indicated a higher upper body fat deposition (19).

2.5. Procedures to Recruit Study Participants

The ArMA supported in the data collection process by inviting interviewers, most of whom were cardiologists. The student investigator trained interviewers on how to fill in the questionnaires, how to take measurements, how to record contact failures; they also got information on some important interviewing skills.

Whenever possible, interviewers established a prior telephone contact with the study participants. Interviewees, willing to participate, enrolled in the study after giving informed oral consent. Interviewers conducted home-based face-to-face interviews using the study instruments and making appropriate measurements; the average duration of interviews was 25 minutes. The fieldwork lasted 2 months (June-July, 2007).

Interviewers tried to contact all respondents from the list of hypertensives, and selected participants from the list of normotensives through random sampling with replacement.

2.6. Study variables

The dependent variable was the presence or absence of HTN. The independent variable was the risk of OSAS. In the current study the participants were classified into high risk when 2 or more categories of BQ had a positive score and into low risk group when only 1 or no category of BQ had a positive score depending on the responses to the individual items and their overall scores in the symptom categories (16;64). In this study, the third category was considered positive only when the participant's BMI was greater than 30 kg/m^2.

The control variables of interest were: age, gender, BMI, neck circumference, waist circumference, waist-to-height ratio, smoking status, weekly alcohol consumption, coffee consumption, weekly physical activity, and presence of diabetes or renal diseases (for more information see Appendix 4).

2.7. Data management and analysis

2.7.1. Data Entry

The student investigator computerized, coded and cleaned (range checking and spot checking) data in SPSS software, and afterwards conducted data analysis using the Stata-8 statistical program.

2.7.2. Statistical methods

Basic descriptive statistics, such as frequencies, median and mean were generated. The Pearson's chi-square test of the null hypothesis of homogeneity was used to compare differences in proportions between groups. The Fisher's Exact test was used for variables with small frequencies (66).

Continuous variables were converted into ordinal variables to describe their distribution among cases and controls and to explore their relationships with HTN (outcome)

and OSAS risk (exposure). However, the original continuous variables were used for the logistic regression analysis. Categorical data were converted into "dummy" variables to be used in regression analysis (67). The possibility of non-linear relationships between the outcome and the potential confounders was explored using linear splines (68;69).

The study examined the relationship between HTN (the outcome variable) and OSAS risk (the independent variable), as well as the main variables (HTN and OSAS risk) and potential confounders using simple logistic regression. The investigators applied unconditional multiple logistic regression models to control for potential confounders and explore potential effect modification and, ultimately, to calculate the odds ratio (OR) and 95% confidence interval (CI) to estimate the strength of the association between HTN and the risk of OSAS (70). In epidemiological terms confounding occurs only if a potential confounding variable affects disease risk (HTN) even among unexposed (those with low risk of OSAS) and is associated with exposure (risk of OSAS) even among controls (normotensives) and is not in the causal pathway between disease (HTN) and exposure (risk of OSAS) (59;71). The described method helped to identify the confounders. To account for effect modification interaction terms were added in the logistic model and tested for statistical significance. All statistical tests were two-sided. The significance level (α) equal to 0.05 was chosen.

2.8. Ethical Considerations

The Institutional Review Board (IRB) #1 within the College of Health Sciences at the American University of Armenia approved the research plan. The participants enrolled in the study after giving informed oral consent. The participants had a right to withdraw from the study at any time. No identification information was recorded on the completed questionnaires, as the questionnaires were coded.

3. RESULTS

3.1. Response Rate

The response rate was 90% for hypertensives and 94% for normotensives. However, the study team failed to contact 99 subjects due to different reasons, such as: being out of town, not at home, at work; change in address or error related to address; death; and illness. Three respondents met exclusion criteria (pregnancy).

The study team was able to interview only 77 people from the list of hypertensives. In addition to this, 31 incident hypertensives were detected from the list of normotensives and added to the cases resulting in 108 cases. The study stopped data collection when 266 interviews were completed. The data analysis was based on data from 108 cases and 157 unmatched controls (one control was excluded from the final analysis). The estimated statistical power based on actual proportions and sample size was 0.98.

3.2. Descriptive Statistics

None of the variables were candidates for imputation or exclusion. There was no sparse data problem for any of the variables under investigation. Diabetes was an exception; there were only 11 people with diabetes: 10 among cases and 1 among controls. To be able to conduct meaningful analysis, the student-investigator combined diabetes and renal disease into one new variable "co-morbidities" for the analysis. The outliers were not excluded from the final analysis.

The proportion of subjects with high risk of OSAS among cases was 35% and 12% among controls. Descriptive statistics (Table 1) showed that controls were younger compared to cases: the mean age among controls was 39 (SD: 14) vs. 58 (SD: 13) among cases. Controls had less body weight compared to cases: the mean BMI was 25 kg/m^2 (SD: 5) for controls, and 30 kg/m^2 (SD: 6) for cases.

Cases and controls were statistically significantly different with respect to OSAS risk, age, diabetes and renal disease, BMI, neck and waist circumferences, waist-to-height ratio, family history of HTN, and were similar with respect to gender distribution and all measured behavioral characteristics, except smoking status (Tables 2 & 3).

In most cases, hypertensive respondents were more likely to report a chronic or acute medical condition (Table 4, Figure 1): there was a statistically significant association between HTN and such medical conditions as angina, coronary heart disease, heart failure, stroke, claudication (poor circulation in legs & arms), diabetes, and kidney disease. One case and one control had hyperthyroidism, and two cases had operated thyroid gland.

Among 108 cases the proportion with treated HTN was 58% (63) - 54% (21) of hypertensive men and 61% (42) of hypertensive women.

Twenty five percent (27) of cases and 28% (44) of controls reported that they needed coffee or other caffeine containing drinks (e.g., coca-cola or strong black tea) to stay awake during the day; 3% (3) of cases and 8% (12) of controls needed both coffee and other drinks. The attempt to overcome sleepiness by consuming beverages rich in caffeine was not associated with age or OSAS risk.

3.3. Collinearity Analysis

In order to avoid collinearity, which occurs when two or more of the explanatory variables are highly correlated (66), the study team calculated the Pearson correlation coefficients for waist circumference, waist-to-height ratio, neck circumference and BMI and observed high correlation between them (see Appendix 5). These variables could not enter the regression model together. In addition, OSAS risk and BMI were highly correlated since BMI was used to estimate the OSAS risk. Therefore, BMI and other measures of habitus, which were highly correlated with BMI, could not enter the multiple logistic regression analysis with the OSAS risk. Hence, the study team chose neck circumference, the least

correlated measure of body habitus, for further analyses. In terms of biological plausibility, the previous studies reported that upper body obesity was more closely related to HTN than overall obesity; and neck circumference was the strongest predictor of OSAS severity compared to any of the obesity markers so far studied (3;4;13;18;19;37;42;44;45;49).

3.4. Simple Logistic Regression

The analysis of the association between HTN and OSAS risk without any adjustment for confounding variables estimated the crude OR to be equal to 3.94 (95% CI: 2.12, 7.34) meaning that odds of HTN in individuals with high risk of OSAS is 3.94 times greater than odds of HTN in those with low risk.

3.4.1. Testing for Confounding

To identify confounders the study applied simple logistic regression analysis (Table 5). This analysis showed that gender, physical activity, alcohol and coffee consumption were not statistically significantly associated with HTN in subjects with low risk of OSAS. Age, neck circumference and family history of HTN are highly significantly associated with HTN in subjects with low risk of OSAS. Current smoking was not statistically significantly associated with HTN, whereas former smoking was associated. Statistically significant association was observed with co-morbidities (kidney disease and/or diabetes), though the CI was very wide.

The results of a simple logistic regression analysis showed that gender, physical activity, family history of HTN, alcohol consumption, current and former smoking, and neck circumference were not statistically significantly associated with the risk of OSAS among normotensives. There was marginally significant association between coffee and OSAS risk in normotensives. Age and co-morbidities were highly significantly associated with OSAS risk among normotensives.

Based on the above-mentioned the study concluded that the following control variables were confounders of the relationship between HTN and OSAS risk: age and co-morbidities. The statistical approach to checking for confounding confirmed these findings, and showed that neck circumference also confounded the relationship between HTN and OSAS risk.

3.5 Linear Spline to Explore Possibility of Non-linear Relationships

Linear spline analysis demonstrated a non-linear relationship between HTN status and neck circumference with a statistically significant spline term with cut-point of 29. However, neck circumference entered the regression model as a continuous variable without the spline term, as there was only 1 observation with neck circumference less than 29 (see Figure 2 and Appendix 6).

The spline term was not statistically significant for the relationship between HTN status and age with breakpoint at age 73 (see Figure 3 and Appendix 6). The spline term with cut-point at age 39 was also tested and it was not statistically significant. Therefore, age entered the regression model as a continuous variable.

3.6. Multiple Logistic Regression Analysis

All identified confounders entered the multiple logistic regression analysis (see Table 6). The risk of having HTN increased with the high risk of OSAS (OR= 2.17; 95% CI: 1.02, 4.63) after adjusting for age, neck circumference and co-morbidities.

Odds of HTN = $e^{-9.236 + 0.78* \text{OSAS risk} + 0.08 * \text{age} + 0.12 * \text{neck circumference} + 1.62 * \text{co-morbidities}}$

The results also showed that one year increase in age increased the odds of HTN 1.09 times (95% CI: 1.06, 1.11), given other variables were fixed. One centimeter (cm) increase in neck circumference increased the odds of HTN 1.13 times (95% CI: 1.04, 1.22), given other variables were fixed. The odds of HTN was 5.04 (95% CI: 1.75, 14.5) times higher

among those who suffered from kidney disease and/or diabetes compared to those who did not have these diseases, after controlling for other variables.

Test of interactions between the covariates and the OSAS risk for statistical significance showed that none of the interaction terms was statistically significant.

Association between CVD and high risk of OSAS was not explored in the current study as only 33 respondents were identified with CVD defined as stroke, myocardial infarction, heart failure, and the estimated power for two-sample comparison of proportions was equal to 0.38. However, it is noteworthy to mention that 33% (11) of them had high risk of OSAS.

4. DISCUSSION

This case-control study investigated the relationship between the risk of OSAS and HTN status in 265 adult people living in Yerevan. The results showed that, OSAS risk was significantly associated with the HTN status independent of all relevant confounding variables.

The unadjusted OR was equal to 3.94. However, epidemiological and biostatistical testing for confounding and colinearity analysis identified the following variables to adjust for: age, neck circumference, and co-morbidities. Gender, physical activity, coffee or alcohol consumption, and smoking did not confound the association between OSAS risk and HTN. Some studies reported similar results with respect to confounding variables (22;28;30).

This study suggested that odds of HTN in persons with high risk of OSAS was 2.17 times greater than odds of HTN in individuals with low risk after controlling for age, neck circumference and co-morbidities.

These findings are consistent with the results of studies that used polysomnogram to ascertain the presence of OSAS; they reported adjusted OR ranging from 2.0 to 3.0 (28;72;73).

However, some clinic-based studies failed to demonstrate independent association (74;75). It could be speculated that small power of those studies did not permit detection of a possible association between HTN and OSAS (33).

The study confirmed that fat deposition in the neck and presence of co-morbidities like diabetes and renal disease were influential determinants of HTN and the risk of developing HTN increased with age.

The study did not demonstrate association between HTN and alcohol probably because consumption of alcohol in the study population was modest (defined as about two drinks daily); and modest consumption of alcohol is not generally associated with BP increases (3). Current smoking was not statistically significantly associated with HTN, whereas former smoking was. It is possible that those people who stopped smoking were sicker and quitted due to their health problems.

Despite the prevailing opinion that gender is an important risk factor for HTN and OSAS (13;19), this study did not identify gender as a confounder.

4.1. Study Limitations

The current study used mostly prevalent cases of HTN (identified during HESA study, 2004), whereas in general, the use of incident cases is preferred as prevalence is influenced not only by the risk of developing HTN but also by factors that determine the duration of illness: "survival", or, in other words, prevalent cases are survivors of a larger pool of incident cases (59). Another disadvantage of prevalent cases is that if disease has been present for a long time then premorbid exposure to risk factors may be difficult to ascertain, especially if it depends on people's memories (59). Nevertheless, prevalent cases have major advantage - they are already available (59). Measurement of OSAS risk (exposure) was through the BQ and not through overnight polysomnogram (gold standard

(20)), which means that only symptomatic subjects could be identified. This could lead to underestimation of the results (71).

With most of the study participants the interviewers were aware of the subjects' case or control status; this could lead to a potential interviewer bias (59).

4.3. Strengths of the Study

The interviewers confirmed the HTN status for cases and controls objectively measuring the BP following the same standard protocol. Interviews were conducted concurrently for cases and controls, which minimizes the effects of short-term changes (e.g. seasonal) (59). The interviewer bias in assessment of exposure (OSAS risk) was minimized, as the interviewers as well as the student investigator were not aware of the respondent's exposure status during the interview. Thus, selection bias, which occurs when study participants are included or excluded from a study because of having some characteristics related to the risk factor under investigation (59;71), is minimized.

All known confounders suggested by the literature were considered during the detailed testing for confounding. The power was bigger compared to many similar studies (see Appendix 7).

5. RECOMMENDATIONS

The study recommends validating the Berlin Questionnaire in Armenia. Although the gold standard for diagnosing OSAS remains the attended overnight polysomnography, it is high cost and labor intensive (76) and may not be affordable for Armenia. Therefore, the use of a screening tool like the BQ, which is cheaper, readily accessible, can be available even in remote marzes of Armenia, has no risk or side effects to the patient, and may help to identify higher-risk patients, should be encouraged.

A nationwide prevalence study of OSAS could help to better understand the burden of disease in Armenia.

There is a need to increase population awareness of OSAS risk factors, symptoms and consequences, as well as to consider the OSAS in national clinical guidelines, particularly in those related to the management of HTN (30;33).

6. CONCLUSION

What is already known on this topic**:** Previous studies have suggested that OSAS was associated with HTN, but evidence from studies, in which all known confounders were considered has been lacking.

What this paper adds: A positive independent association was found in the first epidemiological study exploring association between systemic HTN and OSAS risk conducted in Armenia. The study considered all known confounders and adjusted for the presence of diabetes and renal disease.

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TABLES

Table 1: Descriptive Statistics by Cases and Controls

Variable	Level of measurement	Type of univariate statistics	Values: % (n) Cases	Controls
Marital st.:	Nominal	Percentages		
Married		(frequencies)	78% (84)	69% (108)
Single			8% (9)	29% (45)
Divorced			-	-
Widowed			14% (15)	2% (4)
The highest level formal education:	Ordinal	Percentages (frequencies)		
8th grade or less			5% (6)	1% (2)
Secondary school			28% (30)	18% (28)
Technical college			26% (28)	31% (49)
Institute/university			41% (44)	48% (75)
Other			-	2% (3)
Age	Continuous	Mean	58	39
		median	58	37
		SD	13	14
		min - max	20-90	20-89
Employment st.:	Dichotomous	Percentages		
Yes		(frequencies)	35% (38)	52% (82)
No			65% (70)	48% (75)
BMI	Continuous	Mean	30	25
		median	29	25
		SD	6	5
		min & max	15-47	17-38
Waist circumference (in cm)	Continuous	Mean	100	87
		median	100	87
		SD	17	14
		min & max	46-149	58-131
Waist-to-height ratio	Continuous	Mean	62	53
		median	61	53
		SD	11	9
		min & max	27-99	35-87
Neck circumference (in cm)	Continuous	Mean	38	36
		median	38	35
		SD	4	4
		min & max	29-50	18-52
Weekly alcohol consumption (in units)	Continuous	Mean	1	1
		median	0	0.5
		SD	3	3
		min & max	0-18	0-24
Coffee consumption (in cups)	Continuous	Mean	2	2
		median	2	2
		SD	2	2
		min & max	0-10	0-6

Note: for distribution by OSAS risk, gender, family history of HTN, co-morbidities, smoking status, physical activity see Tables 2-3; st.=status

Table 2: Physical Characteristics of Cases and Controls

Covariates	Cases (n=108)	Controls (n=157)	p-value of Pearson's chi square test
OSAS risk			
high risk	38 (35.19%)	19 (12.10%)	0.000
low risk	70 (64.81%)	138 (87.90%)	
Gender			
female	69 (63.89%)	107 (68.15%)	0.470
male	39 (36.11%)	50 (31.85%)	
Age			
≤39	8 (7.41%)	84 (53.16%)	
40-59	53 (49.07%)	61 (38.61%)	0.000
≥60	47 (43.52%)	13 (8.23%)	
Diabetes			
presence	10 (9.26%)	1 (0.64%)	Fisher's Exact
absence	98 (90.74%)	156 (99.36%)	p=0.001
Kidney disease			
presence	25 (23.15%)	5 (3.18%)	0.000
absence	83 (76.85%)	152 (96.82%)	
Co-morbidities			
presence	32 (29.63%)	6 (3.82%)	0.000
absence	76 (70.37%)	151 (96.18%)	
BMI categories			
≤24.9	16 (14.81%)	80 (50.96%)	0.000
25-29.9	50 (46.30%)	51 (32.48%)	
≥30	42 (38.89%)	26 (16.56%)	
Neck circumference (in cm)			
<35	26 (24.07%)	73 (46.20%)	0.000
35-38.9	35 (32.41%)	52 (32.91%)	
≥39	47 (43.52%)	33 (20.89%)	
Waist circumference (in cm)			
<90	25 (23.15%)	89 (56.33%)	
90-109.9	54 (50.00%)	58 (36.71%)	0.000
≥ 110	29 (26.85%)	11 (6.96%)	
Waist-to-height ratio			
<50	13 (12.04%)	58 (36.71%)	
50-60	39 (36.11%)	66 (41.77%)	0.000
>60	56 (51.85%)	34 (21.52%)	
Family history of HTN			
presence	59 (54.63%)	53 (33.76%)	0.000
absence	38 (35.19%)	104 (66.24%)	
don't know	11 (10.18%)		

Note: co-morbidities is a variable which combined diabetes and renal disease; HTN=hypertension

Table 3: Behavioral Characteristics of Cases and Controls

Covariates	Cases (n=107)	Controls (n=158)	p-value of Pearson chi square test
Smoking status			
never smoker	78 (72.22%)	116 (73.89%)	
current smoker	16 (14.81%)	33 (21.02%)	0.047
former smoker	14 (12.96%)	8 (5.10%)	
Physical activity			
low	11 (10.19%)	12 (7.64%)	
moderate	26 (24.07%)	47 (29.94%)	0.500
high	71 (65.74%)	98 (62.42%)	
Coffee consumption (in cups)			
0	17 (15.74%)	32 (20.25%)	
0.5 -3	71 (65.74%)	93 (58.86%)	0.501
≥4	20 (18.52%)	33 (20.89%)	
Alcohol weekly consumption (in units)			
0	64 (59.26%)	73 (46.20%)	
0.5 -3	36 (33.33%)	74 (46.84%)	0.083
≥4	8 (7.41%)	11 (6.96%)	

Table 4: Prevalence of Chronic & Acute Illnesses among Cases and Controls

Medical illnesses	Cases (n=108)	Controls (n=157)	p-value of Pearson's chi square test
Narcolepsy	3.0%	2.0%	Fisher's Exact p=0.690
Asthma	3.0%	0.6%	Fisher's Exact p=0.308
Chronic bronchitis	6.0%	7.0%	0.636
Angina*	17.0%	2.0%	0.000
Coronary heart disease*	19.0%	0.6%	0.000
Heart failure*	17.0%	5.0%	0.001
Myocardial infarction	7.0%	2.0%	Fisher's Exact p=0.096
Stroke*	5.0%	0.6%	Fisher's Exact p=0.043
Diabetes*	9.0%	0.6%	Fisher's Exact p=0.001
Hypothyroidism	7.0%	3.0%	Fisher's Exact p=0.129
Claudication*	30.0%	13.0%	0.010
Renal (kidney) disease*	23.0%	3.0%	0.000
Emphysema	2.0%	0.0%	Fisher's Exact p=0.165
Allergies causing nasal congestion	12.0%	20.0%	0.098

Note: significance level: * P<0.05

Table 5: Simple Logistic Regression: Testing for Confounding

Factor	Association between HTN Status and Covariates among those with Low Risk of OSAS OR (95% CI)	Association between OSAS Risk and Covariates among Controls OR (95% CI)
Gender	1.52 (0.84, 2.78)*	1.66 (0.62, 4.43)*
Age	1.10 (1.07, 1.13)***	1.04 (1.01, 1.07)***
Co-morbidities	27.2 (6.13, 120.6)***	18.13 (3.06, 107.43)***
Neck circumference	1.12 (1.04, 1.19)***	1.06 (0.94, 1.18)*
Smoking status		
never smoker	1.0	1.0
current smoker	0.62 (0.26, 1.47)*	2.12 (0.72, 6.25)*
former smoker	4.2 (1.49, 11.8)***	3.18 (0.57, 17.70)*
eversmoker (yes/no)	1.27 (0.67, 2.44)*	2.31 (0.86, 6.23)**
Physical activity		
low	1.0	1.0
moderate	0.49 (0.17, 1.46)*	0.47 (0.07, 2.90)*
high	0.66 (0.24, 1.79)*	0.76 (0.15, 3.88)*
Coffee consumption	0.88 (0.72, 1.05)*	1.31 (0.97, 1.76)**
Alcohol weekly consumption	0.997 (0.90, 1.10)*	0.95 (0.76, 1.18)*
Family history of HTN	3.34 (1.78, 6.29)***	0.89 (0.32, 2.50)*

Note: significance level: * P>0.10; ** 0.05<P<0.10; *** P<0.05
Controls = normotensives, co-morbidities is a variable which combined diabetes and renal disease

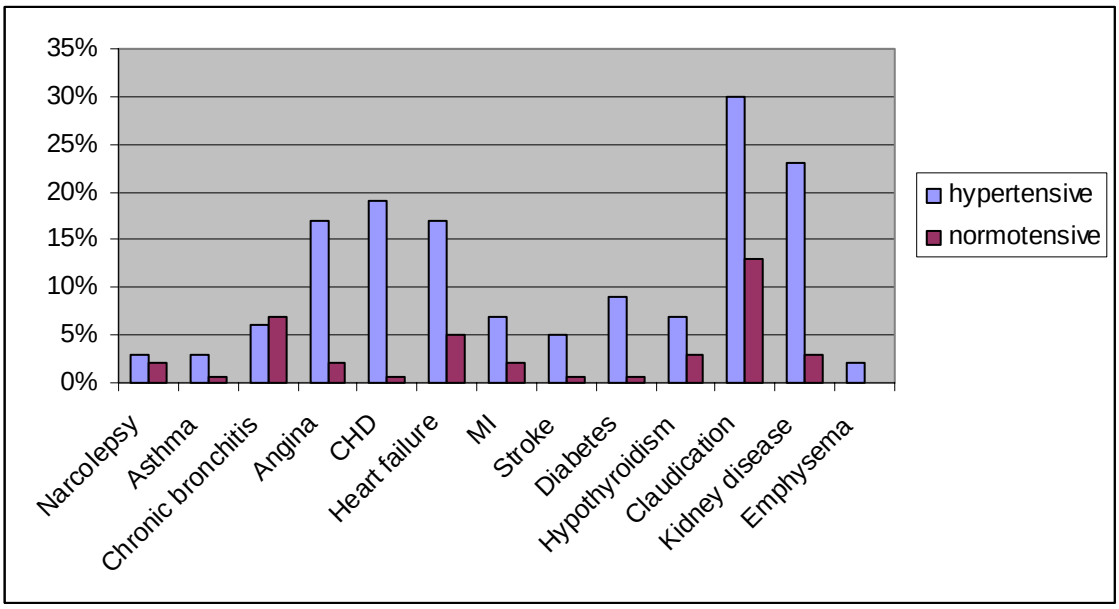
Table 6: Results of Multiple Logistic Regression Models

Model	OSAS risk *OR (95% CI)*	Age *OR (95% CI)*	Neck circumference *OR (95% CI)*	Co-morbidities *OR (95% CI)*
OSAS risk	3.94 (2.12, 7.34)			
OSAS risk+ age	2.93 (1.44, 5.97)	1.09 (1.07, 1.12)		
OSAS risk+ neck circumference	3.25 (1.71, 6.18)		1.14 (1.06, 1.21)	
OSAS risk+ co-morbidities	3.30 (1.71, 6.39)			9.13 (3.60, 23.2)
OSAS risk+ age+ neck circumference	2.59 (1.25, 5.36)	1.09 (1.07, 1.12)	1.13 (1.05, 1.22)	
OSAS risk+ neck circumference + co-morbidities	2.71 (1.37, 5.37)		1.12 (1.05, 1.20)	8.42 (3.26, 21.72)
OSAS risk+ age + co-morbidities	2.49 (1.19, 5.20)	1.09 (1.06, 1.11)		5.42 (1.92, 15.3)
OSAS risk + age + neck circumference + co-morbidities	2.17 (1.02, 4.63)	1.09 (1.06, 1.11)	1.13 (1.04, 1.22)	5.04 (1.75, 14.5)

Note: co-morbidities is a variable which combined diabetes and renal disease

FIGURES

Figure 1: Prevalence of Chronic & Acute Illnesses among Cases and Controls



Note: participants were asked: "Have you been told by a physician that you had or have each condition below?"

Figure 2: Linear Spline to Explore the Possibility of Non-linear Relationships between HTN and Neck Circumference

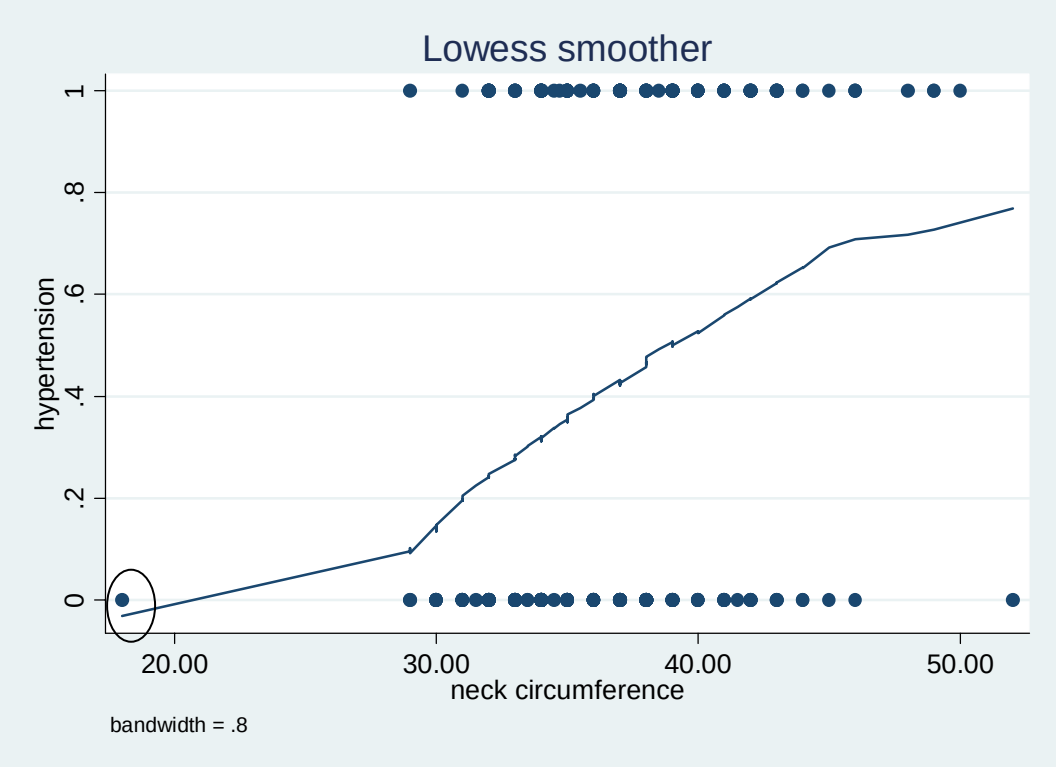
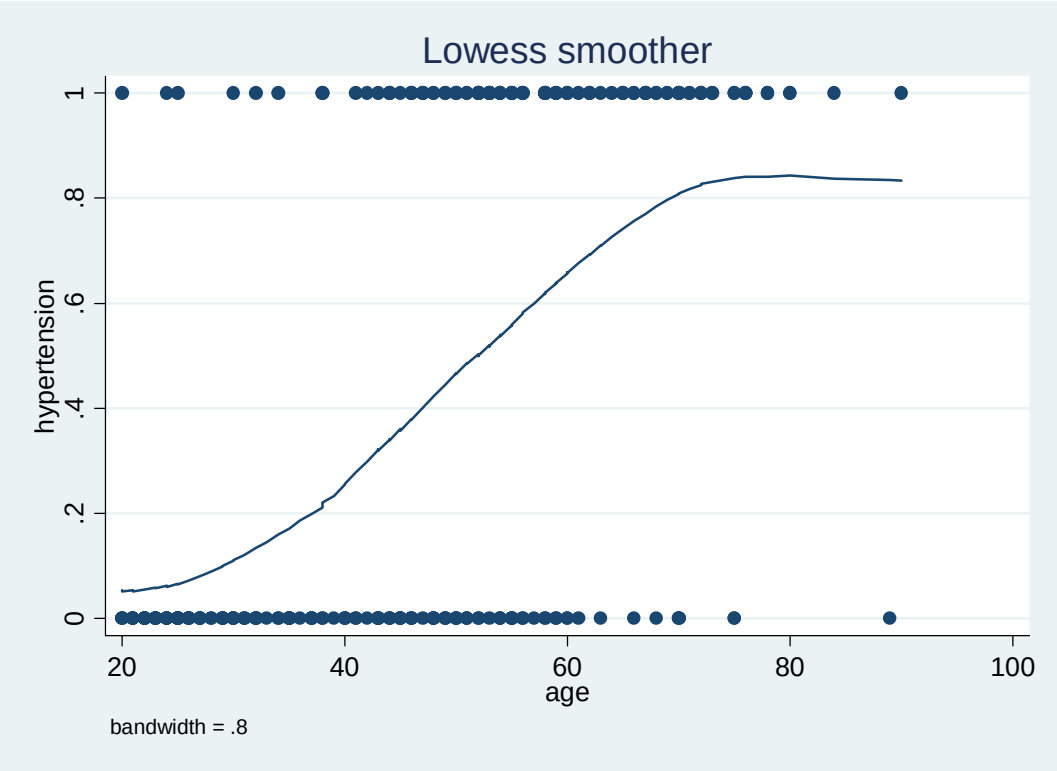


Figure 3: Linear Spline to Explore the Possibility of Non-linear Relationships between HTN & Age



APENDICES

APPENDIX 1

Classification of Blood Pressure for Adults

BP Classification	SBP mm Hg	DBP mm Hg
Normal	<120	and <80
Prehypertension	120–139	or 80–89
Stage 1 hypertension	140-159	or 90–99
Stage 2 hypertension	≥160	or ≥100

Source: Seventh Report of the Joint National Committee (JNC VII) on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension, *2003; 42: 1206.*

APPENDIX 2

Consent Form for Cases

American University Of Armenia

College Of Health Sciences

Title of Research Project: Case-Control Study of Association between Sleep-Disordered Breathing and Hypertension

Dear participants!

The study is conducted by the second year student of AUA College of Health Sciences Ruzan Udumyan in collaboration with the Armenian Medical Association. The study aims to investigate the association between risk of obstructive sleep apnea and hypertension in adult people living in Yerevan. In other words to examine whether obstructive sleep apnea is indeed a risk factor for developing hypertension and, if so, how strong is that effect. Considering the high morbidity and profound health care costs of hypertension, we can infer that assessment of all associated factors/conditions, including obstructive sleep apnea (which is treatable) is important.

You will be asked to complete a questionnaire. We will measure your blood pressure, height, weight, neck circumference and waist circumference. It will take 20-30 minutes. We will inform you of the results of the measurements.

You are asked to participate in the study as you have met the selection criteria. You were selected as a person diagnosed with hypertension in hypertension study conducted by the Armenian Medical Association.

The study does not consider any invasive methods, cannot cause injury, and doesn't pose any risk for you and all other participants. The questionnaire is about your sleep characteristics, smoking habits, coffee and alcohol consumption, physical activity and medical history.

The participation is an opportunity to know whether you are at high risk for sleep apnea or not. You will not get payment for the participation in the study. You may contact the research team for study results.

Every effort will be made to protect the confidentiality of the information provided insofar as it is legally possible. No identification information will be recorded on the completed questionnaire, as the questionnaire will be coded. Contact information will be destroyed upon completion of the research.

It is your decision whether or not to be in this study. You can stop being in this study at any time. You should ask the person in charge listed below any questions you may have about this research study. *You* should ask him/her questions in the future if you do not understand something about the study.

If you want to talk to anyone about this research study you should call the person in charge of the study, Varduhi Petrosyan at (3741) 51 25 64. Or e-mail vpetrosi@aua.am or call Ruzan Udumyan (093) 21 26 06. The person in charge of the study will answer your questions.

If you want to talk to anyone about the research study because you feel you have not been treated fairly or think you have been hurt by joining the study you should contact Yelena Amirkhanyan at (374 1) 51 25 68.

Thank you very much for your participation.

Consent Form for Controls

American University Of Armenia

College Of Health Sciences

Title of Research Project: Case-Control Study of Association between Sleep-Disordered Breathing and Hypertension

Dear participants!

The study is conducted by the second year student of AUA College of Health Sciences Ruzan Udumyan in collaboration with the Armenian Medical Association. The study aims to investigate the association between risk of obstructive sleep apnea and hypertension in adult people living in Yerevan. In other words to examine whether obstructive sleep apnea is indeed a risk factor for developing hypertension and, if so, how strong is that effect. Considering the high morbidity and profound health care costs of hypertension, we can infer that assessment of all associated factors/conditions, including obstructive sleep apnea (which is treatable) is important.

You will be asked to complete a questionnaire. We will measure your blood pressure, height, weight, neck circumference and waist circumference. It will take 20-30 minutes. We will inform you of the results of the measurements.

You are asked to participate in the study as you have met the selection criteria. You were selected as a person with normal blood pressure according to hypertension study conducted by the Armenian Medical Association.

The study does not consider any invasive methods, cannot cause injury, and doesn't pose any risk for you and all other participants. The questionnaire is about your sleep characteristics, smoking, coffee and alcohol consumption, physical activity and medical history.

The participation is an opportunity to know whether you are at high risk for sleep apnea and hypertension or not. You will not get payment for the participation in the study. You may contact the research team for study results.

Every effort will be made to protect the confidentiality of the information provided insofar as it is legally possible. No identification information will be recorded on the completed questionnaire, as the questionnaire will be coded. Contact information will be destroyed upon completion of the research.

It is your decision whether or not to be in this study. You can stop being in this study at any time. You should ask the person in charge listed below any questions you may have about this research study. *You* should ask him/her questions in the future if you do not understand something about the study.

If you want to talk to anyone about this research study you should call the person in charge of the study, Varduhi Petrosyan at (3741) 51 25 64. Or e-mail vpetrosi@aua.am or call Ruzan Udumyan (093) 21 26 06. The person in charge of the study will answer your questions.

If you want to talk to anyone about the research study because you feel you have not been treated fairly or think you have been hurt by joining the study you should contact Yelena

Amirkhanyan at (374 1) 51 25 68.

Thank you very much for your participation.

Համաձայնագիր արյան բարձր ճնշում ունեցողների համար

Հայաստանի Ամերիկյան Համալսարան

Առողջապահական Գիտությունների Դպրոց

Հետազոտության վերնագիրը՝ Քնի ժամանակ խանգարված շնչառության և արյան բարձր ճնշման միջև կապի ուսումնասիրությունը

Հարգելի մասնակիցներ,

Այս ուսումնասիրությունը իրականացվում է Հայաստանի ամերիկյան համալսարանի Առողջապահական Գիտությունների Դպրոցի երկրորդ կուրսի ուսանողուհի Ռուզան Ուդումյանի կողմից՝ համագործակցելով Հայկական բժշկական ասոցիացիայի հետ: Հետազոտության նպատակն է ուսումնասիրել երևանաբնակ չափահաս տարիքի մարդկանց մոտ քնի ժամանակ խանգարված շնչառության և արյան բարձր ճնշման միջև եղած կապը: Այլ կերպ ասած, նպատակն է տեսնել, թե արդյո՞ք քնի ժամանակ խանգարված շնչառությունը կարող է նպաստել արյան բարձր ճնշման զարգացմանը և, եթե այո, ապա որքանով է ուժեղ այդ ազդեցությունը: Հաշվի առնելով արյան բարձր ճնշմամբ բարձր հիվանդացությունը և դրա հետ կապված առողջապահական մեծ ծախսերը՝ կարող ենք ասել, որ արյան բարձր ճնշման զարգացման հետ կապված բոլոր գործոնների, այդ թվում նաև քնի ժամանակ խանգարված շնչառության (որը ի դեպ բուժելի է), գնահատումը կարևոր է:

Եթե համաձայնեք մասնակցել այս հետազոտությանը, Ձեզնից կխնդրվի պատասխանել հարցաշարի: Մենք կչափենք Ձեր արյան ճնշումը, հասակը, քաշը, վզի շրջագիծը և գոտկատեղի շրջագիծը: Դուք կտեղեկացվեք չափումների արդյունքներին: Այս ամենը կտևի 20-30 րոպե:

Ձեզ խնդրել ենք մասնակցել այս ուսումնասիրությանը, որովհետև Դուք համապատասխանում եք ընտրվելու չափանիշներին և, քանի որ համաձայն Հայկական բժշկական ասոցիացիայի կողմից անցկացրած հիպերտենզիայի հետազոտության ունեք արյան բարձր ճնշում:

Այս հետազոտությունը չի ենթադրում որևէ միջամտություն, չի կարող վնասել և որևէ ռիսկ չի ներկայացնում Ձեր և բոլոր այլ մասնակիցների համար: Հարցաշարը Ձեր քնի, ունեցած հիվանդությունների, ծխելու, սուրճի և ալկոհոլի օգտագործման, ֆիզիկական ակտիվության մասին է:

Հետազոտությանը մասնակցելով Դուք կիմանաք, թե արդյո՞ք քնի ժամանակ վատ եք շնչում: Դուք գումար չեք ստանալու մասնակցության համար: Ցանկության դեպքում կարող եք տեղեկանալ ուսումնասիրության արդյունքներին:

Հնարավոր ամեն ջանք կգործադրվի տրամադրված ինֆորմացիան գաղտնի պահելու համար: Հարցաշարի վրա չեն նշվելու Ձեր անունը և հեռախոսահամարը: Հարցաշարը կոդավորվելու է: Հետազոտությունը վերջացնելուց հետո հաղորդակցության ինֆորմացիան ոչնչացվելու է:

Դուք եք որոշում մասնակցել, թե՝ ոչ այս ուսումնասիրությանը: Դուք կարող եք դադարեցնել Ձեր մասնակցությունը ցանկացած պահի: Այս հետազոտության վերաբերյալ ունեցած ցանկացած հարց կարող եք ուղղել հետազոտության ղեկավարին /նշված է ներքևում/: Հետազոտության վերաբերյալ ունեցած անհասկանալի հարցերը Նրան կարող եք ուղղել նաև հետագայում:

Եթե ուզում եք որևէ մեկի հետ խոսել այս հետազոտության մասին, ապա կարող եք զանգահարել հետազոտության ղեկավար Վարդուհի Պետրոսյանին՝ (3741) 51 25 64, էլ-փոստ՝ vpetrosi@aua.am կամ Ռուզան Ուդումյանին՝ (093) 21 26 06: Հետազոտության համար պատասխանատու անձնավորությունը

կպատասխանի Ձեր հարցերին:

Եթե Դուք ուզում եք խոսել որևէ մեկի հետ այս հետազոտության մասին, քանի որ գտնում եք, որ Ձեր հանդեպ անարդարացի են վարվել, կամ մտածում եք, որ մասնակցությունը վնասել է Ձեզ, ապա զանգահարեք Ելենա Ամիրխանյանին (374 1) 51 25 68:

Շնորհակալություն Ձեր մասնակցության համար:

Համաձայնագիր արյան նորմալ ճնշում ունեցողների համար

Հայաստանի Ամերիկյան Համալսարան

Առողջապահական Գիտությունների Դպրոց

Հետազոտության վերնագիրը՝ Քնի ժամանակ խանգարված շնչառության և հիպերտենզիայի միջև կապի ուսումնասիրությունը

Հարգելի մասնակիցներ,

Այս ուսումնասիրությունը իրականացվում է Հայաստանի ամերիկյան համալսարանի Առողջապահական Գիտությունների Դպրոցի երկրորդ կուրսի ուսանողուհի Ռուզան Ուդումյանի կողմից ՝ համագործակցելով Հայկական բժշկական ասոցիացիայի հետ: Հետազոտության նպատակն է ուսումնասիրել երևանաբնակ չափահաս տարիքի մարդկանց մոտ քնի ժամանակ խանգարված շնչառության և արյան բարձր ճնշման միջև եղած կապը: Այլ կերպ ասած, նպատակն է տեսնել, թե արդյո՞ք քնի ժամանակ խանգարված շնչառությունը կարող է նպաստել արյան բարձր ճնշման զարգացմանը և, եթե այո, ապա որքանով է ուժեղ այդ ազդեցությունը: Հաշվի առնելով արյան բարձր ճնշմամբ բարձր հիվանդացությունը և դրա հետ կապված առողջապահական մեծ ծախսերը՝ կարող ենք ասել, որ արյան բարձր ճնշման զարգացման հետ կապված բոլոր գործոնների, այդ թվում նաև քնի ժամանակ խանգարված շնչառության (որը ի դեպ բուժելի է), գնահատումը կարևոր է:

Եթե համաձայնեք մասնակցել այս հետազոտությանը, Ձեզնից կխնդրվի պատասխանել հարցաշարի: Մենք կչափենք Ձեր արյան ճնշումը, հասակը, քաշը, վզի շրջագիծը և գոտկատեղի շրջագիծը: Դուք կտեղեկացվեք չափումների արդյունքներին: Այս ամենը կտևի 20-30 րոպե:

Ձեզ խնդրել ենք մասնակցել այս ուսումնասիրությանը, որովհետև Դուք համապատասխանում եք ընտրվելու չափանիշներին և, քանի որ համաձայն Հայկական բժշկական ասոցիացիայի կողմից անցկացրած հիպերտենզիայի հետազոտության ունեք արյան նորմալ ճնշում:

Այս հետազոտությունը չի ենթադրում որևէ միջամտություն, չի կարող վնասել և որևէ ռիսկ չի ներկայացնում Ձեր և բոլոր այլ մասնակիցների համար: Հարցաշարը Ձեր քնի, ունեցած հիվանդությունների, ծխելու, սուրճի և ալկոհոլի օգտագործման, ֆիզիկական ակտիվության մասին է:

Հետազոտույանը մասնակցելով Դուք կիմանաք, թե արդյո՞ք ունեք արյան բարձր ճնշում և արդյո՞ք քնի ժամանակ վատ եք շնչում: Դուք գումար չեք ստանալու մասնակցության համար: Ցանկության դեպքում կարող եք տեղեկանալ ուսումնասիրության արդյունքներին:

Հնարավոր ամեն ջանք կգործադրվի տրամադրված ինֆորմացիան գաղտնի պահելու համար: Հարցաշարի վրա չեն նշվելու Ձեր անունը և հեռախոսահամարը: Հարցաշարը կոդավորվելու է: Հետազոտությունը վերջացնելուց հետո հաղորդակցության ինֆորմացիան ոչնչացվելու է:

Դուք եք որոշում մասնակցել թե ոչ այս ուսումնասիրությանը: Դուք կարող եք դադարեցնել Ձեր մասնակցությունը ցանկացած պահի: Այս հետազոտության վերաբերյալ ունեցած ցանկացած հարց կարող եք ուղղել հետազոտության ղեկավարին /նշված է ներքևում/: Հետազոտության վերաբերյալ ունեցած անհասկանալի հարցերը Նրան կարող եք ուղղել նաև հետագայում:

Եթե ուզում եք որևէ մեկի հետ խոսել այս հետազոտության մասին, ապա կարող եք զանգահարել հետազոտության ղեկավար Վարդուհի Պետրոսյանին՝ (3741) 51 25 64, էլ-փոստ՝ vpetrosi@aua.am կամ Ռուզան Ուդումյանին՝ (093) 21

26 06: Հետազոտության համար պատասխանատու անձնավորությունը կպատասխանի Ձեր հարցերին:

Եթե Դուք ուզում եք խոսել որևէ մեկի հետ այս հետազոտության մասին, քանի որ գտնում եք, որ Ձեր հանդեպ անարդարացի են վարվել, կամ մտածում եք, որ մասնակցությունը վնասել է Ձեզ, ապա զանգահարեք Ելենա Ամիրխանյանին (374 1) 51 25 68:

Շնորհակալություն Ձեր մասնակցության համար:

APPENDIX 3

Questionnaires

Screening Questions

Ask the following questions before starting an interview. If interviewee answers "yes" to any of them, thank and stop the interview. Proceed if interviewee answers "no" to all of them:

1. Are you pregnant? (Ask this question if the respondent is female)
    a. Yes (thank and stop the interview)
    b. No
2. Did you undergo upper-airway surgery recently?
    a. Yes (thank and stop the interview)
    b. No

Note: Tracheostomy is an exclusion criterion.

Questionnaire #1

ID #_____ Interviewer_____	Date _ _/_ _/_ _ dd/mn/yr Start time _____
Interviewee's gender: ☐ M ☐ F	**1.** What is your age (year of birth) _____
2. Are you currently ☐ married ☐ single ☐ divorced ☐ widowed *(check **one** response)*	**3**. What is the highest level of formal education you completed? ☐ 8th grade or less ☐ secondary school ☐ technical college ☐ institute/university ☐ other (specify) *(check **one** response)*
4. Do you work? ☐ Yes ☐ No	

5. Have you been told by a physician that you had or have each condition below?
*(check **all** that apply)*

- Narcolepsy (inability to stay awake)	☐ Yes	☐ No
- Asthma	☐ Yes	☐ No
- Chronic bronchitis	☐ Yes	☐ No
- Angina	☐ Yes	☐ No
- Coronary heart disease or hardening of the arteries	☐ Yes	☐ No
- Heart failure	☐ Yes	☐ No
- Myocardial infarction	☐ Yes	☐ No
- Stroke	☐ Yes	☐ No
- Diabetes	☐ Yes	☐ No
-Hypothyroidism	☐ Yes	☐ No
- Claudication (poor circulation in legs & arms)	☐ Yes	☐ No
- Renal (kidney) disease	☐ Yes	☐ No
- Emphysema (form of lung disease)	☐ Yes	☐ No
- Hypertension or high blood pressure	☐ Yes	☐ No

6. Have you ever undergone coronary bypass surgery or coronary angioplasty? :

☐ Yes ☐ No ☐ Unsure

7. Have you ever had any other heart or cardiac surgery?

☐ Yes ☐ No ☐ Unsure

8. What is your normal blood pressure reading?

Blood pressure: _____over _____ ☐ Do not know

9. How often do you measure your blood pressure?

☐ often: _____ times a month

☐ when I feel bad

☐ never *(skip to Q **14**)*

☐ other _____

10. When was your blood pressure reading last taken?

Taken: _____ ☐ Do not know

11. What was your last blood pressure reading?

Blood pressure: _____over_____ ☐ Do not know

12. Were you taking any medication to control your blood pressure at the time it was last taken?

☐ Yes ☐ No ☐ Do not know

13. Have you ever had blood pressure of 140/90 mm Hg or more?

☐ Yes ☐ No ☐ Do not know

14. Are you presently taking medication(s) for your blood pressure?

☐ Yes ☐ No

15. Do you have any allergies that cause nasal congestion?

☐ Yes ☐ No (*skip to Q **17***)

16. Do you take medication for allergy?

☐ Yes ☐ No

17. Do you take medication for any disease or condition?

☐ Yes ☐ No

If yes,

18. What diseases do you take medication for?

_____

_____

19. Do you take any medicine for sleeping?

☐ Yes ☐ No

20. Was your mother or father diagnosed with high blood pressure?

☐ mother ☐ father ☐ neither

21. Do you currently smoke cigarettes?

☐ Yes ☐ No (*skip to Q **24***)

If yes:

22. How many years total have you been a regular smoker? _____ years

23. About how many cigarettes do you smoke per day?

_____ cigarettes per day

If no:

24. Have you been a regular smoker?

☐ Yes ☐ No *(skip to Q **27**)*

If yes:

25. How many years total have you been a regular smoker? _____ years

26. About how many cigarettes did you smoke per day?

_____ cigarettes per day

27. Do you use alcohol?

☐ Yes ☐ No (*skip to Q **29***)

If yes:

28. How many drinks do you usually have in a week? (drink means one 12 ounce bottle of beer, one 5 ounce glass of wine, or one 1.5 ounce vodka, cognac, whiskey, tequila, gin, rum)

_____ drinks per week

29. Do you use coffee?

☐ Yes ☐ No *(skip to Q **32**)*

If yes:

30. What is usual daily coffee consumption?

_____ cups per day

31. Do you need coffee to stay awake during the day?

☐ Yes ☐ No

32. Do you need any other stimulant (e.g. coca-cola, strong black tea) to stay awake during the day?

☐ Yes ☐ No

33. Excluding times of illness or *pregnancy*, what was the range of your weight over the past five years?

Least weight: _____kg Most weight: _____kg

Now I am going to ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Now, think about all the **vigorous activities** which take hard physical effort that you did in the **last 7 days**. Vigorous activities make you breathe much harder than normal and may include heavy lifting, digging, aerobics, or fast bicycling. Think only about those physical activities that you did for **at least 10 minutes at a time.**

34. During the **last 7 days**, on how many days did you do **vigorous** physical activities?

_____ Days per week ☐ Don't Know/Not Sure

(*If respondent answers zero, refuses or does not know, skip to **Q 36)***

35. How much time did you usually spend doing vigorous physical activities on one of those days?

_____ Hours per day ☐ Don't Know/Not Sure

_____ Minutes per day

(*probe:* An average time for one of the days on which you do vigorous activity is being sought.

If the respondent can't answer because the pattern of time spent varies widely from day to day, ask:

"How much time in total would you spend over the last 7 days doing vigorous physical activities?"

Now think about activities which take **moderate physical effort** that you did in the **last 7 days**. Moderate physical activities make you breathe somewhat harder than normal and may include carrying light loads, bicycling at a regular pace, or doubles tennis. Do not include walking.

Again, think about only those physical activities that you did for **at least 10 minutes at a time.**

36. During the **last 7 days**, on how many days did you do **moderate** physical activities?

_____ Days per week ☐ Don't Know/Not Sure

(*If respondent answers zero, refuses or does not know, skip to Q **38***)

37. How much time did you usually spend doing moderate physical activities on one of those days?

_____ Hours per day ☐ Don't Know/Not Sure

_____ Minutes per day

(probe: An average time for one of the days on which you do moderate activity is being sought.

If the respondent can't answer because the pattern of time spent varies widely from day to day, or includes time spent in multiple jobs, ask:

"What is the total amount of time you spent over the last 7 days doing moderate physical activities*?"*

Now think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

38. During the last 7 days, on how many days did you walk for **at least 10 minutes at a time?**

_____ Days per week ☐ Don't Know/Not Sure

(If respondent answers zero, refuses *or does not know, skip to* ***Berlin Questionnaire)***

39. How much time did you usually spend walking on one of those days?

_____ Hours per day ☐ Don't Know/Not Sure

_____ Minutes per day

(*probe:* An average time for one of the days on which you walk is being sought.

If the respondent can't answer because the pattern of time spent varies widely from day to day, ask:

"What is the total amount of time you spent walking over the last 7 days?")

Berlin Questionnaire

1. Do you snore? *(check one response)*	☐ a. Yes ☐ b. No ☐ c. Don't know *If the response is No or Don't know skip to Q **5***
If you snore: 2. Your snoring is: *(check one response)*	☐ a. Slightly louder than breathing ☐ b. As loud as talking ☐ c. Louder than talking ☐ d. Very loud–can be heard in adjacent rooms ☐ e. Don't know
3. How often do you snore *(check one response)*	☐ a. Nearly every day ☐ b. 3-4 times a week ☐ c. 1-2 times a week ☐ d. 1-2 times a month ☐ e. Never or nearly never
4. Has your snoring ever bothered other people? *(check one response)*	☐ a. Yes ☐ b. No ☐ c. Don't Know
5. Has anyone noticed that you quit breathing during your sleep? *(check one response)*	☐ a. Nearly every day ☐ b. 3-4 times a week ☐ c. 1-2 times a week ☐ d. 1-2 times a month ☐ e. Never or nearly never
6. How often do you feel tired or fatigued after your sleep? *(check one response)*	☐ a. Nearly every day ☐ b. 3-4 times a week ☐ c. 1-2 times a week ☐ d. 1-2 times a month ☐ e. Never or nearly never/ don't know

7. During your waking time, do you feel tired, fatigued or not up to par? *(check one response)*	☐ a. Nearly every day ☐ b. 3-4 times a week ☐ c. 1-2 times a week ☐ d. 1-2 times a month ☐ e. Never or nearly never/don't know
8. Have you ever nodded off or fallen asleep while driving a vehicle? *(check one response)*	☐ a. Yes ☐ b. No
If yes: 9. How often does this occur? *(check one response)*	☐ a. Nearly every day ☐ b. 3-4 times a week ☐ c. 1-2 times a week ☐ d. 1-2 times a month ☐ e. Never or nearly never
10. Do you have high blood pressure? *(check one response)*	☐ a. Yes ☐ b. No ☐ c. Don't know

Anthropometric Measurements

Height _____ cm

Neck circumference _____ cm
(At the level of the cricothyroid membrane)

Weight _____ kg

Waist circumference _____ cm
(At the level of the umbilicus)

Blood Pressure Readings

	Left arm		Right arm	
	Sist.	Diast.	Sist.	Diast.
1-st measurement				
2-nd measurement				
3-rd measurement				

Ð³ñó»ñ Ù³ëÝ³ ÏÇóÝ»ñÇÝ ÁÝ ï ñ»Éáõ Ñ³Ù³ñ

Ð³ñóñ»ù Ñ» ï ¨ï³É Ñ³ñó»ñÁ Ñ³ñóáõÙÁ ëÏë»Éáõó ³é³ç: ºÃ» å³ï³ëË³ÝáÕÁ å³ï³ëË³ÝÇ "²ï á" hարցերից որևէ մեկին, ³å³ßÝáñÑ³Ï³ÉáõÃïáõÝ Ñ³ï ï Ý»ù ¨ ÁÝ¹Ñ³ ï »ù Ñ³ñó³½ñáõïóÁ: Ð³Ï³é³Ï ¹»åùáõÙ` ß³ñáõÝ³Ï»ù:

1. Դուք հղի է՞ք: *(հարցրեք, եթե պատասխանողը կին է)*

³. ²ïá (*ßÝáñÑ³Ï³ÉáõÃïáõÝ Ñ³ï ï Ý»ù ¨ ÁÝ¹Ñ³ ï »ù Ñ³ñó³½ñáõïóÁ*)

µ. àã

2. Դուք ունեցել է՞ք վերին շնչուղիների վիրահատություն վերջերս

³. ²ïá (*ßÝáñÑ³Ï³ÉáõÃïáõÝ Ñ³ï ï Ý»ù ¨ ÁÝ¹Ñ³ ï »ù Ñ³ñó³½ñáõïóÁ*)

µ. àã

Եթե պատասխանողը տարել է տրախեոստոմիա, ապա մի շարունակեք հարցազրույցը:

Հարցաշար #1

Հարցաթերթիկի համարը _____ Հարցազրույց վարող՝ _____	Ամսաթիվը՝ ____/_____/_____ օր/ամիս/տարեթիվ Հարցազրույցի սկիզբը՝ _____
Պատասխանողի սեռը՝ ☐ իգական ☐ արական	1.Ե՞րբ եք ծնվել *(նշեք միայն տարեթիվը)* _____
2. Ներկայումս Դուք՝ *(Նշեք միայն **մեկ** պատասխան)* ☐ ամուսնացած եք ☐ ամուսնացած չեք ☐ ամուսնալուծված եք ☐ ամուրի եք	3. Ո՞րն է ամենաբարձր կրթությունը, որ ստացել եք՝ *(Նշեք միայն **մեկ** պատասխան)* ☐ թերի միջնակարգ ☐ միջնակարգ ☐ միջնակարգ մասնագիտական ☐ ինստիտուտ/համալսարան ☐ այլ _____
4. Դուք աշխատու՞մ եք՝ ☐այո ☐ ոչ	
5. Ձեզ երբևէ բժիշկը ասե՞լ է, որ ունեք ներքոնշյալ վիճակներից որևէ մեկը՝ *(Նշեք **բոլոր** համապատասխանող տարբերակները)* Ý³ñÏáÉ»åëÇ³ /ùÝ»Éáõ ³Ý¹ÇÙ³¹ñ»ÉÇ å³Ñ³Ýç/ ☐ ³Ûá ☐ áã ³ëÃÙ³ ☐ ³Ûá ☐ áã ËñáÝÇÏ³Ï³Ý µñáÝËÇ ï ☐ ³Ûá ☐ áã ë ï »ÝáÏ³ñ¹Ç³ ☐ ³Ûá ☐ áã ëրտի պսակաձև անոթների հիվանդություն կամ աթերոսկլերոզ ☐ ³Ûá ☐ áã ëրտի անբավարարություն ☐ ³Ûá ☐ áã սñ ï ³ÙÏ³ÝÇ ÇÝý³ñÏ ï ☐ ³Ûá ☐ áã Ï³Ãí³Í ☐ ³Ûá ☐ áã ¹իաբետ ☐ ³Ûá ☐ áã հիպոթիրոիդիզմ *(վահանաձև գեղձի պրոբլեմ)* ☐ ³Ûá ☐ áã ³ñÛ³Ý ßñç³Ý³ éáõÃÛ³Ý Ë³Ý·³ñáõÙ Ó»éù»ñáõÙ ¨ á ï ù»ñáõÙ ☐ ³Ûá ☐ áã »ñÇÏ³ÙÇ ÑÇí³Ý¹áõÃÛáõÝ ☐ ³Ûá ☐ áã էմֆիզեմա *(թոքերի հիվանդության տեսակ)* ☐ ³Ûá ☐ áã արյան բարձր ճնշում ☐ ³Ûá ☐ áã	

6. Երբևէ տարել ե՞ք աորտոկորոնար շունտավորման վիրահատություն

☐ այո ☐ ոչ ☐ չգիտեմ

7. Երբևէ տարել ե՞ք որևէ այլ սրտի վիրահատություն

☐ այո ☐ ոչ ☐ չգիտեմ

8. Որքա՞ն է Ձեր նորմալ ճնշումը

_____/_____ մմ.ս.ս. ☐ չգիտեմ

9. àñù ³±Ý Ñ³×³ Ë »ù ã³ ÷áõÙ Ò»ñ ×ÝßáõÙÁ:

☐ å³ñµ»ñ³µ³ñ` ³ÙÇëÁ _____ ³Ý·³Ù

☐ í³ ï ÇÝùÝ³½·³óáÕáõÃ⁇³Ý Å³Ù³Ý³ Ï

☐ »ñµ»ù ã»Ù ã³ ÷»É *(անցեք հարց **14**- ին)*

☐ ³ÛÉ _____

10. Ե՞րբ եք վերջին անգամ չափել Ձեր արյան ճնշումը՝

ժամանակը _____ ☐ չգիտեմ

11. Որքա՞ն է եղել Ձեր արյան ճնշումը վերջին չափման ժամանակ

արյան ճնշումը _____/_____մմ. ս.ս ☐ չգիտեմ

12. Վերջին չափման ժամանակ Դուք դեղորայք ընդունե՞լ եք արյան ճնշումը կարգավորելու համար

☐ այո ☐ ոչ ☐ չգիտեմ

13. Երբևէ գրանցվե՞լ է Ձեզ մոտ 140/90 մմ. և ավելի բարձր ճնշում:

☐ այո ☐ ոչ ☐ չգիտեմ

14. Դուք ներկայումս դեղորայք ընդունու՞մ եք արյան ճնշումը կարգավորելու համար:

☐ այո ☐ ոչ

15. Դուք ունե՞ք որևէ ալերգիա, որն առաջացնում է քթի լորձաթաղանթի այտուց և դժվարացնում է շնչառությունը՝

☐ այո ☐ ոչ *(անցեք հարց **17** -ին)*

16. Դուք դեղորայք ընդունու՞մ եք ալերգիայի համար

☐ այո ☐ ոչ

17. Դուք դեղորայք ընդունու՞մ եք որևէ հիվանդության կամ վիճակի համար

☐ այո ☐ ոչ

Եթե «այո»,

18. Ի՞նչ հիվանդությունների համար եք դեղորայք ընդունում

_____

_____

19. Քնելու համար որևէ դեղորայք ընդունու՞մ եք

☐ այո ☐ ոչ

20. Ձեր մայրը կամ հայրը արյան բարձր ճնշում ունեցե՞լ են

☐ մայրը ☐ հայրը ☐ ոչ մեկը

21. Դուք ծխու՞մ եք՝

☐ այո ☐ ոչ *(անցեք հարց 24-ին)*

Եթե «այո»,

22. Քանի՞ տարի է, որ ծխում եք

_____ *տարիների քանակը*

23. Քանի՞ գլանակ եք ծխում օրական ՝

_____*գլանակների օր. քանակը*

Եթե «ոչ»,

24. Երբևիցե ծխե՞լ եք՝

☐ այո ☐ ոչ *(անցեք հարց 27-ին)*

Եթե «այո»,

25. Քանի՞ տարի եք ծխել

_____ *տարիների քանակը*

26.Քանի՞ գլանակ եք ծխել օրական ՝

_____ *գլանակների օր. քանակը*

27.Ոգելից խմիչքներ օգտագործու՞մ եք՝

☐ այո ☐ ոչ *(անցեք հարց 29-ին)*

Եթե «այո»,

28. Սովորաբար քանի՞ միավոր ոգելից խմիչք եք օգտագործում շաբաթվա ընթացքում՝
/ միավոր նշականում է մեկ 340-350 գր.-անոց շիշ գարեջուր, մեկ 140-150 գր.-անոց բաժակ գինի, մեկ 45-50 գր.-անոց բաժակ օղի, կոնյակ, ջին, տեկիլա/

_____ բաժակ շաբաթական

29. Սուրճ օգտագործու՞մ եք՝

☐ այո ☐ ոչ *(անցեք հարց 32-ին)*

Եթե «այո»,

30. Սովորաբար որքա՞ն սուրճ եք օգտագործում օրվա ընթացքում՝

_____ գավաթ օրական

31.Դուք զգու՞մ եք սուրճի կարիք ցերեկը արթուն մնալու համար:

☐ այո ☐ ոչ

	32. Դուք զգու՞մ եք տոնուսը բարձրացնող որևէ այլ ըմպելիքի (օրինակ՝ կոկա-կոլայի, թունդ սև թեի) կարիք ցերեկը արթուն մնալու համար: ☐ այո ☐ ոչ

33. Որքա՞ն է եղել Ձեր քաշը վերջին հինգ տարիների ընթացքում՝ չհաշված *հղիության* կամ հիվանդության ժամանակ ունեցած քաշը

նվազագույն քաշը _____կգ առավելագույն քաշը _____ կգ

Հիմա ես կտամ հարցեր **վերջին 7 օրերի** ընթացքում ֆիզիկական ակտիվության վրա ծախսած ժամանակի վերաբերյալ: Խնդրում եմ պատասխանել բոլոր հարցերին՝ նույնիսկ եթե Ձեզ ֆիզիկապես ակտիվ չեք համարում: Մտածեք այն գործողությունների մասին, որոնք կատարում եք աշխատանքի վայրում, տանը, բակում, տեղից տեղ տեղափոխվելիս և ազատ ժամանակ՝ թարմանալու, մարզվելու կամ ժամանցի համար:

Մտածեք բոլոր այն գործողությունների մասին, որոնք պահանջում են **բարձր ֆիզիկական լարում** և կատարել եք **վերջին 7 օրերի** ընթացքում: Բարձր ֆիզիկական լարում պահանջող գործողությունները այն գործողություններն են, որոնց կատարման ժամանակ շնչում եք սովորականից շատ ավելի հաճախ (ինչպիսիք են օրինակ՝ծանրություն բարձրացնելը, հող փորելը, աերոբիկան, արագ հեծանիվ քշելը): Մտածեք միայն այն ֆիզիկական գործողությունների մասին, որոնց վրա ծախսել եք **առնվազն 10 րոպե անընդմեջ**:

34. Վերջին 7 օրերի ընթացքում քանի օր եք կատարել բարձր ֆիզիկական լարում պահանջող գործողություններ

_____ օր շաբաթական ☐ չգիտեմ

*(Եթե պատասխանը **0** է, չգիտեմ կամ հրաժարվում է պատասխանել անցեք հարց **36**- ին)*

35. Սովորաբար որքա՞ն ժամանակ եք ծախսել բարձր ֆիզիկական լարում պահանջող գործողությունների վրա այդ օրերից մեկում

_____ ժամ օրական

_____ րոպե օրական ☐ չգիտեմ

/ Պարզաբանեք՝ ծախսած միջին ժամանակը այն օրվա ընթացում, երբ կատարում եք բարձր ֆիզիկական լարում պահանջող գործողություն*:*

Եթե պատասխանողը չի կարող պատասխանել, քանի որ տարբեր օրեր տարբեր ժամանակ է ծախսում, ապա հարցրեք՝

« Որքա՞ն ժամանակ եք ծախսել բարձր ֆիզիկական լարում պահանջող գործողությունների վրա անցած բոլոր 7 օրերի ընթացքում»:/

Հիմա մտածեք բոլոր այն գործողությունների մասին, որոնք պահանջում են **միջին ֆիզիկական լարում** և կատարել եք **վերջին 7 օրերի** ընթացքում: Միջին ֆիզիկական լարում պահանջող գործողությունները այն գործողություններն են, որոնց կատարման ժամանակ շնչում եք սովորականից ինչ որ չափով հաճախ (ինչպիսիք են օրինակ՝ թեթև իրերի տեղափոխումը, ոչ արագ հեծանիվ քշելը, թենիս խաղալը և այլն): Քայլելը հաշվի չառնեք: Նորից մտածեք միայն այն ֆիզիկական գործողությունների մասին, որոնց վրա ծախսել եք **առնվազն 10 րոպե** անընդմեջ:

36. Վերջին 7 օրերի ընթացքում քանի՞ օր եք կատարել միջին ֆիզիկական լարում պահանջող գործողություններ

_____ օր շաբաթական ☐ չգիտեմ

*(Եթե պատասխանը **0** է, չգիտեմ կամ հրաժարվում է պատասխանել անցեք հարց **38**- ին)*

37. Սովորաբար որքա՞ն ժամանակ եք ծախսել միջին ֆիզիկական լարում պահանջող գործողությունների վրա այդ օրերից մեկում

_____ ժամ օրական

_____ րոպե օրական ☐ չգիտեմ

/ Պարզաբանեք՝ ծախսած միջին ժամանակը այն օրվա ընթացում, երբ կատարում եք միջին ֆիզիկական լարում պահանջող գործողություն*:*

Եթե պատասխանողը չի կարող պատասխանել, քանի որ տարբեր օրեր տարբեր ժամանակ է ծախսում, ապա հարցրեք՝

« Որքա՞ն ժամանակ եք ծախսել միջին ֆիզիկական լարում պահանջող գործողությունների վրա անցած բոլոր 7 օրերի ընթացքում»:/

Հիմա մտածեք այն ժամանակի մասին, որ ծախսել եք **քայլելու** վրա **վերջին 7 օրերի** ընթացքում՝ աշխատանքի վայրում և տանը, տեղից տեղ գնալիս և առհասարակ քայլելու վրա, որ կատարել եք պարզապես թարմանալու, մարզվելու կամ ժամանցի համար:

38. Վերջին 7 օրերի ընթացքում քանի՞ օր եք քայլել առնվազն **10 րոպե անընդմեջ:**

_____ օր շաբաթական ☐ չգիտեմ

*(Եթե պատասխանը **0** է, չգիտեմ կամ հրաժարվում է պատասխանել անցեք **Բեռլին հարցաշարին**)*

39. Սովորաբար որքա՞ն ժամանակ եք ծախսել քայլելու վրա այդ օրերից մեկում

_____ ժամ օրական ☐ չգիտեմ

_____ րոպե օրական

/ Պարզաբանեք՝ ծախսած միջին ժամանակը այն օրվա ընթացում, երբ քայլում եք:

Եթե պատասխանողը չի կարող պատասխանել, քանի որ տարբեր օրեր տարբեր ժամանակ է ծախսում, ապա հարցրեք՝

« Որքա՞ն ժամանակ եք ծախսել քայլելու վրա անցած բոլոր 7 օրերի ընթացքում»:/

Հարցաշար “Բեռլին”

1. Դուք խռմփացնու՞մ եք */Նշեք միայն մեկ պատասկան/*	☐ Այո ☐ Ոչ ☐ Չգիտեմ *Եթե պատասխանը “ոչ” կամ “չգիտեմ” է անցեք հարց **5**-ին*
2. Ձեր խռմփոցի ձայնը */Նշեք միայն մեկ պատասկան/*	☐ Քիչ ավելի բարձր է քան շնչառության ձայնը ☐ Խոսելու պես բարձր է ☐ Խոսելուց բարձր է ☐ Շատ բարձր է՝ կարող է լսվել կից սենյակներում
3. Որքա՞ն հաճախ եք խռմփացնում */Նշեք միայն մեկ պատասկան/*	☐ Գրեթե ամեն օր ☐ Շաբաթը 3-4 անգամ ☐ Շաբաթը 1-2 անգամ ☐ Ամիսը 1-2 անգամ ☐ Երբեք կամ գրեթե երբեք
4. Ձեր խռմփոցը երբևէ անհանգստացրե՞լ է մարդկանց */Նշեք միայն մեկ պատասկան/*	☐ Այո ☐ Ոչ ☐ Չգիտեմ
5. Որևէ մեկը երբևէ նկատե՞լ է, որ Դուք չեք շնչում քնած ժամանակ */Նշեք միայն մեկ պատասկան/*	☐ Գրեթե ամեն օր ☐ Շաբաթը 3-4 անգամ ☐ Շաբաթը 1-2 անգամ ☐ Ամիսը 1-2 անգամ ☐ Երբեք կամ գրեթե երբեք
6. Որքա՞ն հաճախ եք Ձեզ հոգնած զգում քնելուց հետո */Նշեք միայն մեկ պատասկան/*	☐ Գրեթե ամեն օր ☐ Շաբաթը 3-4 անգամ ☐ Շաբաթը 1-2 անգամ ☐ Ամիսը 1-2 անգամ ☐ Երբեք կամ գրեթե երբեք

7. Դուք Ձեզ հոգնած զգու՞մ եք արթուն ժամանակ */Նշեք միայն մեկ պատասկան/*	☐ Գրեթե ամեն օր ☐ Շաբաթը 3-4 անգամ ☐ Շաբաթը 1-2 անգամ ☐ Ամիսը 1-2 անգամ ☐ Երբեք կամ գրեթե երբեք
8. Երբևէ ննջե՞լ եք կամ քնե՞լ եք մեքենա վարելու ժամանակ */Նշեք միայն մեկ պատասկան/*	☐ Այո ☐ Ոչ *եթե “այո” անցեք հաջորդ հարցին, եթե “ոչ” անցեք հարց 10-ին:*
9. Որքա՞ն հաճախ է դա տեղի ունենում */Նշեք միայն մեկ պատասկան/*	☐ Գրեթե ամեն օր ☐ Շաբաթը 3-4 անգամ ☐ Շաբաթը 1-2 անգամ ☐ Ամիսը 1-2 անգամ ☐ Երբեք կամ գրեթե երբեք
10. Դուք ունե՞ք արյան բարձր ճնշում */Նշեք միայն մեկ պատասկան/*	☐ Այո ☐ Ոչ ☐ Չգիտեմ

Անտրոպոմետրիկ չափումներ

հասակը _____ սմ վզի շրջագիծը _____ սմ

(մատանիաձև վահանաձառային թաղանթի մակարդակի վրա)

քաշը _____ կգ գոտկատեղի շրջագիծը_____ սմ

(պորտի մակարդակով)

Զարկերակային արյան ճնշման չափումներ

	Ձախ ձեռք		Աջ ձեռք	
	Սիստոլիկ	Դիաստոլիկ	Սիստոլիկ	Դիաստոլիկ
1-ին չափում				
2-րդ չափում				
3- րդ չափում				

Շատ շնորհակալություն մասնակցության համար

Հարցումի վերջը _____

APPENDIX 4

Measurement Matrix

Operational definition	Variable definition	Level of measurement
	Dependent variable	
Questions 5_14, 8-14, BQ-10	Hypertension (*for main research question*)	Nominal-dichotomous 1= hypertensive 0 = normotensive
Questions 5_6, 5_7, 5_8	CVD *(for subquestion*)	Nominal-dichotomous 1= has CVD 0 = doesn't have CVD
	Independent variable	
Berlin Questionnaire	OSAS risk	Nominal-dichotomous 1= high risk 0 = low risk
	Control variables	
Question 1	Age	Continuous
	Gender	Nominal-dichotomous 0= female 1 = male
Height and weight measurements	Body mass index	Continuous
Neck circumference measurement	Neck circumference	Continuous
Waist circumference measurement	Waist circumference	Continuous
Waist circumference and height measurements	Waist-to-height ratio	Continuous
Questions 21-26	Smoking status	Nominal 0 = never smoker 1 = current smoker 2 = former smoker
Questions 27-28	Weekly use of alcohol	Continuous
Questions 29- 32	Coffee consumption	Continuous
Questions 34-39	Physical activity	Categorical 1 = low 2 = moderate 3 = high
Question 5_9	Diabetes	Nominal-dichotomous 1= yes 0 = no
Question 5_12	Renal disease	Nominal-dichotomous 1= yes 0 = no
Questions 5_9, 5_12	Co-morbidities	Nominal-dichotomous 1= yes 0 = no

Operational definition=questions asked to obtain information on concept or issue
Variable definition = variable constructed from questions for data analysis

APPENDIX 5

Pearson correlation Coefficients

```
correlate wc wc_ht bmi nc                                        (obs=265)

             |       wc    wc_ht      bmi       nc
-------------+------------------------------------
          wc |   1.0000
       wc_ht |   0.9542   1.0000
         bmi |   0.7845   0.8197   1.0000
          nc |   0.6350   0.5053   0.5179   1.0000
```

APPENDIX 6

STATA Output for Logistic Regression

1. Simple logistic regression:

```
logit htn osas

Iteration 0:   log likelihood = -179.12764

Iteration 1:   log likelihood = -169.13636

Iteration 2:   log likelihood = -169.13355

Logit estimates                                   Number of obs   =        265

                                                  LR chi2(1)      =      19.99

                                                  Prob > chi2     =     0.0000

Log likelihood = -169.13355                       Pseudo R2       =     0.0558

------------------------------------------------------------------------------

         htn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]

-------------+----------------------------------------------------------------

         osas|   1.371906   .3169845     4.33   0.000     .7506274    1.993184

       _cons |  -.6787584   .1467377    -4.63   0.000    -.9663591   -.3911578

------------------------------------------------------------------------------
```

2. Spline for age with cutpoint of 39 years is added:

```
gen agespline_39=0
. replace agespline_39=age-39 if age>=39 & age!=.
(173 real changes made)

. logit htn osas age agespline_39

Iteration 0:   log likelihood = -179.12764
Iteration 1:   log likelihood = -130.06914
Iteration 2:   log likelihood = -127.30492
Iteration 3:   log likelihood = -127.13678
Iteration 4:   log likelihood = -127.13497
Iteration 5:   log likelihood = -127.13496
Logit estimates                                   Number of obs   =        265
                                                  LR chi2(3)      =     103.99
                                                  Prob > chi2     =     0.0000
Log likelihood = -127.13496                       Pseudo R2       =     0.2903
```

```
------------------------------------------------------------------------------
         htn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        osas |   1.065523    .364778     2.92   0.003     .3505714    1.780475
         age |   .1001495    .044287     2.26   0.024     .0133485    .1869505
agespline_39 |  -.0144242    .054461    -0.26   0.791    -.1211658    .0923173
       _cons |  -5.328728   1.567799    -3.40   0.001    -8.401557   -2.255899
------------------------------------------------------------------------------

. lincom age+agespline_39

 ( 1)  age + agespline_39 = 0

------------------------------------------------------------------------------
         htn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |   .0857253   .0169057     5.07   0.000     .0525907    .1188598
------------------------------------------------------------------------------
```

3. Spline for age with cutpoint of 73 years is added:

```
logit htn osas age  agespline1_73

Iteration 0:   log likelihood = -179.12764
Iteration 1:   log likelihood =  -129.3376
Iteration 2:   log likelihood = -126.20998
Iteration 3:   log likelihood = -126.09116
Iteration 4:   log likelihood = -126.09089
Logit estimates                                   Number of obs   =        265
                                                  LR chi2(3)      =     106.07
                                                  Prob > chi2     =     0.0000
Log likelihood = -126.09089                       Pseudo R2       =     0.2961
------------------------------------------------------------------------------
         htn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        osas |   1.035524   .3682916     2.81   0.005     .3136856    1.757362
         age |   .0960506   .0131479     7.31   0.000     .0702811    .1218201
agespline~73 |  -.1488872   .0893992    -1.67   0.096    -.3241065    .0263321
       _cons |  -5.264676   .6767804    -7.78   0.000    -6.591141   -3.938211
------------------------------------------------------------------------------
```

```
. lincom age+ agespline1_73

 ( 1)  age + agespline1_73 = 0

------------------------------------------------------------------------------
         htn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |  -.0528366   .0841432    -0.63   0.530    -.2177543    .1120811
------------------------------------------------------------------------------
```

4. Spline for neck circumference with cutpoint of 29 is added:

```
logit htn osas  nc  ncspline_29

Iteration 0:   log likelihood = -179.12764
Iteration 1:   log likelihood = -161.36543
Iteration 2:   log likelihood = -161.17631
Iteration 3:   log likelihood = -161.15032
Iteration 4:   log likelihood = -161.14114
Iteration 5:   log likelihood =  -161.1378
Iteration 6:   log likelihood = -161.13658
Iteration 7:   log likelihood = -161.13614
Iteration 8:   log likelihood = -161.13597
Iteration 9:   log likelihood = -161.13591
Iteration 10:  log likelihood = -161.13589
Iteration 11:  log likelihood = -161.13588
Iteration 12:  log likelihood = -161.13588
Iteration 13:  log likelihood = -161.13588
Iteration 14:  log likelihood = -161.13588

Logit estimates                                   Number of obs   =        265
                                                  LR chi2(3)      =      35.98
                                                  Prob > chi2     =     0.0000
Log likelihood = -161.13588                       Pseudo R2       =     0.1004

------------------------------------------------------------------------------
         htn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        osas |   1.179739   .3268509     3.61   0.000     .5391225    1.820355
          nc |    1.24026   .0103006   120.41   0.000     1.220071    1.260449
 ncspline_29 |  -1.114006   .0428945   -25.97   0.000    -1.198077   -1.029934
       _cons |  -37.57796          .        .       .            .           .
------------------------------------------------------------------------------
```

```
. lincom nc+ ncspline_29

 ( 1)  nc + ncspline_29 = 0

------------------------------------------------------------------------------
          hn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         (1) |   .1262545   .0336988     3.75   0.000      .060206     .192303
------------------------------------------------------------------------------
```

5. Model with major variables (HTN & OSAS risk) and confounders:

```
logit hn slapnea age nc comorbid

Iteration 0:   log likelihood = -179.12764
Iteration 1:   log likelihood = -121.32601
Iteration 2:   log likelihood = -116.62352
Iteration 3:   log likelihood = -116.35941
Iteration 4:   log likelihood = -116.35807

Logit estimates                                   Number of obs   =        265
                                                  LR chi2(4)      =     125.54
                                                  Prob > chi2     =     0.0000
Log likelihood = -116.35807                       Pseudo R2       =     0.3504

------------------------------------------------------------------------------
          hn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     slapnea |   .7756675   .3857751     2.01   0.044     .0195621    1.531773
         age |   .0836196   .0123681     6.76   0.000     .0593785    .1078606
          nc |   .1196183   .0397007     3.01   0.003     .0418064    .1974302
    comorbid |   1.617335   .5396766     3.00   0.003     .5595879    2.675081
       _cons |  -9.236652   1.656804    -5.57   0.000    -12.48393   -5.989375
------------------------------------------------------------------------------
```

APPENDIX 7

Non-randomized Studies of Hypertension and OSAS

Study	Population	No of subjects	Sex (M/F)	Confounding variables considered	Comments
Kales	Hypertensives and normal controls	50/50	37/13?	Age, sex	HT correlates with OSAHS severity
Fletcher	Hypertensives and normotensive controls	80	80/0	Age, weight	AHI correlates with HT
Warley	Hypertensive patients	30	30/0	Age, BMI	No excess respiratory disturbance in HT
Stradling	Community population	752	224/224	Age, BMI, smoking, alcohol	No independent predictors of BP identified
Mayer	Hypertensive OSAHS patients	12	12/0	None	BP falls with CPAP treatment
Mendelson	Sleep clinic patients	619	619/0	Weight, age	More hypoxaemia (probably OSAHS related) in hypertensives
Bearpark	Population sample	400	294/106	BMI, smoking, alcohol, sex	BP predicted by OSAHS severity
Schwartz	Hypertensive OSAHS patients	7	7/0	None	Day and night BP higher in OSAHS than non-apnoeic snorers
Bartel	Hypertensive and matched normotensive controls	20	4/16	Age, sex, BMI, neck size, sleepiness	Hypoxaemia in non-REM is the most potent predictor of diastolic BP
Worsop	Hypertensive and normotensive patients	93	81/12	BMI, age, sex, alcohol	Higher incidence of OSAHS in hypertensives
Grote	Hypertensive sleep clinic patients	591		Age	Increasing severity of HT with increasing respiratory disturbance

AHI, apnoea/hypopnoea index; BMI, body mass index; BP, blood pressure; HT, hypertension; CPAP, continuous positive airway pressure; ?, not documented in publication.

Source: Sleep 6: Obstructive sleep apnoea/hypopnoea syndrome and hypertension
G V Robinson, J R Stradling, R J O Davies

LIST OF POTENTIAL JOURNALS FOR PUBLICATION

1. “Hypertension”

2. “Sleep Medicine Journal”

3. “Chest”