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## ASSOCIATION BETWEEN SLEEP DISORDERS AND CHRONIC DISEASES IN PATIENTS OF THE BRAZILIAN NATIONAL HEALTH SYSTEM

### ASSOCIAÇÃO ENTRE DISTÚRBIOS DO SONO E DOENÇAS CRÔNICAS EM PACIENTES DO SISTEMA ÚNICO DE SAÚDE

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#### ABSTRACT

Many factors are associated with sleep disorders, causing an increase in health spending. The objective of this study was to analyze the association of sleep disorders and non-communicable chronic diseases in patients over 50 years of age, attended by Basic Health Care Units of Presidente Prudente. In total, 363 patients participated. The history of diseases was self-reported through the use of a questionnaire, the level of physical activity was evaluated by the Baecke questionnaire, and sleep quality was assessed using the Mini-Sleep Questionnaire. Anthropometric and body composition data were collected using a stadiometer and scale; patients in the highest (75<sup>th</sup>) percentile were considered obese. Statistical analysis was performed using the Student t test, chi-square test, and binary logistic regression. The results showed that sleep disorders are associated with osteoporosis, arthritis/osteoarthritis, low back pain, depression, and obesity. Additionally, obesity and physical inactivity influence the occurrence of non-communicable chronic diseases.

**Keywords:** Sleep disturbance. Chronic diseases. Brazilian national health system.

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#### RESUMO

Inúmeros fatores estão associados aos distúrbios do sono ocasionando o aumento nos gastos com saúde. O objetivo do trabalho foi analisar a associação dos distúrbios do sono e doenças crônicas não transmissíveis em pacientes com idade superior a 50 anos atendidos por Unidades Básicas de Saúde de Presidente Prudente. Participaram 363 pacientes. O histórico de doenças foi auto relatada a partir da aplicação de questionário, o nível de atividade física foi verificado através do questionário de Baecke, e a qualidade do sono foi avaliada utilizando o *Mini-Sleep questionnaire*. Dados antropométricos e de composição corporal foram coletados utilizando estadiômetro e balança, foram considerados obesos os pacientes dentro do percentil 75. A análise estatística foi composta pelos testes *t* de Student, qui-quadrado, e regressão logística binária. Os resultados mostraram que o distúrbio do sono está associado as doenças osteoporose, artrite/artrose, dor lombar, depressão e obesidade. Adicionalmente obesidade e inatividade física influenciam na ocorrência de doenças crônicas não transmissíveis.

**Palavras-chave:** Distúrbio do sono. Doenças crônicas. Sistema único de saúde.

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#### Introduction

Sleep is an event of great complexity that directly interferes with the clinical state of the individual<sup>1</sup>. Sleep benefits are due to neurobiological processes<sup>2</sup>, such as maintenance of physical and mental health, which can modify body temperature, cardiac work, and hormone production, leading to an essential restorative state and proper functioning of the organism<sup>3</sup>.

Fernandes<sup>4</sup>, in a review study, reported that sleep phases take into consideration non-rapid eye movements (NREM) and rapid eye movements (REM), observed on the electrocardiogram tracing, thus determining the sleep architecture. The sleep cycle consists of five stages, each lasting 90 minutes, and is repeated four to five times a night. Each phase presents specific physiological stages.

The NREM phase corresponds to 75% of the sleep period, comprising four stages: stage 1-drowsiness, in which the individual begins to feel the first sensations of sleep; stage 2-

has an average duration of 5 to 15 minutes, during which cardiac activity is reduced, muscles relax, and body temperature decreases; stage 3-similar to stage 4, is distinguished only in relation to the level of depth of sleep, which is a little lower; stage 4- has a duration of approximately 40 minutes and is the deep sleep phase. The NREM stage is of paramount importance to the body as secretions of hormones that aid growth occur and it is essential for the recovery of physical energy, added to which, at this stage there is deep rest and less neural activity. The REM stage is defined by the accentuation of brain activity. It does not result in deep rest, although dreams occur, and it is an important phase for emotional recovery<sup>4</sup>.

Factors such as retirement, death of a companion, and change of routine, among others can alter the architecture of sleep, resulting in disturbances, such as reversal of the sleep cycle, changes in the time of each stage, episodes of nocturnal awakenings, daytime sleepiness, and alterations at the beginning or end of the sleep period<sup>5</sup>.

The prevalence of sleep disorders in the general population is quite varied, between 10% and 48%<sup>6</sup>, and has been associated with non-communicable chronic diseases such as hypertension<sup>7</sup>, obesity, dyslipidemia<sup>8</sup>, insulin resistance<sup>9</sup>, diabetes mellitus<sup>10</sup>, chronic pain<sup>11</sup>, low back pain<sup>12</sup>, osteoporosis, osteoarthritis, arthrosis<sup>13</sup>, and depression<sup>14</sup>. However, the practice of physical activity seems to be associated with better sleep quality<sup>8</sup>, being a method of prevention and treatment without medication<sup>15</sup>.

Additionally, it has been seen that sleep disorders are associated with higher health expenditures in Brazil, related to higher consumption of drugs<sup>16</sup>. With the purpose of reducing the economic impact in the country and public health management in Presidente Prudente, reporting on sleep disorders and the association with numerous non-communicable chronic diseases in the SUS could contribute in both the preventive and curative sectors<sup>17</sup>. Thus, the objective of the present study was to analyse the association of sleep disorders and non-communicable chronic diseases in patients over 50 years of age, attended by Basic Health Units in Presidente Prudente.

## Methods

### *Participants*

A cross-sectional study, performed with the consent of the Municipal Health Department, in two Basic Health Units (BHUs), in the city of Presidente Prudente – SP. For the selection of the sample, a group of trained evaluators remained in the BHUs, in the morning and afternoon, for 30 days. During this period, the research was publicized and all patients who fulfilled the inclusion criteria were invited to participate ((i) aged  $\geq 50$  years, (ii) active registry in the BHUs, and (iii) signature of the free and informed consent term).

Initially, 513 patients were evaluated, however 150 were excluded as they did not complete all evaluations. Thus, 363 patients met all the inclusion criteria and were included in the study. The project was approved by the Research Ethics Committee (Process no. 241291/2013).

### *Procedures*

In the present study, all questionnaires and evaluations were performed face-to-face, by a trained and qualified monitor.

The dependent variable was the presence of diseases. Patients, through questionnaires, reported chronic diseases diagnosed in the previous year. The diseases considered were the

most frequent among patients seen in the basic care units of the SUS<sup>18,19</sup>: arterial hypertension, diabetes mellitus, arrhythmia, infarction, osteoporosis, arthritis/arthrosis, low back pain, and depression. This form of disease evaluation has been shown to be of great value and used in studies carried out in BHUs<sup>20-22</sup>.

Level of physical activity was assessed using the Baecke questionnaire<sup>23</sup>, composed of 16 questions, divided into 3 domains; i) occupational physical activities (8 questions), ii) physical exercises in leisure (4 questions), iii) physical activities of leisure and locomotion (4 questions), being that the sum of these domains generates the habitual physical activity score. Based on this overall score, patients were classified by quartiles, in which patients located in the 25th percentile (<P25) were classified as insufficiently active. This methodology for classifying physical activity has been used in previous studies<sup>20-22</sup>.

Sleep was assessed using the Mini-Sleep questionnaire<sup>24</sup>, previously validated for the Portuguese language<sup>25</sup>. The instrument is composed of 10 questions, each with seven possible answers (1=never, 2=very rarely, 3=rarely, 4=sometimes, 5=frequently, 6=very often, and 7=always), and the sum of the answers generates a score (the higher the score, the worse the sleep disturbances). For the present study, following the guidelines of the instrument, scores  $\geq 25$  points were considered as the presence of a disorder.

Body mass (in Body brand scale, model 230, Portugal) and height (Sanny stadiometer, Personal Caprice model, Brazil) were collected according to the protocol of Lohman et al.<sup>26</sup>. Body fat was analysed by bioelectrical impedance (in Body brand, model 230, Portugal), validated software<sup>27</sup>, provided by the manufacturer. All recommendations were previously reported to patients. For the statistical analysis, the sample was subdivided into percentiles, individuals located in the highest quartile ( $\geq P75$ ) for fat percentage being considered obese.

### *Statistical analysis*

Numerical variables are presented as mean and standard deviation. The Student t test for independent samples established comparisons according to the presence or absence of sleep disturbance. The Chi-square test in a 2x2 contingency table, with application of the Yates correction, was used to analyze associations. Multivariate models were created using binary logistic regression (expressed as odds ratio [OR] and its 95% confidence intervals ([95% CI])). The adequacy of the model was evaluated by the Hosmer-Lemeshow test. Statistical significance was set at 5% and all procedures were performed in BioStat version 5.0.

## **Results**

Comparisons of the descriptive variables of the sample according to sleep quality are presented in Table 1. Of the sample analyzed, 61.16% demonstrated sleep disorders. Subjects with sleep disorders presented lower age (p-value = 0.001) and height (p-value = 0.018), and higher body mass (p-value=0.020) and body fat (p-value=0.001). The physical activity score showed no difference between the groups (p-value=0.162).

**Table 1.** Comparison of descriptive variables according to sleep quality.

Variables	Altered sleep*	Unaltered sleep	p=value**
	(n= 222) (61.16%) Mean ± SD	(n= 141) (38.84%) Mean ± SD	
Age (years)	60.54 ± 8.01	64.18 ± 10.01	0.001
Height (cm)	156.09 ± 13.50	159.11 ± 8.35	0.018
Body mass (kg)	74.61 ± 15.23	70.86 ± 13.70	0.020
HPA (score)	6.52 ± 1.58	6.77 ± 1.68	0.162
Body fat (%)	40.53 ± 8.74	36.47 ± 8.05	0.001
Lean mass (kg)	23.98 ± 5.12	24.36 ± 5.24	0.504

SD= Standard deviation; HPA= Habitual physical activity; \*= Score in mini-sleep questionnaire  $\geq 25$  points; \*\*=Student's t-test for independent samples.

Source: Authors

Associations between disease occurrence and sleep quality are presented in Table 2. It was possible to observe that individuals with sleep disorders had a higher occurrence of arterial hypertension (Altered: 66.7% and Unaltered: 55.6%, p-value=0.047), osteoporosis (Altered: 23.4% and Unaltered: 10.4%, p-value=0.003), arthritis/arthrosis (Altered: 57.7% and Unaltered: 33.3%, p-value=0.001), low back pain (Altered: 32.4% and Unaltered: 16.3%, p-value=0.047), and depression (Altered: 32.4% and Unaltered: 9.7%, p-value=0.001).

**Table 2.** Association between diseases and sleep quality.

Diseases	Altered sleep*	Unaltered sleep	p-value**
	n (%)	n (%)	
Arterial hypertension	148 (66.7%)	75 (55.6%)	0.047
Diabetes mellitus	60 (27.1%)	24 (17.8%)	0.062
Arrhythmia	27 (12.2%)	15 (11.1%)	0.897
Infarction	19 (8.6%)	6 (4.4%)	0.206
Osteoporosis	52 (23.4%)	14 (10.4%)	0.003
Arthritis/Arthrosis	128 (57.7%)	45 (33.3%)	0.001
Low back	72 (32.4%)	22 (16.3%)	0.001
Depression	72 (32.4%)	13 (9.7%)	0.001

\*= Score in mini-sleep questionnaire  $\geq 25$  points; \*\* Chi-square test in a 2x2 contingency table, in which the Yates correction was applied.

Source: Authors.

Multivariate models were created, taking into account the diseases that were significantly associated in the chi-square test (Table 3). Altered sleep was associated with a higher occurrence of arterial hypertension (OR=1.99 [95%CI=1.21-3.27]), however obesity was also associated with the outcome (OR=2.47 [95%CI=1.00 - 6.05]). Regardless of physical inactivity and obesity, sleep disorders were associated with a higher occurrence of osteoporosis (OR=2.43 [95% CI=1.21 - 4.89]), arthritis/arthrosis (OR=2.48[95% CI=1.53 - 4.03]), and low back pain (OR=2.15[95% CI=1.22-3.79]). On the other hand, depressive symptoms were associated with alterations in sleep (OR=3.05[95%CI=1.56-5.95]) and physical inactivity (OR=2.12[95%CI=1.12 - 4.01]). This highlights that all the multivariate models created were adequately adjusted.

**Table 3.** Association between sleep quality, physical inactivity, obesity, and occurrence of diseases, adjusted model.

	Binary Logistic Regression	
	OR (95%IC)*	Adjusting the model**
Arterial hypertension		0.125
Altered sleep	<b>1.99 (1.21 – 3.27)</b>	
Physical inactivity ( $\leq$ P25)	1.37 (0.76 – 2.46)	
Body fat ( $\geq$ P75)	<b>2.47 (1.00 – 6.05)</b>	
Osteoporosis		0.382
Altered sleep	<b>2.43 (1.21 – 4.89)</b>	
Physical inactivity ( $\leq$ P25)	1.79 (0.93 – 3.43)	
Body fat ( $\geq$ P75)	4.97 (0.64 – 38.7)	
Arthritis/Arthrosis		0.941
Altered sleep	<b>2.48 (1.53 – 4.03)</b>	
Physical inactivity ( $\leq$ P25)	1.04 (0.59 – 1.80)	
Body fat ( $\geq$ P75)	1.78 (0.80 – 4.48)	
Low back pain		0.191
Altered sleep	<b>2.15 (1.22 – 3.79)</b>	
Physical inactivity( $\leq$ P25)	0.69 (0.37 – 1.30)	
Body fat ( $\geq$ P75)	1.31 (0.48 – 3.60)	
Depression		0.449
Altered sleep	<b>3.05 (1.56 – 5.95)</b>	
Physical inactivity( $\leq$ P25)	<b>2.12 (1.12 – 4.01)</b>	
Body fat ( $\geq$ P75)	1.14 (0.34 – 3.77)	

OR= odds ratio; 95%IC= 95%confidence interval; \*=Multivariate model adjusted simultaneously for sleep quality, physical inactivity, body fat, sex, chronological age, and schooling; \*\*= Hosmer-Lemeshow test, which denotes adequate fit when p-value is higher than 5%.

Source: Authors.

## Discussion

A cross-sectional study, whose objective was to analyze the association of sleep disorders and non-communicable chronic diseases in patients over 50 years of age, attended by Basic Health Units of Presidente Prudente. It was possible to observe that sleep disorders were associated with hypertension, osteoporosis, arthritis/arthrosis, low back pain, and depression. In addition, sleep disorders presented differences between ages, height, body mass, and percentage of body fat.

Concerning arterial hypertension associated with sleep disorders, similar results were found by Bansil et al.<sup>28</sup> with a prevalence of arterial hypertension of 61.5% of the sample. Nieto et al.<sup>29</sup> evaluated 6,132 subjects of both sexes, aged  $\geq$ 40 years, and in the association of sleep disorders with hypertension, also found obesity as a confounding factor. These results could be explained by sleep apnea, as it is one of the intermediary mechanisms by which obesity is related to arterial hypertension.

In this sense, the hypothesis assumes that the condition of hypoxia could be a factor of elevation of arterial pressure<sup>30</sup>. Fujita and Hata<sup>31</sup> evaluated 6,803 men and 22,800 women in a cohort, with the objective of analyzing the effect of obesity on the incidence of arterial hypertension, and concluded that even though the male gender were more obese, the highest incidence of arterial hypertension according to obesity was in the female gender, since the distribution of body fat between genders is different.

Regarding sleep disorders and their association with musculoskeletal disorders, especially osteoporosis and arthritis/arthrosis, a study of 85 women aged 50-82 years showed that approximately 60% of the sample presented sleep disorders due to the severity of the osteoporosis located in the back<sup>32</sup>. One possible explanation is the inflammatory condition present in osteoporosis, added to which there is greater bone resorption secondary to the effects of the pro-inflammatory cytokines IL-1, IL-6, and TNF- $\alpha$ , present in greater quantity in these patients, causing pain and accentuating sleep alterations<sup>33</sup>.

In contrast, a meta-analysis aiming to investigate the association between sleep duration and the risk of osteoporosis as an outcome in women between 40-86 years, found that sleep duration of eight hours or more may be associated with an increased risk of osteoporosis. The exact biological mechanism of the association between sleep duration and osteoporosis has not yet been fully elucidated, although a long duration of sleep is also associated with the level of estrogen, which may have an impact on bone health<sup>34</sup>.

In the same sense, the relationship between sleep disorders and arthritis/arthrosis was also found in the study by Lima et al.<sup>35</sup>, who evaluated 2,637 adults of both genders in order to guide sleep patterns according to socioeconomic/demographic variables, chronic diseases and symptoms, resulting in a higher prevalence regardless of sleep duration (short or long), in individuals with arthritis/osteoporosis, osteoporosis, and emotional problems.

The study of Parmelee, Tighe and Dautovich<sup>36</sup> reported strong evidence of the link between sleep disorders in patients diagnosed with arthritis, the main focus of the study being the association of pain caused by arthritis and depressive symptoms. However, the results demonstrated the unique role of sleep problems as immediate drivers of pain.

Results presented by Zanuto et al.<sup>12</sup>, evidenced the high prevalence of low back pain and sleep disorders. Similar findings were reported in Germany, Turkey, and France, justified by the difficulty encountered by people with low back pain to relax and often move in bed during the night, a factor that results in difficulty falling asleep<sup>37</sup>.

An association between depression and sleep disorders was found in the present study and corroborates with Chang et al.<sup>38</sup>, whose study aimed to examine the relationship between the perception of sleep quality and depression. The authors evaluated 2,972 elderly people and their results showed that quality of sleep was associated with depression, increasing the chances of depression by 31.9%, as well as the use of sleeping pills which altered the chances of depression by 29.5%. Additionally, in older adults with poor sleep quality, it was noted that daily nocturnal disturbances are more likely compared to daily daytime disturbances. These findings were confirmed by Bosh et al.<sup>39</sup>, who, similar to the present study, found a prevalence of 80% of depressive patients who had sleep disorders.

In addition, after adjustments, physical inactivity was also associated with depressive factors, demonstrating that physical inactivity increases two times the chance of developing depression. The study by Minghelli et al.<sup>14</sup> compared the levels of depression in active and inactive elderly, with a sample of 72 elderly divided into active and inactive. The results showed that in the inactive group, the chance of developing anxiety and depression was 38 times, 92.1% presented depression, in contrast to the active group in which the chances of developing depression was 11 times and only 23.5% were depressive.

In the current study, the practice of physical activity did not present a direct association with sleep disorders. This situation is similar to the systematic review performed by Legnani et al.<sup>40</sup>, according to the authors, the subject has not yet established consensus in the literature, suggesting that other factors may interfere in this relationship.

When relating sleep disorders and age, the present study showed that the group with sleep disturbances were younger, which does not corroborate with the literature as studies

have shown an increased prevalence of sleep disorders with aging, especially above 65 years<sup>29</sup>.

As limitations of the study, the importance of more direct measures of evaluation of sleep disorders, such as the use of biochemical markers, is highlighted. In addition, the cross-sectional study design allows investigation of the momentary condition of individuals and not the cause effect.

On the other hand, studies with SUS patients are important, as the expenses of actions and public health services of the Southeastern region in the year 2000 were R\$ 412.33 per inhabitant, and, after 10 years, this value increased to R\$ 716.93<sup>17</sup>. These data point to the need to evaluate the factors related to the increase in the prevalence of chronic diseases in order to understand the factors associated with the increase in SUS costs.

The analyzed sample presents the problem of sleep disorders in patients of the public health service, and indicates the need for awareness actions on the subject that require attention and may lead to the management of preventive policies.

## Conclusions

Sleep disorders are associated with diseases such as osteoporosis, arthritis/arthrosis, low back pain, depression, and obesity in patients of the unified health system. Additionally obesity and physical inactivity influence the occurrence of non-communicable chronic diseases.

## References

1. Luyster FS. Sleep: A health imperative. *Sleep* 2012;35(6):727-734.
2. Carskadon MA, Dement W. Normal human sleep: an overview. In: Kryger MH, Roth T, Dement WC, editors. *Principles and practice of sleep medicine*. 4th ed. Philadelphia: W.B. Saunders 2005:13-23.
3. Carter PJ. Longitudinal analysis of sleep in relation to BMI and body fat in Children: the FLAME Study. *BMJ* 2011;342: 1-7.
4. Fernandes RMF. O sono normal. *Medicina* 2006;39(2):157-68.
5. Ohayon MM, Carskadon MA, Guilleminault C, Vitiello MV. Meta-Analysis of Quantitative Sleep Parameters From Childhood to Old Age in Healthy Individuals: Developing Normative Sleep Values Across the Human Lifespan. *Sleep* 2004;27(7):1253-70.
6. Zanuto EAC, Lima MCS, Araújo RG, Silva EP, Anzolin CC, Araújo MYC, et al. Distúrbios do sono em adultos de uma cidade do Estado de São Paulo. *Rev Bras de Epidemiol* 2015;18(1):42-53.
7. Peppard P, Young T, Palta M, Skatrud J. Prospective study of the association between sleep-disordered breathing and hypertension. *N Engl J* 2000;342:1378-84.
8. Zanuto EAC, Christófaro DGD, Fernandes RA. Qualidade de sono e suas associações com prática de exercícios físicos no lazer e excesso de peso entre servidores públicos. *Rev Bras Cineantropom Desempenho Hum* 2014;16(1):27-35.
9. Skomoro RP. Sleep complaints and restless legs syndrome in adult type 2 diabetics. *Sleep Med* 2001;2(5):417-22.
10. Berglund G, Nilsson PM, Roost M, Engstrom G, Hedblad B. Incidence of diabetes in middle-aged men is related to sleep disturbances. *Diabetes Care* 2004;27(10):2464-9.
11. Pimenta CAM, Koizumi MS, Teixeira MJ. Dor crônica e depressão: estudo em 92 doentes. *Rev Esc Enferm USP* 2000;34(1):76-83.
12. Zanuto EAC, Codogno JS, Christófaro DGD, Vanderlei LCM, Cardoso JR, Fernandes RA. Prevalência de dor lombar e fatores associados entre adultos de cidade média brasileira. *Ciênc Saúde Coletiva* 2015;20(5):1575-1582.
13. Sousa CC, Filho CAL. Avaliação da Qualidade do Sono em Pacientes com Apneia Obstrutiva do Sono em Teresina-Pi. REAS. *Rev Eletrônica Acervo Saúde* 2014;6(2):617-623.

14. Minghelli B, Tomé B, Nunes C, Neves A, Simões C. Comparação dos níveis de ansiedade e depressão entre idosos ativos e sedentários. *RevPsiquiátrClín* 2013;40(2):71-76.
15. Zuo H, Shi Z, Yuan B, Dai Y, Hu G, Wu G., et al. Interaction between physical activity and sleep duration in relation to insulin resistance among non-diabetic Chinese adults. *BMC Public Health* 2012;12:247.
16. Francisco PMSM; Bastos TF; Costa KS; Prado MAMB; Barros MBA. The use of medication and associated factors among adults living in Campinas, São Paulo, Brazil: differences between men and women. *Ciênc Saúde Colet* 2014;19(12):4909-21.
17. Piola SF, França JRM, Nunes A. Os efeitos da Emenda Constitucional 29 na alocação regional dos gastos públicos no Sistema Único de Saúde no Brasil. *Ciênc Saúde Coletiva* 2016;21(2):411-421.
18. Turi BC, Codogno JS, Fernandes RA. Frequência de ocorrência de doenças crônicas degenerativas em adultos com mais de 50 anos. *Rev Bras Ativ Fís Saúde* 2012;15(4):218-223.
19. Freitas Júnior IF, Castoldi RC, Moreti DG, Pereira ML, Cardoso ML, Codogno JS, et al. Aptidão física, história familiar e ocorrência de hipertensão arterial, osteoporose, doenças metabólicas e cardíacas entre mulheres. *Rev SOCERJ* 2009;22(3):158-64.
20. Codogno JS, Fernandes RA, Rosa CSC, Bueno DR, Monteiro HL. Custo com tratamento e indicadores de risco em pacientes diabéticos, segundo esquema terapêutico. *Rev da Educ Fís UEM* 2011;22(1):111-118.
21. Codogno JS, Turi B, Fernandes RA, Bonfim MR, Pastre CM, Monteiro HL. Association between musculoskeletal disorders and healthcare expenditures among patients from the Brazilian public healthcare system. *Medicina (USP.FMRP)* 2015; 48:143-150.
22. Codogno JS, Turi BC, Kemper HCG, Fernandes RA, Christofaro DGD, Monteiro HL. Physical inactivity of adults and 1-year health care expenditures in Brazil. *Int J Public Health (Online)* 2015;60:309-316.
23. Baecke JA, Burema J, Frijters JE. A short questionnaire for the measurement of habitual physical activity in epidemiological studies. *Am J Clin Nutr* 1982;36(5):936-942.
24. Zomer J, Peled AH, Rubin E, Lavie P. Mini-sleep Questionnaire (MSQ) for screening large populations for EDS complaints. In: Koella, W. P.; Ruther, E.; Schulz, H. editors. *Sleep 84*. Stuttgart: Gustav Fischer Verlag 1985:467-70.
25. Falavigna A, Souza Bezerra ML, Teles AR, Kleber FD, Velho MC, Silva RC, et al. Consistency and reliability of the Brazilian Portuguese version of the Mini-Sleep Questionnaire in undergraduate students. *Sleep Breath* 2011;15(3):351-5.
26. Lohman TG, Roche AE, Martorell R. Anthropometric standardization reference manual. Illinois: Human Kinetics Books, 1988.
27. Rodrigues MN, Silva SC, Monteiro WD, Farinatti PTV. Estimativa de gordura corporal através de equipamentos de bioimpedância, dobra cutâneas e pesagem hidrostática. *Rev Bras Med Esportes* 2001;7(4):125-31.
28. Bansil P, Kuklina EV, Merritt RK, Yoon PW. Associations Between Sleep Disorders, Sleep Duration, Quality of Sleep, and Hypertension: Results From the National Health and Nutrition Examination Survey, 2005 to 2008. *J Clin Hypertension* 2011;13(10):739-43.
29. Nieto FJ, Young TB, Lind BK, Shahar E, Samet JM, Redline S, et al. for the Sleep Heart Health Study. Association of Sleep-Disordered Breathing, Sleep Apnea, and Hypertension in a Large Community-Based Study. *JAMA* 2000;283(14):1829-1836.
30. Poyares D, Moraes W. Obesidade e Distúrbio Respiratório do Sono, Uma Associação de Fatores de Risco. *Arq Bras Endocrinol Metab* 2007;51-7.
31. Fujita M, Hata A. Sex and age differences in the effect of obesity on incidence of hypertension in the Japanese population: A large historical cohort study. *J Am Soc Hypertension* 2014;8(1):64-70.
32. Ryan PJ, Blake G, Herd R, Fogelman I. A clinical profile of back pain and disability in patients with spinal osteoporosis. *Bone* 1994;15:27-30.
33. Rodrigues IG, Barros MBA. Osteoporose autorreferida em população idosa: pesquisa de base populacional no município de Campinas, São Paulo. *Rev Bras Epidemiol* 2016; 19(2): 294-306.
34. Moradi S, Shab-bidar S, Alizadeh S, Djafarian K. Association between sleep duration and osteoporosis risk in middle-aged and elderly women: A systematic review and meta-analysis of observational studies. *Metab Clin Exp* 2017;69:199-206.
35. Lima MG, Francisco PMSB, Barros MBA. Sleep duration pattern and chronic diseases in Brazilian adults. *Sleep Medicine* 2012;13(2):139-144.
36. Parmelee PA, Tighe CA, BS, Dautovich ND. Sleep Disturbance in Osteoarthritis: Linkages with Pain, Disability and Depressive Symptoms. *Arthritis Care Res (Hoboken)*. 2015;67(3): 358-365. doi:10.1002/acr.22459
37. Kelly GA, Blake C, Power CK, O'keeffe D, Fullen BM. The association between chronic low back pain and sleep: a systematic review. *Clin J Pain* 2011;27(2):169- 181.

38. Chang KJ, Son SJ, Lee Y, Back JH, Lee KS, Lee SJ, et al. Perceived sleep quality is associated with depression in a Korean elderly population. *Arch GerontolGeriatr* 2014;59:468–473.
39. Bosch P, Rover P, Staudte H, Lim S, Van Den Noort M. Schizophrenia, Depression, and Sleep Disorders: Their Traditional Oriental Medicine Equivalents. *J Acupunct Meridian Stud* 2015;8(1):17-22.
40. Legnani RFS, Legnani E, Gasparotto GS, Bacil EDA, Silva MP, Campos W. Sleep habits and physical activity in students: a systematic review. *Rev EducFis UEM* 2015;26(1):147-156.

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