

# Sleep disturbances in adults in a city of Sao Paulo state

## *Distúrbios do sono em adultos de uma cidade do Estado de São Paulo*

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**ABSTRACT:** *Objective:* To analyze the occurrence of sleep-related disorders among adults from Presidente Prudente, Brazil, as well as to identify associations with behavioral, socio-demographic and nutritional status variables. *Methods:* After random selection of the sample, interviews were performed with 743 adults of both genders, living in Presidente Prudente, Brazil. Sleep-related disorders, demographic variables (sex, age, ethnicity and schooling), behavioral variables (leisure physical activity, alcohol consumption, and smoking) and nutritional status were analyzed by questionnaires. *Results:* The prevalence of sleep-related disorders was 46.7%, with 95% confidence interval (95%CI) 43.1 – 50.2. In the multivariate analysis, female sex, with odds ratio (OR) 1.74 (95%CI 1.26 – 2.40), schooling (OR = 0.49; 95%CI 0.28 – 0.82), overweight (OR = 1.99; 95%CI 1.39 – 2.85) and obesity (OR = 2.90; 95%CI 1.94 – 4.35) were associated with sleep-related disorders. *Conclusion:* There is high occurrence of sleep-related disorders in this sample, which was associated with female sex, lower schooling, overweight and obesity.

**Keywords:** Sleep initiation and maintenance disorders. Sleep. Motor activity. Overweight. Obesity. Educational status.

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**RESUMO:** *Objetivo:* Analisar a ocorrência de distúrbios relacionados ao sono entre adultos de Presidente Prudente, São Paulo, bem como identificar suas associações com variáveis comportamentais, sociodemográficas e de estado nutricional. *Métodos:* Após a seleção aleatória da amostra, foram realizadas entrevistas face a face com 743 adultos de ambos os sexos, residentes na cidade de Presidente Prudente, São Paulo. Foram aplicados questionários para análise de distúrbios relacionados ao sono, variáveis sociodemográficas (sexo, idade, etnia, escolaridade), comportamentais (atividade física no lazer, etilismo e tabagismo) e de estado nutricional. *Resultados:* Foram observados distúrbios relacionados ao sono em 46,7% da amostra, com intervalo de confiança de 95% (IC95%) 43,1 – 50,2. Após a análise multivariada, foi observado que o sexo feminino, com *odds ratio* (OR) = 1,74 (IC95% 1,26 – 2,40), escolaridade (OR = 0,49; IC95% 0,28 – 0,82), sobrepeso (OR = 1,99; IC95% 1,39 – 2,85) e obesidade (OR = 2,90; IC95% 1,94 – 4,35) foram associados à ocorrência de distúrbios relacionados ao sono. *Conclusão:* É elevada a ocorrência de distúrbios de sono na amostra analisada, os quais foram mais frequentes em mulheres, pessoas de menor escolaridade e com sobrepeso e obesidade.

*Palavras-chave:* Distúrbios do início e manutenção do sono. Sono. Atividade motora. Sobrepeso. Obesidade. Escolaridade.

## INTRODUCTION

The sleep is considered to be a complex biological process which alternates with periods of wakefulness. The sleep-wake states are mediated by neural and hormonal modulations, such physiological processes alter the body temperature, the cardiac work and the hormone production<sup>1</sup>, leading to a neurological condition essential to the growth (during childhood and adolescence), learning/memory and functioning of the organism<sup>2,3</sup>. The sleep consists of two distinct states: the rapid eye movement (REM) and the non-rapid eye movement (NREM)<sup>2</sup>, which are manifested in cycles organized throughout an average night's sleep. However, disorders affecting these two states may result in the worsening of the quality of life and the installation, in long term, of several metabolic and cardiovascular diseases<sup>1</sup>.

Nowadays, alterations in sleep patterns are very common among children<sup>3</sup>, adults<sup>4,5</sup> and elderly people<sup>6</sup>, with international studies indicating a high prevalence of sleep disorders in adults (37.2 to 69.4%)<sup>4,7</sup>. Studies carried out in São Paulo show that 32% of São Paulo's citizens presented symptoms of insomnia<sup>8</sup>, as well as that, between 1987 and 2007, the percentage of paulistanos who had "trouble sleeping", "maintaining the sleep throughout the night" and "waking up" increased significantly<sup>9</sup>.

Besides that, recent studies have identified an association between sleep disorders, metabolic and cardiovascular diseases (hypertension, dyslipidemia and diabetes mellitus)<sup>10-12</sup>, risk behaviors (smoking)<sup>13,14</sup> and the presence of overweight and/or obesity<sup>15</sup>. Sleep disorders, as well as the shorter duration of sleep, are associated to weight gain<sup>16,17</sup>, and the decrease in the quality of sleep seems to be associated to higher food intake and alcohol consumption<sup>18</sup>. On the other hand, the improvement on the sleep quality seems to be mediated by factors such as regular physical activity<sup>19,20</sup>.

Although there is a high prevalence of sleep disorders among the world's population, and that this outcome is associated to a higher occurrence of complications and health expenses<sup>4,21,22</sup>, there is little national information on the investigation of sleep disorders and associated variables in the Brazilian population. This absence of information is relevant in cities in the inner country areas, in which the sleep behavior seems to differ significantly from the one in big metropolitan centers.

Thus, the objective of this study was to analyze the occurrence of sleep-related disorders among adults in Presidente Prudente, São Paulo, as well as to identify their associations to behavioral, sociodemographic and nutrition status variables.

## METHODS

### DESIGN AND PARTICIPANTS

A descriptive / analytical cross-sectional study. During the second half of 2012, 743 adults (older than 18 years of age) of both gender, living in the city of Presidente Prudente were interviewed. The municipality is located in the West region of the state of São Paulo, it has about 208,000 inhabitants and a human development index of 0.846. The interview consisted of questionnaires in order to report the quality of sleep<sup>23</sup> and the practice of physical activities during leisure time<sup>24</sup>. Behavioral and sociodemographic variables were also registered.

The sample size calculation was performed considering an estimated occurrence of sleep related disorders among adults of 35%<sup>1</sup> (due to the absence of representative national values, this reference was extracted from a great epidemiological survey with the American population). The minimum sample size in order to conduct the study was of 708 adults, estimated through an equation for the estimation of populational parameters, which considered a total population of approximately 208,000 inhabitants, alpha of 5% ( $Z = 1.96$ ), error of 3% and design effect of 30% (for using their households as final sample unit).

The sample consisted of individuals from the five geographic regions in the city (Center, East, West, North and South), listing and selecting randomly all the districts in each region. Within each district, 20 streets/avenues were randomly selected, and

6 households randomly selected in each one of them were assessed. All residents of these households were considered eligible and, then, invited into taking part in the study, respecting the inclusion criteria: (a) to be aged 18 years old or older; (b) to be living in the city for at least two years. All the subjects accepted taking part in the study and signed the Informed Consent approved by the Research Ethics Committee of the *Faculdade de Ciências e Tecnologia* of the *Universidade Estadual Paulista*, Campus of Presidente Prudente, São Paulo.

## DEPENDENT VARIABLE: SLEEP RELATED DISORDERS

In order to analyze the sleep related disorders, we used the Mini-sleep Questionnaire<sup>23</sup> (translated into Portuguese and validated in our midst)<sup>25</sup>, consisting of 10 questions with 7 possibilities of answers (never = 1; almost never = 2; rarely = 3; sometimes = 4; often = 5; very often = 6; and always = 7), which analyze different aspects related to sleep: sleepiness, insomnia, snoring, difficulty to sleep and waking up during the night. The sum of these 10 questions results in a numerical score classified into 4 categories for each sleep disorder degree: good sleep (score between 10 and 24 points), slight disorder (score between 25 and 27 points), moderate disorder (score between 28 and 30 points) and severe disorder (score above 30 points). For this study, we observed the presence of “sleep disorders” when there are values  $\geq 25$  points.

## INDEPENDENT VARIABLES: BEHAVIORAL

The current practice of physical activities during leisure time (leisure PA) was assessed using the questionnaire of Baecke et al.<sup>24</sup>, which was previously validated for the Brazilian population by Florindo et al.<sup>26</sup>. The questionnaire was answered during the face to face interview in the interviewees' own households. The leisure PA was evaluated by the second section of the instrument, regarding the athletic activities held during leisure time. The practice of other activities other than athletic ones (weightlifting, gymnastics, fighting modalities and walks) were also computed. Three constructs of this physical activities practices during leisure time were analyzed: the intensity (low, moderate and vigorous), weekly time of practice, in hours per week (h/week) (< 1h/week; 1 – 2h/week; 2 – 3h/week; 3 – 4h/week; > 4h/week) and the prior engagement time (< 1 month; 1 – 3 months; 4 – 6 months; 7 – 9 months; > 9 months). This way, we considered as physically active the participants who reported a minimum of 180 minutes per week (3 – 4 h/week) of physical activities of moderate or vigorous intensity, within the last four months (4 – 6 months). Three categories were created: (i) absence of leisure physical

activity (leisure AP): individuals who did not report any physical activity practice; (ii) < 180 min: individuals who reported less than 180 minutes per week or lower intensity than the one established or shorter prior engagement time; (iii) > 180 min: individuals who reached the proposed cutoff point<sup>27,28</sup>.

The consumption of alcohol and smoking were also identified: smoking (the interviewee self-reports being a smoker [yes or no]) and the consumption of alcohol (no[no day at all] / yes [at least once a week]).

## **INDEPENDENT VARIABLES: SOCIODEMOGRAPHIC**

During the interview, the participants reported: gender (male / female); chronological age (categorized into four groups: 18 – 29.9; 30 – 44.9; 45 – 59.9; and  $\geq 60$  years of age); ethnics (caucasian, black, yellow and others). School education was registered in 1 to 4 years of elementary school; 5 to 8 years of complete elementary school; complete high/technical school; and complete college education.

## **INDEPENDENT VARIABLES: NUTRITIONAL STATE**

The body mass and height were related by the participants themselves, and later on, the Body Mass Index (BMI) was calculated through the division of the body mass by the squared height ( $\text{kg}/\text{m}^2$ ). Thus, the participants were classified in average weight (values between 18.6 and 24.99  $\text{kg}/\text{m}^2$ ), overweight (values between 25 and 29.99  $\text{kg}/\text{m}^2$ ) and obesity (values  $\geq 30$   $\text{kg}/\text{m}^2$ ).

## **STATISTICAL ANALYSIS**

The category variables were expressed as prevalence, and their respective confidence intervals were calculated. The  $\chi^2$  test was used in the analysis of the associations between the presence of sleep disorders and the independent variables. Later on, the binary logistic regression was employed, using the variables which presented significance of up to 20% in the  $\chi^2$  test, in order to develop three multivariate models, in which the hierarchical entrance of independent variables of sociodemographic (gender, age and school education) and behavioral (physical activity, alcohol consumption and smoking) origin and the nutritional state was adopted. This process resulted in adjusted values of *odds ratio* (OR) and confidence intervals of 95% (95%CI). The test of Hosmer and Lemeshow was used in order to analyze the degree of adjustment of the multivariate models created. Significance values (p-value) were statistically

considered when lower than 5%, and all the analysis were performed in the statistical BioEstat (version 5.0) software.

## RESULTS

The average age of the interviewees was  $49.9 \pm 17.3$  years of age (95%CI 48.6 – 51.1 years of age). In the analyzed sample, the occurrence of sleep related disorders was 46.7% (95%CI 43.1 – 50.2) (slightly altered sleep: 8,9%; moderately altered sleep: 9%; severely altered sleep: 28.8%). As for age, 30.6% of the interviewees were 60 years old or older. There was an elevated occurrence of overweight/obesity in the analyzed sample (58.3%), as well as an increased percentage of people with, at least, complete high/technical school degree (61.8%).

Sleep disorders were more often reported by women (OR = 1.75; 95%CI 1.30 – 2.37), older people (60 years old or older; OR = 2.26; 95%CI 1.40 – 3.64) and overweight people (OR = 3.00; 95%CI 2.04 – 4.41). On the other hand, people with higher school education less often present the analyzed outcome (Table 1).

Using the independent variables with significance of up to 20% in the  $\chi^2$  test, three multivariate models were developed adopting a hierarchical entry of socioeconomical and behavioral variables and nutritional state. The last model created did not get saturated (test of Hosmer and Lemeshow with  $p = 0.987$ ) and identified that women (OR = 1.74; 95%CI 1.26 – 2.40), people with lower school education and overweight (OR = 1.99; 95%CI 1.39 – 2.85) and obesity (OR = 2.90; 95%CI 1.94 – 4.35) presented higher occurrence of the analyzed outcome.

## DISCUSSION

The occurrence of sleep related disorders was 46.7% (95%CI 43.1 – 50.2). This percentage is higher than the one observed in previous studies on the theme in adult populations of other countries and, also, in the city of São Paulo<sup>1,8,29</sup>. Throughout the last few years, it has been possible to observe a significant decrease in sleep time of the adult population<sup>1</sup> and, along with this decrease, it has also been observed the decrease of the sleep quality<sup>9</sup>. On the other hand, most studies on the theme are conducted with populations living in great urban areas, and little is known about this variable in smaller towns (places significantly different from great urban centers as for quality of life and behaviors, which may impact in the quality of sleep). Our study shows that, although yet little explored in the Brazilian population of countryside cities, this kind of outcome deserves more attention, once it is also highly present

Table 1. Factors associated to sleep disorders among adults in Presidente Prudente, São Paulo.

	Sleep disorder*	$\chi^2$	OR <sub>crude</sub> (95%CI)
	n (%)	p-value	
Gender		0.001	
Male	110 (38.2)		1.00
Female	237 (52.1)		1.75 (1.30 – 2.37)
Age (years)		0.001	
18 – 29.9	36 (32.7)		1.00
30 – 44.9	82 (42.7)		1.53 (0.93 – 2.50)
45 – 59.9	110 (51.9)		2.21 (1.37 – 3.58)
≥ 60	119 (52.4)		2.26 (1.40 – 3.64)
Race		0.458	
Caucasian	291 (47.2)		1.00
Black	39 (47.0)		0.99 (0.62 – 1.56)
Yellow	9 (31.1)		0.52 (0.23 – 1.18)
Others	8 (50.0)		1.11 (0.41 – 3.01)
School education		0.001	
< 4 years	95 (61.3)		1.00
5 – 8 years	68 (52.7)		0.70 (0.43 – 1.13)
High/technical school	121 (41.4)		0.44 (0.30 – 0.66)
Complete college education	63 (37.7)		0.38 (0.24 – 0.60)
Leisure PA		0.001	
APA-leisure (0 min/week)	232 (51.1)		1.00
< 180 min/week	77 (42.3)		0.70 (0.49 – 0.99)
≥ 180 min/week	38 (35.5)		0.52 (0.34 – 0.81)
Alcohol (weekly intake)		0.248	
No	201 (49)		1.00
Yes	145 (43.7)		0.80 (0.59 – 1.08)
Smoking		0.168	
No	294 (45.7)		1.00
Yes	52 (52.5)		1.31 (0.86 – 2.00)
Nutritional status (BMI)		0.001	
Average (18.6 – 24.99 kg/m <sup>2</sup> )	108 (35.1)		1.00
Overweight (25 – 29.99 kg/m <sup>2</sup> )	131 (50.4)		1.88 (1.34 – 2.63)
Obesity (≥ 30 kg/m <sup>2</sup> )	107 (61.8)		3.00 (2.04 – 4.41)

\*Questionnaire score ≥ 25 points; OR: *odds ratio*; 95%CI: confidence interval of 95%; PA: physical activity; APA-leisure: absence of leisure physical activity; min/week: minutes per week; BMI: body mass index.

Table 2. Adjusted model for the association between sleep disorders and variables.

	Model 1	Model 2	Model 3
	OR (95%CI)	OR (95%CI)	OR (95%CI)
<b>Gender</b>			
Male	1.00	1.00	1.00
Female	<b>1.65 (1.21 – 2.25)</b>	<b>1.63 (1.19 – 2.23)</b>	<b>1.74 (1.26 – 2.40)</b>
<b>Age (years)</b>			
18 – 29.9	1.00	1.00	1.00
30 – 44.9	1.36 (0.82 – 2.26)	1.37 (0.82 – 2.28)	1.22 (0.72 – 2.06)
45 – 59.9	<b>1.83 (1.11 – 3.01)</b>	<b>1.86 (1.12 – 3.03)</b>	1.57 (0.94 – 2.64)
≥ 60	1.44 (0.84 – 2.49)	1.53 (0.88 – 2.26)	1.36 (0.77 – 2.40)
<b>School education</b>			
< 4 years	1.00	1.00	1.00
5 – 8 years	0.72 (0.42 – 1.21)	0.70 (0.41 – 1.18)	0.69 (0.40 – 1.18)
High/technical school	<b>0.50 (0.31 – 0.81)</b>	<b>0.53 (0.33 – 0.86)</b>	<b>0.50 (0.31 – 0.82)</b>
Complete college education	<b>0.42 (0.25 – 0.71)</b>	<b>0.47 (0.27 – 0.80)</b>	<b>0.49 (0.28 – 0.84)</b>
<b>Leisure PA</b>			
APA-leisure (0 min/week)		1.00	1.00
< 180 min/week		0.79 (0.55 – 1.14)	0.83 (0.57 – 1.21)
≥ 180min/week		<b>0.63 (0.40 – 0.99)</b>	0.67 (0.42 – 1.08)
<b>Smoking</b>			
No		1.00	1.00
Yes		1.31 (0.84 – 2.06)	1.45 (0.91 – 2.30)
<b>Nutritional state (BMI)</b>			
Average (18.6 – 24.99 kg/m <sup>2</sup> )			1.00
Overweight (25 – 29.99 kg/m <sup>2</sup> )			<b>1.99 (1.39 – 2.85)</b>
Obesity (≥ 30 kg/m <sup>2</sup> )			<b>2.90 (1.94 – 4.35)</b>

Model 1: model adjusted through socioeconomic variables (gender, age and school education); Model 2: model adjusted through socioeconomic and behavioral variables (leisure physical activity and smoking); Model 3: model adjusted through socioeconomic, behavioral and overweight variables; OR: *odds ratio*; 95%CI: confidence interval of 95%; PA: physical activity; APA-leisure: absence of leisure physical activity; min/week: minutes per week; BMI: body mass index; bold data denotes statistical significance at p-value <0.05.

in this portion of the population and it is related to the development of different health problems<sup>1</sup>.

Obesity is related to the development of sleep disorders<sup>1</sup>. In this sense, this high occurrence of sleep disorders may be associated to the excess of weight (overweight and obesity) rates observed in these interviewees (58% of them). The excess of weight affects the quality of sleep in different ways, as is the case of the obstructive sleep apnea, in which the excess of adiposity in the neck area interferes in the circulation of the air and, consequently, in breathing<sup>30</sup>. Furthermore, sleep disorders are related to weight gain, since an sole night of sleep deprivation significantly affects the levels of ghrelin and cortisol, favoring, thus, the reduction of energy expenditure<sup>30</sup>. Besides, there is a relation between obstructive sleep apnea and the resistance to leptin by the organism<sup>31</sup>. On the other hand, although there are some consistent biological theories connecting both variables, it is necessary to stress that it is still not possible to indicate with absolute certainty the causality relations between the sleep disorder and the higher body adiposity.

Also, the relation between weight excess and the insufficient physical activity practice seems to also affect the quality of sleep. In a longitudinal study performed by Zuo et al.<sup>19</sup> in China, it was verified, in a sample of 1,224 adults, that the practice of physical activities was pointed out as a prevention factor against sleep disorders. On the other hand, the insufficient practice of physical activities did not remain associated to the outcome after the addition of the excess of weight (overweight and obesity), showing that this possible protective effect of physical activities, apparently, is due to the lower BMI of the subject, i.e., more active people have better quality of sleep because they have lower adiposity levels<sup>32</sup>.

Women presented higher occurrence of sleep disorders. Biologically, women's sleep is more fragmented when compared to men's<sup>33</sup>. Besides, the stressful social context in which women are in (social expectations as to their work, family caring, aesthetics, etc.) may lead them into taking up unhealthy behaviors of negative impact on their sleep<sup>34</sup>.

In this study, people with higher school education presented lower occurrence of sleep disorders. This association shows that factors related to school education (economic condition and occupation) may interfere in the processes related to sleep disorders. The school education has been used as an economic status indicator<sup>27,28,32</sup>, and lower school education refers back to more stressful occupations as well as to lower access to health services with the intention of prevention<sup>35</sup>. Also, higher school education may also mean higher capability of association of what are beneficial health behaviors and, thus, preventing problems which may cause sleep disorders.

This study did not identify smoking as a risk factor to sleep disorders, as oppose to the others<sup>13,14</sup>. In the study of Kim et al.<sup>13</sup>, it was observed that smoking may trigger sleep disorders and even be a risk factor to the obstructive sleep apnea syndrome. This way, the differences observes between these studies may be explained, at least

in parts, by the difference between the questionnaires used and the absence of more accurate analysis on the problems with obstructive sleep apnea; also, due to the fact that former smokers were inserted in the group of “non-smokers”.

As a study limitation, we stress the absence of more detailed measures on the consumption of alcohol (amount consumed) and smoking (number of cigarettes consumed per day and prior exposure to smoking), as well as the absence of information regarding the kind of workload. Such information may be very useful to future studies interested in analyzing more thoroughly the relation of the outcome at hand regarding behavioral variables.

Finally, the results presents evidence a problem in public health, which deserves attention from the professionals of the area, because actions on raising awareness on the matter and education related to a good quality of sleep are little common, whether in basic care or in prevention in school grounds.

## CONCLUSION

In short, it is possible to conclude that there is a high prevalence of sleep disorders among adult individuals in the city of Presidente Prudente, São Paulo, as well as the fact that this outcome is associated to female gender, to the presence of overweight/obesity and to lower school education.

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