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Prevalence of sleep complaints in Colombia at different altitudes ☆, ☆☆, ★

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ABSTRACT

Study objectives: To determine the prevalence of sleep complaints in adults in Colombia at different altitudes.
Design: Cross-sectional, population-based and observational study.
Setting: Urban areas in three cities (Bogotá, Bucaramanga, Santa Marta) located between 15 and 2640 masl. Subjects Over 18 years old.
Interventions: Epworth sleepiness scale (ESS), Pittsburgh sleep quality index (PSQI), Berlin questionnaire, STOP-Bang questionnaire and diagnostic criteria for restless leg syndrome (IRLSSG).
Measurements and results: The overall prevalence of sleep complaints was 59.6% (CI 95%: 57.3; 61.8%). According to the Pittsburgh scale, 45.3% (CI 95%: 43.0; 47.5) required medical assistance. The Berlin questionnaire indicated that 19.0% (CI 95%: 17.3; 20.8%) had a high risk of sleep apnea (OSA) compared to 26.9% (CI 95%: 24.9; 29.0%) according to STOP-Bang. Among the subjects, 13.7% (CI 95%: 12.3; 15.3%) had excessive daytime sleepiness and 37.7% (CI 95%: 35.5; 39.8%) had a restless leg syndrome. When comparing cities, significant differences in the overall frequency of subjects requiring care were found between Santa Marta (higher frequency) and the other two cities. Differences in sleep problem frequency (Pittsburgh) were observed between Bogota (higher frequency) and Bucaramanga and also between Santa Marta (higher frequency) and the other two cities. The high risk of OSA (STOP-Bang) was different between Bogota (higher frequency) and Bucaramanga and also between Santa Marta (high frequency) and Bucaramanga.
Conclusions: We observed a high prevalence of sleep complaints with significant differences among the cities, indicating a need to pay a greater attention to these problems.
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1. Introduction

Social and urban developments have resulted in unhealthy lifestyles. Sleep habits have changed significantly, and altered habits can cause sleep disorders [1].

The prevalence of sleep problems is 56% in the US population, 31% in Western Europe, and 23% in Japan [2]. Insomnia is the most common sleep disorder, followed by respiratory sleep disorders and restless legs syndrome [1].

Altitude has been shown to increase central apneas even in healthy people and to be associated with higher apnea-hypopnea index in those with obstructive sleep apnea [3,4] Even more, in

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those with obstructive apnea, some of the episodes convert to central [5].

Due to Colombia's rugged geography, it is important to understand the impact of various disorders at different altitudes. The aim of this study was to establish the prevalence of sleep complaints in adults in three Colombian cities located between 15 and 2640 meters above sea level.

This study is part of the project *"Prevalence and Diagnostic Tests of Sleep Disorders, and their Relationship to Cardiovascular Risk in Colombia at Different Altitudes."*

2. Materials and methods

2.1. Study Design

A cross-sectional population study was conducted in three Colombian cities (Santa Marta, Bucaramanga, and Bogota) located at 15, 959, and 2640 meters above sea level, respectively. The target population was adults aged 18 and over, living in urban areas. Subjects with mental disorders were excluded and replaced using the same sampling technique. The protocol was approved by the Research Ethics Committee of the Pontificia Universidad Javeriana in Bogota.

2.2. Sampling

We performed a community-based strategy to select subjects, and independent samples were taken in the three cities. The pollster toured the building clockwise, recording the number of homes. Later, the pollster attempted to communicate with the adults in those homes. In the event that eligible subjects were not found in a building, the pollster counted the homes of the adjacent buildings. The questionnaires were applied by interviewers in person.

2.3. Sample size

Sample size was calculated considering the adult population of interest. The Levy and Lemeshow formula was used for the calculation [6] based on the following parameters: a population estimated between 18 and 90 years of age for the three cities (with a combined population of 5,200,000 adults) with an overall estimated prevalence of 6.5% in Colombia, an estimate accuracy of 10% and a type I error of 5%; the sample size was calculated as 5600 people. This sample was taken as follows: 1867 in Bogota, 1867 in Bucaramanga, and 1866 in Santa Marta.

2.4. Measuring instruments

Data were collected between February and July 2013. Participants answered a 40-item questionnaire that included contact information, demographic data, the Epworth Sleepiness Scale (ESS), the Pittsburgh Sleep Quality Index (PSQI), the Berlin questionnaire, the STOP-Bang questionnaire and questions related to diagnostic criteria for restless legs syndrome proposed by the International Restless Legs Syndrome Study Group (IRLSSG).

The ESS [7] is designed to measure the propensity for daytime sleep or EDS, and was validated in Colombia by Chica et al. [8].

The PSQI in the Colombian validation (PSQI-CV) is a questionnaire that assesses sleep quality and classifies people as "good or poor sleepers." [9].

The Berlin questionnaire explores three categories related to the risk of sleep apnea. It was validated in Colombia by Polanía et al. [10].

The STOP-Bang questionnaire for sleep apnea was developed to assess the likelihood of OSA in the surgical field and has been validated in the general population [11].

Diagnostic criteria for RLS proposed by the IRLSSG were taken into account; and subjects were considered as positive if at least two positive criteria out of four were found [12].

2.5. Statistical analysis

The analysis included the overall prevalence of sleep disturbances by city and sex. Weighted means or percentages were used, according to the expansion factors established under the selection probabilities considered for the study design, along with an adjustment for population distribution by city, age, and sex based on population projections for the 2012 census. Additionally, confidence intervals were estimated at 95%. STATA (13.0) (StataCorp; College Station, TX) was used for the statistical analyses.

3. Results

The number of subjects surveyed was 5474 (32.6% in Bogota, 33.1% in Bucaramanga, and 34.3% in Santa Marta). The compliance level of the selected sample was greater than 95% in each city (overall, 97.3%). The percentage of missing data was 4.1%.

Most of subjects were female (53.8%) between 18 and 44 years of age (66.1%) (Table 1). The weighted average age of the population was 40.1 years.

Only 41.5% had a body mass index (BMI) in the normal weight category, and women had a higher prevalence of obesity (17.3 versus 11.1%) (Fig. 1). Additionally, women required more sleep medication and had worse sleep quality. Distribution by sex and age groups was similar for the three cities.

The subjects had regular sleep schedules (93.5%), with an average duration of 7.9 ± 3.1 h of sleep. With respect to sleep habits, went to bed early and got up early (38.4%) than those who stayed up late and got up late (18.2%) (Table 2).

The population had good sleep quality (68.8%); however, it was found that approximately 45.0% of subjects snore. However, most of the snorers did not know whether they stop breathing during sleep (53.3%).

For those over 65 years of age, it was found that 58.8% slept more than eight hours; however, this group also had the highest use of sleep medications. The overall prevalence of sleep complaints was 59.6% (95% CI: 57.3; 61.8%).

According to the Pittsburgh scale, 45.3% (95% CI: 43.0, 47.5%) of the population requires medical care due to sleep problems

Table 1
Sociodemographic data by place of residence, qualitative variables (n=5474).

Variable	Bogota		Bucaramanga		Santamarta	
	%*	CI 95%	%*	CI 95%	%*	CI 95%
Age groups						
18–44	66.08	(63.69; 68.38)	64.67	(62.45; 66.83)	68.17	(65.89; 70.37)
45–65	26.55	(24.42; 28.79)	25.74	(23.86; 27.71)	24.52	(22.53; 26.63)
> 65	7.38	(6.24; 8.69)	9.59	(8.26; 11.11)	7.31	(6.12; 8.71)
Sex						
Masculine	46.27	(43.67, 480.89)	45.05	(42.66, 470.47)	46.34	(43.89, 480.81)
Femenine	53.73	(51.11, 560.33)	54.95	(52.53, 570.34)	53.66	(51.19, 560.11)

%*: Weighted percent by expansion factors 95% CI: 95% confidence interval.

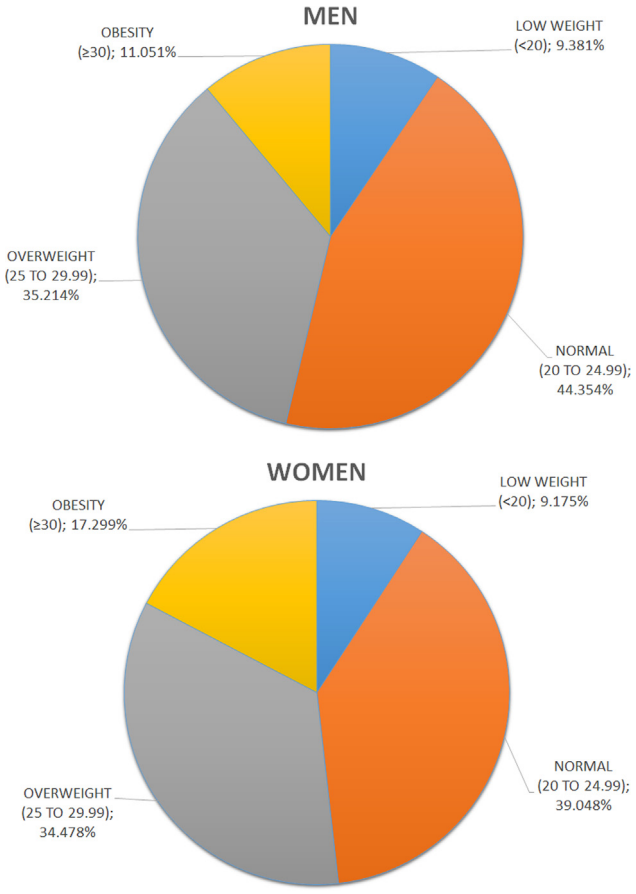


Fig. 1. Distribution of body mass index by sex.

(Fig. 2). The overall prevalence of high risk for sleep apnea, according to the Berlin questionnaire, was 19.0% (95% CI: 17.3; 20.8%). However, with the STOP-Bang questionnaire, the overall prevalence of high risk for OSA (26.9%; 95% CI: 24.9; 29.0%) was higher than that reported by this questionnaire. It was identified that 13.7% (95% CI: 12.3; 15.3%) of the population has EDS, and 37.7% (95% CI: 35.5; 39.8%) reported restless legs syndrome.

In the analysis by city, the population of Santa Marta had a high prevalence of sleep complaints (72.4%). In that city, high-risk percentages were found for severe sleep apnea (by STOP-Bang (28.9%)), OSA (by the Berlin questionnaire (21.2%)), restless legs (54.5%), and propensity for EDS (29.9%). Bogota had the second-highest frequency of sleep disturbances (59.7%), attributable in part to a high-risk-weighted prevalence for OSA in the STOP-Bang (27.2%) questionnaire. When comparing cities with respect to the frequency of sleep problems, there were statistically significant differences in the overall frequency of patients who require medical care in Santa Marta (higher frequency) versus the other two cities. The frequencies of sleep problems according to the Epworth scale and the restless legs syndrome questionnaire were statistically significant in the comparison between Santa Marta (higher frequency) and the other cities. There were also differences in the frequency of sleep problems (Pittsburgh) not only between Bogota (higher frequency) and Bucaramanga but also between Santa Marta (higher frequency) and the other two cities. With respect to the frequency of high OSA risk (STOP-Bang) requiring medical care, statistically significant differences were found not only between the cities of Bogota (higher frequency) and Bucaramanga but also between Santa Marta (higher frequency) and Bucaramanga (Table 3).

Finally, the relationship between age and average sleep time was U-shaped, with a minimum of 7.6 h in subjects between 45 and 54 years of age and a maximum of 10 h in those over 75 (Fig. 3).

4. Discussion

This is the first study with probability sampling in different Colombian cities to use a specially designed questionnaire based on five instruments for the clinical detection of sleep symptoms associated with sleep disorders. The study, which described the prevalence of sleep complaints in three cities in Colombia at different altitudes, found that in general, symptoms increased with age and were more common in women (except in the risk for OSA recorded in the STOP-Bang questionnaire). The city with fewer sleep disturbances was Bucaramanga and the city with more sleep disturbances was Santa Marta.

The scales used were chosen both to facilitate comparison with results from other studies and latitudes and because they have the best performance. In addition, the scales' complementarity provides important information and enables the identification of different sleep disorders that have important medical implications.

The overall prevalence of sleep complaints in Colombia (59%) is similar to that reported in the US (56%) [2] and higher than that reported in Western Europe (31%), Japan (23%), [2] Chile (25%) [13], and Brazil (35%). However, this "omnibus" survey excluded patients with restless legs syndrome and sleep apnea, thus possibly underestimating sleep-disorder prevalence. Hirotsu et al in a Brazilian population have found that sleep complaints increase with age, and there were more frequent in women findings similar to our results [14].

The weighted overall prevalence of high risk for sleep apnea, according to the Berlin questionnaire, was 19.0% (95% CI 17.3–20.8%). The prevalence of OSA was lower than in other studies; however, its frequency remained higher in men (STOP-Bang). In primary care patients in the US and Europe, there was a 32.3% prevalence of high risk for OSA using the Berlin questionnaire [15]. This figure was higher in men (37.8%) than in women (27.8%), consistent with the findings of this study. However, with the STOP-Bang questionnaire, the overall weighted prevalence of high risk for OSA (26.9%; 95% CI, 24.9–29.0%) was higher than that reported by this questionnaire. In Latino population, specifically in Sao Paulo, Tufik S et al in a multivariate logistic regression model identified several independent and strong associations for the presence of OSAS: men had greater association than women (OR = 4.1; 95% CI, 2.9–5.8; $P < 0.001$ similar to the findings of this study [16].

In the Hispanic/Latino population, there are also smaller numbers of sleep complaints compared to those in this study. The prevalence of sleep-disordered breathing was 25.8% in the Latino population of four US cities (n = 16,415) [17], the prevalence of overall snoring was 45.7%, lower than the value found in Platino and the snoring rate was 58.7% in those older than 40 [18]. In the Platino study, the prevalence of OSA was estimated based on the combined presence of usual snoring, witnessed apneas, and EDS. The reported prevalence for women and men, respectively, was 2.4% and 1.5% in Caracas, 0.5% and 3.7% in Montevideo, 2.4% and 4.4% in Mexico, and 5.0% and 8.8% in Santiago. In São Paulo, Brazil, the overall prevalence was 16.9% with full polysomnography [19]. Bogota has the highest number of people who stop breathing during sleep (8.60%), which could be explained by the higher altitude and correspondingly lower oxygen partial pressure. This finding is important because OSA is considered a disease that has a strong impact on public health. It is the most common organic sleep disorder that causes EDS [1]. It was identified that 13.7% (95% CI: 12.3; 15.3%) of the population has EDS, less than that reported

Table 2
Data on sleep habits of adults according to place of residence (n=5474).

Variable	Bogota		Bucaramanga		Santamarta	
	%*	CI 95%	% *	CI 95%	% *	CI 95%
Irregular sleep pattern						
Yes	5.93	(4.707; 7.432)	6.67	(5.522; 8.046)	17.46	(15.58; 19.52)
No	94.08	(92.57; 95.29)	93.99	(91.95; 94.48)	82.54	(80.48; 84.42)
Hours of sleep						
Less than 5	5.14	(4,297; 6,562)	2.71	(2.058; 3.566)	4.24	(3.387; 5.301)
Between 5 and 8	75.95	(73,69; 78,07)	76.14	(74.04; 78.11)	77.67	(75.61; 79.6)
More than 8	18.73	(16,8; 20,84)	21.15	(19.26; 23.17)	18.09	(16.31; 20.01)
Sleep medication						
Never	84.01	(82.12; 85.74)	94.53	(93.36; 95.49)	96.10	(93.36; 95.49)
One or twice a month	3.17	(2.369; 4.24)	1.42	(.9569; 2.093)	1.28	(.8392; 1.945)
One or twice a week	2.24	(1.621; 3.097)	0.70	(.4021; 1.205)	0.58	(.3188; 1.046)
Three or more a week	10.57	(9.179; 12.15)	3.36	(2.615; 4.307)	2.04	(1.494; 2.783)
Sleep quality						
Very good	12.55	(10.9; 14.42)	24.36	(22.36; 26.47)	9.59	(8.239; 11.13)
Good	69.14	(66.77; 71.42)	62.66	(60.34; 64.92)	70.51	(68.28; 72.65)
Bad	15.18	(13.54; 16.99)	11.16	(9.783; 12.7)	17.59	(15.86; 19.46)
Very bad	3.12	(2.375; 4.09)	1.82	(1.287; 2.581)	2.31	(1.716; 3.104)
Snoring						
Yes	45.64	(43.11; 48.19)	44.03	(41.69; 46.4)	48.30	(45.89; 50.72)
No	50.60	(48.06; 53.14)	52.12	(49.74; 54.48)	50.55	(48.13; 52.96)
Not known	3.76	(2.945; 4.79)	3.85	(3.032; 4.875)	1.16	(.7357; 1.814)
Witnessed apneas						
Yes	8.60	(7.267; 10.14)	4.42	(3.542; 5.505)	1.36	(.8954; 2.056)
No	38.00	(35.54; 40.53)	41.72	(39.4; 44.08)	47.32	(44.91; 49.74)
Not known	53.40	(50.85; 55.93)	53.86	(51.49; 56.21)	51.32	(48.9; 53.73)

%*: Weighted percent by expansion factors 95% CI: 95% confidence interval.

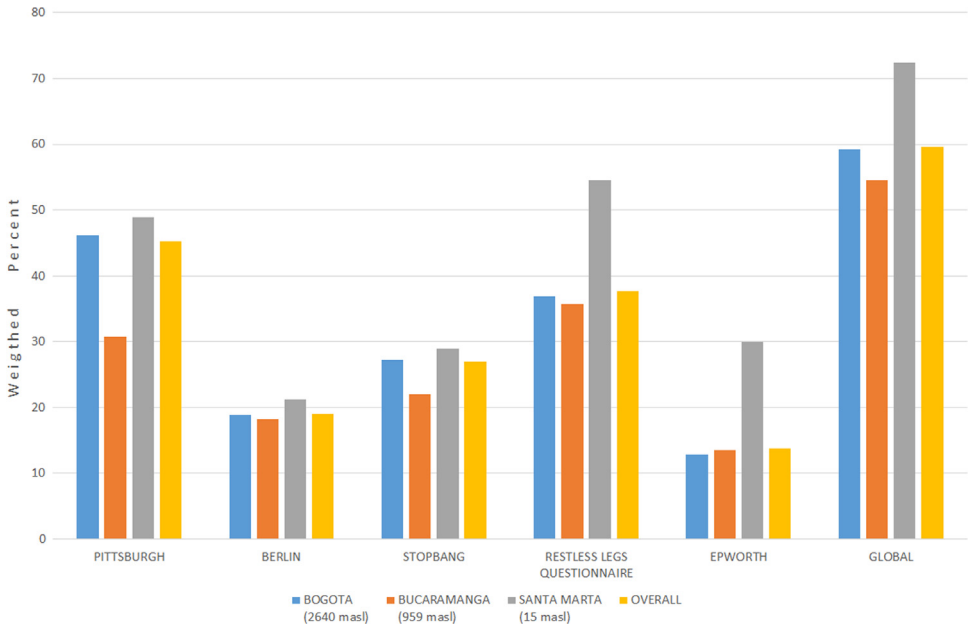


Fig. 2. Global prevalence of sleep complaints weighted according to different scales and cities.

in Caracas (14.7%), Mexico (17.7%), and Santiago(22.7%), and higher than in Montevideo (9.5%) and São Paulo (8.5%) [19]. It is also important to mention the prevalence found by Bittencourt in Brazil : 61% for snoring, 35% for insomnia, 53% for leg kicking, and 37% for breathing pauses higher than our findings of 45% for snoring, 37% for leg kicking and 8.6% for breathing pauses and lesser than our finding 41% for insomnia [20].

The prevalence of insomnia was 45%, in line with what has been reported in the scientific literature as the most common sleep disorder. The insomnia rate found is higher than that

described in the Platino study in LatinAmerica of 31% in Caracas and Montevideo, 36% in Mexico City, and 42% in Santiago de Chile, [18] it is lower than in 11 countries in Latin America using the Pittsburgh questionnaire, reporting 46.2% with insomnia and poor sleep quality [21].

In Colombia, the frequency of sleep disorders has been investigated in the Province of Caldas (SUECA study) [22,23]. The most common disorder was insomnia (47.2%), followed by snoring (33.0%). The percentage of the insomniac population that took some sleeping medication was 15% [22] a figure similar to that found in this study. It has also been addressed by Monterrosa et al in a study in female population where they found an insomnia prevalence of 27.5% [24]. Rueda et al. have conducted a population survey in Bucaramanga investigating only for insomnia, finding a prevalence of 26.2% [25]. For those older than 65 years of age, 58.8% slept more than eight hours. However, this group also reported an increased use of sleep medication. In the US, 57% of people over 65 complain of at least one chronic sleep problem, 43% complain of difficulty in initiating or maintaining sleep, and 19% complain that they wake up too early in the morning [1].

Average hours of sleep per day was 7.9 ± 1.7 h, consistent with the suggestion of the US National Sleep Foundation (between 7 and 9 h) and what has been reported in Latin America in 1776 individuals from 18 to 70 years of age from three of the largest cities where an average of 5.8 h of sleep per day was described [19]. In the US, the relationship between age and average sleep time is also U-shaped, similar to that found in our study [1] (Fig. 3).

The prevalence of RLS is 37.7% (95% CI: 35.5; 39.8%), quite high compared with the findings of two recent literature syntheses [26,27]. Ohayon et al. report a prevalence of 3.9–14.3% if minimum criteria (IRLSSG) are used for the diagnosis [26]. Innes et al. find a prevalence of 4–29% in the North American and Western European adult populations [27].

This study provides great value by evaluating the population of three cities at different altitudes with respect to the impact of altitude on the quality and frequency of sleep problems, the problems arising from desaturation, and the potentially increased risk at low barometric pressures that determine lower inspired oxygen pressure.

The expected effects of altitude due to differences in oxygen pressure showed no clear trend. Explanations for this phenomenon include the possibility that the differential frequencies of overweight may have confounded the relationship with altitude, or that the subjects experience different stress levels due to their cities' sizes, social, mobility and inequality problems, and weather conditions. Taking into account that Colombia is geographically located in the tropics, its ambient temperature depends primarily on altitude, and there are no seasonal variations in temperature. A high proportion of the population in the warmest cities does not routinely use air conditioning, and therefore, ambient temperature can alter sleep hygiene more easily at lower altitudes.

The capital concentrates a high number of people from elsewhere, and its large size implies significant psychosocial stress problems. Bucaramanga has recently become a center of migration from the north and east of the country and has experienced very rapid urban growth, although infrastructure does not keep pace, resulting in proportionally greater problems than in Bogota. Although Santa Marta has the advantage of being a few meters above sea level, it concentrates more problems of social inequality and development challenges than the other two cities.

It must be mentioned that the prevalence values are higher than those found in the general population in other studies, perhaps due to the use of more predictive tests. Indeed, there is a high probability prevalence rather than disease prevalence because to

Table 3
P values obtained when comparing the need for medical care between places of residence.

Scale	P value		
	Bogota versus Bucaramanga	Bogota versus Santa Marta	Bucaramanga versus Santa Marta
Pittsburgh	< 0.001	< 0.001	< 0.001
Berlin	0.999	0.303	0.072
Stopbang	0.002	0.895	< 0.001
Restless legs Questionnaire	0.999	< 0.001	< 0.001
Epworth	0.999	< 0.001	< 0.001
Global	0.071	< 0.001	< 0.001

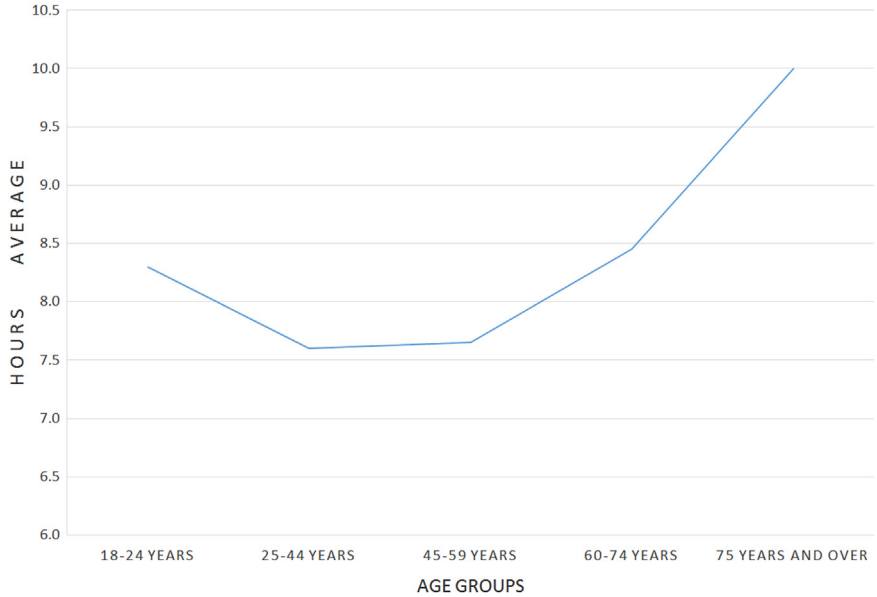


Fig. 3. Relationship between age and average sleep time.

determine disease, polysomnography or the gold standard result for each condition is required.

Nevertheless, the prevalence data recorded are adequate to attract attention to the problem of sleep disturbances as factors that significantly affect individuals' quality of life and pose risks for the development of complications and accidents, along with alterations in intellectual and labor productivity and attention disorders. Having determined the magnitude of the problem provides crucial information to develop strategies both to diagnose and manage these conditions and to provide education to both society and the medical community.

5. Conclusions

The study found a high prevalence of sleep complaints and a high probability of OSA with significant differences among cities at different altitudes. However, the frequencies were confounded by differential distributions in overweight subjects and potentially by differences in psychosocial stress and ambient temperature, which can alter sleep hygiene.

A combination of screening tests is needed, with operational characteristics that are being evaluated against the gold standard to improve diagnosis. It is imperative to increase the knowledge of sleep complaints among the general population and healthcare staff.

Conflicts of interest

None of the investigators has conflicts of interest to disclose.

Summary at a glance

We studied and evaluated the presence of sleep complaints (by sleep scales) and we believe that this study will substantially contribute to the understanding of them, and will be an important piece of information in the therapeutic approach of the different sleep symptoms associated with sleep disorders.

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