Multimorbidity and Sleep Patterns among Adults in a Peruvian Semi-Urban Area

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Abstract

Objective To assess if the duration and quality of sleep vary due to the presence of multimorbidity.

Materials and Methods We performed a secondary analysis using data from a population-based study involving adult subjects aged between 30 and 69 years residing in a semi-urban area of Tumbes, Peru. The duration (normal, short or prolonged) and quality (good or poor) of sleep were our outcome variables, whereas the exposure was multimorbidity (two or more chronic conditions). Crude and adjusted Poisson regression models were built to assess the association of interest, and prevalence ratios (PRs) and 95% confidence intervals (95%CIs) were reported.

Results We analyzed data from 1,607 subjects with a mean age of 48.2 (standard deviation [SD]: ± 10.6) years, 809 (50.3%) of whom were women. Multimorbidity was present in 634 (39.5%; 95%CI: 37.1–41.9%) subjects, and 193 (12.1%; 95%CI: 10.5–13.7%) were short sleepers, 131 (8.2%; 95%CI: 6.9–9.6%) were long sleepers, and 312 (19.5%; 95%CI: 17.5–21.5%) had poor sleep quality. In the multivariate model, multimorbidity was associated with prolonged sleep duration (PR = 1.45; 95%CI: 1.03–2.04) and poor sleep quality (PR = 2.04; 95%CI: 1.65–2.52).

Conclusions Multimorbidity was associated with prolonged, but not short, sleep duration, as well as with poor sleep quality. Our results suggest the need of assessing sleep patterns among adults with multimorbidity.

Keywords
- sleep
- sleep hygiene
- chronic disease
- multiple chronic conditions

Introduction

Lifestyle changes in modern society are affecting the duration and quality of sleep of the population.[1,2] For this reason, several international institutions, including the National Sleep Foundation (NSF), the American Academy of Sleep Medicine (AASM), and the Sleep Research Society (SRS) recommend that adults should sleep 7 to 9 hours per night to reduce the risk of developing non-communicable diseases (NCDs).[3–5] There is more evidence for the adverse health effects of short sleep than long sleep, although it is not yet clear whether long sleep is associated with such effects.[6,7] In addition, these same institutions state that an adequate sleep duration is not enough to have a healthy sleep, and sleep quality is also relevant.[3]

While the association between sleep and existing chronic conditions is bidirectional,[8,9] several studies show the effect of different chronic conditions, such as type-2 diabetes, hypertension, cardiovascular diseases,[10] periodontitis,[11] and cognitive impairment,[12] on the duration and quality of sleep. However, there are few studies on the association of

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multimorbidity and sleep,[13] and they are less common in low- and middle-income countries. As a result, it can be hypothesized that more chronic conditions can have a multiplicative effect on sleep duration and quality. According to the World Health Organization (WHO),[14] the presence of two or more chronic diseases in the same person is known as multimorbidity, which tends to become more common as the population ages due to their increased risk of suffering from more than one NCD.[15]

Most studies on the prevalence of multimorbidity are self-reported and focus on older adults[16] or use hospital clinical records.[17] The prevalence of multimorbidity in Latin America ranges from 12.4% to 25.1%.[16] A study conducted in Peru, specifically in Tumbes, Lima, and Puno, reported a prevalence of multimorbidity of 19%, which was higher in urban than in rural areas, with rates of 22.8% in Lima and of 14.7% in semi-urban areas of Tumbes.[18] In resource-constrained settings, the health issues associated with multimorbidity are of relevance, as the rise in cases of individuals with multiple chronic conditions may lead to an increase in healthcare costs and use, as well as reduced work productivity and working performance, and increased mortality.[19,20]

While it is almost clear that there is an association between certain chronic conditions and some sleep patterns, whether the prevalence of sleep patterns varies due to the presence of multimorbidity has not yet been fully studied. Therefore, the present study aimed to evaluate whether sleep duration and quality vary due to the presence of multimorbidity among adults aged between 30 and 69 years in a Peruvian semi-urban area.

Material and Methods

Study Design

We performed a secondary analysis of data from a cross-sectional, population-based study conducted in 2017 in a semi-urban area of Tumbes, Northern Peru, close to the border with Ecuador. We have used the term *semi-urban* because the area is undergoing a transition due to an ongoing urbanization process (which results in rural areas intermixed with rapidly-growing urban sections), which predisposes the population to a higher risk of presenting NCDs.[21]

Participants

The original study was based on sex-stratified random sampling using the most current census of the area, conducted in 2014. Only one participant per household was selected to avoid clustering of risk factors. The selected population comprised individuals aged 30 to 69 years, who had been residing for at least six months in the study area, who understood the study procedures, and consented to participate. Bedridden individuals and those with physical disability, as well as pregnant women, were excluded from the study.

For the present analysis, we included people from whom we could obtain complete data regarding our variables of interest: sleep quality and duration, as well as the twelve conditions used to define multimorbidity.

With 1,607 participants with complete data, we have a power of 85% to detect a difference of 7% in any sleep pattern between those with and without multimorbidity (that is, 30% versus 23%, for example) at a significance level of 5%.

Variables of Interest

The outcomes of interest were the duration and quality of sleep. Sleep duration was evaluated through the question: "On average, in the last year, how many hours a day did you sleep (including naps)?". The number of hours reported was further categorized based on the guidelines of the US National Sleep Foundation;[3] thus, in adults (aged < 65 years), the duration was deemed normal when the participants reported sleeping between 7 and 9 hours; it was considered short when < 7 hours; and prolonged was defined as > 9 hours. In older adults (aged $\geq$ 65 years) the normal sleep duration was between 7 and 8 hours, the short duration was of < 7 hours, and the prolonged duration was of > 8 hours.

On the other hand, sleep quality was defined using the Pittsburgh Sleep Quality Index (PSQI), a questionnaire consisting of 19 personal questions grouped into the following components: subjective sleep quality; sleep latency; sleep duration; habitual sleep efficiency; sleep disturbance; use of hypnotic medications; and daytime dysfunction. Each of these components is assessed with answers with scores between 0 and 3 points, which must be added to obtain a final score that can vary between 0 and 21 points, with scores greater than 5 points indicating poor sleep quality.[22] Additionally, this scale contains 5 items for the companion or partner, but these do not interfere with the final score. The acceptance and validation of this instrument in Peru were achieved through a cross-sectional descriptive study[23] in a random sample of 4,445 adult residents of the provinces of Lima and Callao in 2015.

The exposure variable of interest was multimorbidity, which comprised the presence of at least two of the following conditions: depression, assessed through the Patient Health Questionnaire-9 (PHQ-9); anxiety, defined using the Goldberg Anxiety Scale; cognitive impairment, assessed using the Leganes Scale; and gingival disease, assessed using the Periodontitis Self-Report Scale.[24] Hypertension and type-2 diabetes were other conditions measured objectively and self-reported. Hypertension was defined as systolic blood pressure $\geq$ 140 mmHg or diastolic blood pressure $\geq$ 90 mmHg, or if the participant reported having a medical diagnosis of hypertension or receiving antihypertensive treatment.[25] For this, the last two out of three blood pressure measurements, taken at least two minutes apart and after 5 minutes of resting, were considered. Blood pressure was measured using an automatic monitor (M7, model HEM-780, OMRON Corporation, Kyoto, Japan). Type-2 diabetes mellitus was defined based on the oral glucose tolerance test, with fasting glucose $\geq$ 126 mg/dL, or postprandial glucose $\geq$ 200 mg/dL, or previous diagnosis of type-2 diabetes mellitus, or if the subject was receiving antidiabetic treatment.[26] Finally, other self-reported conditions were added, such as hypercholesterolemia, cardiac arrhythmias, myocardial infarction, heart failure, stroke, and cancer.

Other variables considered as potential confounders were: sex (male versus female); age (< 50 versus ≥ 50 years); level of schooling (primary, secondary or higher education); and socioeconomic status, based on a well-being index developed using household assets and possessions, and then divided into tertiles (low, medium and high). Other variables included were: physical activity, assessed using the International Physical Activity Questionnaire (IPAQ) and categorized into low versus moderate/high; alcohol consumption, assessed according to the Alcohol Use Disorders Identification Test (AUDIT); and smoking, defined as the self-reported consumption of at least one cigarette per day. Finally, the Body Mass Index (BMI, in Kg/m^2), classified as normal, overweight, and obese according to WHO cut-off points.[27]

Procedures

Each potential participant was visited in their respective household and checked to ensure that they were the selected person and that they met the selection criteria. Then, they were invited to participate in the study using the informed consent form. After this initial visit, an appointment was scheduled to guarantee an appropriate fasting period (between 8 and 12 hours) to obtain the blood samples for the study.

The sample was obtained by trained personnel, and the fasting time was confirmed before the oral glucose tolerance test. A 7.5-mL blood sample was obtained at the time of the first evaluation; then, 75 g of anhydrous glucose in 300 mL of water was administered orally and, after two hours, the second blood sample was taken. These samples were analyzed in a certified private laboratory in Lima. For the glucose measurement, a Cobas Modular Platform (Roche Diagnostics, Basel, Switzerland) automatic analyzer was used with reagents provided by Roche Diagnostics. During the two-hour waiting period, the participant answered the questionnaire, and blood pressure and anthropometric measurements (weight and height) were taken.

Statistical Analysis

The Stata software, version16 for Windows (StataCorp, College Station, TX, US), was used for data analysis. First, summary measures such as mean and standard deviation (SD) values for the numerical variables, and frequencies and percentages for the categorical variables, were used to describe the study population. In addition, the prevalence and 95% confidence intervals (95%CIs) of the variables of interest were also estimated.

To assess the association regarding our variables of interest (multimorbidity, sleep duration, and sleep quality), generalized linear models were developed, both crude and adjusted, with Poisson distribution and robust variance. Multivariable models were adjusted for sex, age, level of schooling, socioeconomic status, smoking, alcohol consumption, and physical activity. In addition, sex was evaluated as potential effect modifier of the associations of interest using the likelihood ratio test. Prevalence ratios (PRs) and 95%CIs were reported. Values of $p < 0.05$ were considered statistically significant.

Ethics

The original project protocol and consents were approved by the Ethics Committee of Universidad Peruana Cayetano Heredia, Lima, Peru, and the London School of Hygiene and Tropical Medicine, London, UK. The present protocol was reviewed and approved by the Research Ethics Committee of Universidad Científica del Sur (approval code: 795–2020-PRE 15).

Results

In the original study, 2,114 individuals were contacted, 486 of whom refused to participate; moreover, 16 were excluded, 3 did not complete the corresponding blood tests, and 2 had no information on sleep. Therefore, a total of 1,607 participants were analyzed; they had a mean age of 48.2 (SD: $\pm$ 10.6) years, 809 (50.3%) of them were female, only 341 (21.2%) had higher education, and 1,090 (67.8%) reported they were employed at the time of the study.

In the present study, 634 (39.5%; 95%CI: 37.1%–41.9%) subjects met our multimorbidity criteria. The variables associated with multimorbidity in the bivariable analysis were (►**Table 1**): sex ($p < 0.001$), age ($p < 0.001$), level of schooling ($p < 0.001$), employment status ($p < 0.001$), alcohol consumption ($p < 0.001$), physical activity ($p < 0.001$), and BMI ($p < 0.001$).

The mean sleep duration was of 7.8 (SD: $\pm$ 1.2) hours. We found that 193 (12.1%; 95%CI: 10.5%–13.7%) subjects were short sleepers, and 131 (8.2%; 95%CI: 6.9%–9.6%) were long sleepers. Sex ($p < 0.001$), age ($p = 0.01$), level of schooling ($p = 0.03$), socioeconomic status ($p = 0.007$), employment status ($p < 0.001$), smoking ($p = 0.001$), and physical activity ($p = 0.003$) were associated with sleep duration (►**Table 2**).

On the other hand, a total of 312 (19.5%; 95%CI: 17.5%–-21.5%) participants had poor sleep quality. Gender ($p < 0.001$), age ($p < 0.001$), level of schooling ($p = 0.001$), and employment status ($p < 0.001$) were associated with sleep quality (►**Table 3**).

Although the probability of presenting short or prolonged sleep duration among people with multimorbidity was high, in the multivariable models (►**Table 4**), the presence of multimorbidity was only associated with prolonged sleep (adjusted PR = 1.45; 95%CI: 1.03–2.04). The association between multimorbidity and poor sleep quality was significant (adjusted PR = 2.04; 95%CI: 1.65–2.52).

Finally, sex was not an effect modifier of the associations between multimorbidity and short sleep duration ($p = 0.96$), multimorbidity and prolonged sleep duration ($p = 0.26$), or between multimorbidity and sleep quality ($p = 0.54$).

Discussion

The present study showed that subjects with multimorbidity were more likely to have prolonged sleep and poor sleep

Table 1 Characteristics of the study population according to the presence of multimorbidity.

	Multimorbidity		
	No	Yes	*p*-value
	N = 973	N = 634	
Sex: N (%)			
Female	416 (42.8%)	393 (62.0%)	< 0.001
Male	557 (57.2%)	241 (38.0%)	
Age: N (%)			
< 50 years	636 (65.4%)	284 (44.8%)	< 0.001
≥ 50 years	337 (34.6%)	350 (55.2%)	
Level of schooling: N (%)			
Primary education	267 (27.4%)	251 (39.6%)	< 0.001
Secondary education	470 (48.3%)	278 (43.9%)	
Higher education	236 (24.3%)	105 (16.5%)	
Socioeconomic level: N (%)			
Low	314 (32.3%)	224 (35.3%)	0.42
Medium	342 (35.2%)	208 (32.8%)	
High	317 (32.5%)	202 (31.9%)	
Employment status: N (%)			
Not employed	275 (28.3%)	242 (38.2%)	< 0.001
Employed	698 (71.7%)	392 (62.8%)	
Health insurance: N (%)			
No	88 (9.0%)	52 (8.2%)	0.56
Yes	885 (91.0%)	582 (91.8)	
Daily smoker: N (%)			
No	909 (93.4%)	606 (95.6%)	0.07
Yes	64 (6.6%)	28 (4.4%)	
Alcohol consumption: N (%)			
No	878 (90.2%)	608 (95.9%)	< 0.001
Yes	95 (9.8%)	26 (4.1%)	
Practice of physical activity: N (%)			
Moderate/high	645 (66.3%)	358 (56.5%)	< 0.001
Low	328 (33.7%)	276 (43.5%)	
Body Mass Index: N (%)			
Normal	293 (30.1%)	132 (20.8%)	< 0.001
Overweight	413 (42.5%)	293 (46.2%)	
Obese	267 (27.4%)	209 (33.0%)	

quality. However, multimorbidity was not associated with short sleep duration. In addition, 4 out of 10 people were found to have multimorbidity, and ~ 1 in 8 individuals had poor sleep quality.

Studies have tried to determine the association between multimorbidity and certain sleep patterns, and two different European studies showed such association: the first one,[7] conducted in Portugal, used a definition of multimorbidity based on 12 chronic conditions, and the other one, conducted in Luxembourg,[4] defined multimorbidity based on 17 conditions. Both studies reported an association between multimorbidity and short sleep duration. However, regarding the results, the studies used different cut-off points to define short and prolonged sleep duration, with normal sleep considered to be between 6 and 9 hours. Another factor that made their results different from those of the present study may be the inclusion of self-reported conditions when defining multimorbidity.[4,7] Another study, conducted in Canada, reported a significant association between multimorbidity and short and

Table 2 Characteristics of the study population according to sleep duration.

	Sleep Duration			
	Short	Normal	Prolonged	*p*-value
	N = 193	N = 1283	N = 131	
Sex: N (%)				
Female	73 (37.8%)	655 (51.1%)	81 (61.8%)	< 0.001
Male	120 (62.2%)	628 (48.9%)	50 (38.3%)	
Age: N (%)				
< 50 years	95 (49.2%)	758 (59.1%)	67 (51.2%)	0.01
≥ 50 years	98 (50.8%)	525 (40.9%)	64 (48.8%)	
Level of schooling: N (%)				
Primary education	68 (35.2%)	400 (31.2%)	50 (38.2%)	0.03
Secondary education	76 (39.4%)	608 (47.4%)	64 (48.8%)	
Higher education	49 (25.4%)	275 (21.4%)	17 (13.0%)	
Socioeconomic level: N (%)				
Low	50 (25.9%)	432 (33.7%)	56 (42.8%)	0.007
Medium	66 (34.2%)	451 (35.1%)	33 (25.2%)	
High	77 (39.9%)	400 (31.2%)	42 (32.0%)	
Employment status: N (%)				
Not employed	42 (21.8%)	411 (32.0%)	64 (48.9%)	< 0.001
Employed	151 (78.2%)	872 (68.0%)	67 (51.1%)	
Health insurance: N (%)				
No	18 (9.3%)	114 (8.9%)	8 (6.1%)	0.53
Yes	175 (90.7%)	1169 (91.1%)	124 (93.9%)	
Daily smoker: N (%)				
No	171 (88.6%)	1,218 (94.9%)	126 (96.2%)	0.001
Yes	22 (11.4%)	65 (5.1%)	5 (3.8%)	
Alcohol consumption: N (%)				
No	179 (92.8%)	1,185 (92.4%)	122 (93.1%)	0.94
Yes	14 (7.2%)	98 (7.6%)	9 (6.9%)	
Practice of physical activity: N (%)				
Moderate/high	133 (68.9%)	804 (62.7%)	66 (50.4%)	0.003
Low	60 (31.1%)	479 (37.3%)	65 (49.6%)	
Body Mass Index: N (%)				
Normal	42 (21.8%)	347 (27.1%)	36 (27.5%)	0.05
Overweight	87 (45.1%)	574 (44.7%)	45 (34.3%)	
Obese	64 (33.2%)	362 (28.2%)	50 (38.2%)	

prolonged sleep duration in adults aged ≥ 45 years, with the association being stronger in younger adults.[28] On the other hand, a Chinese study which assessed 14 conditions for multimorbidity found an association of multimorbidity and poor sleep, defined by merging subjects with short and prolonged sleep duration into a single category,[29] in contrast to our study, in which these patterns were separated. Furthermore, the latter study did not consider depression within the conditions assessed for multimorbidity.

With regard to sleep quality, two studies[28,30] agree with our findings. The first, a Canadian study, found a significant association regarding multimorbidity and dissatisfaction with sleep quality.[28] Unlike the present study, in this report,[28] sleep quality was not assessed using a validated scale such as the Pittsburgh Index, but by means of a multiple-choice question. The second study,[30] conducted in China, investigated multimorbidity in older adults living in rural and urban areas, and the authors found a significant association between the presence of multiple conditions and poor

Table 3 Characteristics of the study population according to sleep quality.

	Sleep Quality		
	Good	Poor	*p*-value
	N = 1292	N = 312	
Sex: N (%)			
Female	609 (47.1%)	198 (63.5%)	< 0.001
Male	683 (52.9%)	114 (36.5%)	
Age: N (%)			
< 50 years	768 (59.4%)	150 (48.1%)	< 0.001
≥ 50 years	524 (40.6%)	162 (51.9%)	
Level of schooling: N (%)			
Primary education	387 (30.0%)	130 (41.7%)	< 0.001
Secondary education	622 (48.1%)	124 (39.7%)	
Higher education	283 (21.9%)	58 (18.6%)	
Socioeconomic level: N (%)			
Low	425 (32.9%)	111 (35.6%)	0.67
Medium	446 (34.5%)	103 (33.0%)	
High	421 (32.6%)	98 (31.4%)	
Employment status: N (%)			
Not employed	391 (30.2%)	126 (40.4%)	< 0.001
Employed	901 (69.7%)	186 (59.6%)	
Health insurance: N (%)			
No	114 (8.8%)	26 (8.3%)	0.78
Yes	1,178 (91.3%)	286 (91.7%)	
Daily smoker: N (%)			
No	1,221 (94.5%)	291 (93.3%)	0.40
Yes	71 (5.5%)	21 (6.7%)	
Alcohol consumption: N (%)			
No	1,189 (92.0%)	294 (94.2%)	0.19
Yes	103 (8.0%)	18 (5.8%)	
Practice of physical activity, N (%)			
Moderate/high	804 (62.2%)	198 (63.5%)	0.69
Low	488 (37.8%)	114 (36.5%)	
Body Mass Index: N (%)			
Normal	358 (27.7%)	67 (21.5%)	0.08
Overweight	561 (43.4%)	144 (46.2%)	
Obese	373 (28.9%)	101 (32.4%)	

sleep quality, but only in those living in the rural area. However, this study,[30] like the previous one,[28] did not assess sleep quality using a validated scale.

While the issue of multimorbidity may be relatively new, several chronic conditions and their relationship with sleep patterns have been evaluated on an individual basis. Regarding sleep duration, for example, metabolic syndrome, which is the presence of high blood pressure, central obesity, dyslipidemia and hyperglycemia, has been associated with short sleep duration.[30] As for sleep quality, hypertension,[31] diabetes mellitus,[32] chronic kidney disease,[33] and breast cancer[34] have all been associated with poor sleep quality. Similarly, higher levels of anxiety and depression, which can occur in the aforementioned pathologies, may contribute to such an effect on sleep, either because of the disease itself or because of the medication used.[31,32,34]

The prevalence of multimorbidity found in the present study was of 40%, and it was higher in women, which is double the figure reported in a previous Peruvian study.[18] These results are consistent with those found in a systematic

Table 4 Association between multimorbidity and sleep characteristics: crude and adjusted models.

	Sleep Duration				Sleep Quality	
	Short (versus normal)		Prolonged (versus normal)		Poor (versus good)	
	Crude	Adjusted*	Crude	Adjusted*	Crude	Adjusted*
	PR (95%CI)	PR (95%CI)	PR (95%CI)	PR (95%CI)	PR (95%CI)	PR (95%CI)
Multimorbidity						
Yes (versus no)	1.21 (0.93–1.58)	1.29 (0.98–1.69)	1.69 (1.22–2.34)	1.45 (1.03–2.04)	2.29 (1.87–2.81)	2.04 (1.65–2.52)

Abbreviations: 95%CI, 95% confidence interval; PR, prevalence ratio.
Note: *Adjusted for sex, age, level of schooling, socioeconomic level, daily smoker, alcohol consumption, and practice of physical activity.

review[35] of multimorbidity estimates in Latin America and the Caribbean, which found a prevalence similar to that of the present study (43%), which was higher in women than in men. This predominance in terms of sex could be due to the fact that certain pathologies such as mental health problems are more related to the female sex.

In relation to sleep characteristics, it has been found that the female sex has a higher prevalence of prolonged sleep and poor sleep quality; in contrast, the male sex has a higher prevalence of short sleep. Some studies[36,37] suggest that the possible factors associated with poor sleep quality in women are due to: physiological sexual differences; a higher prevalence of psychological disorders, including anxiety, depression, stress, among others; and specific aspects such as motherhood, family burden, economic contribution, and social role.

It is known that multimorbidity, and the increasing number of multiple morbidities, is more evident in older adults; but the present study included mostly young adults; nevertheless, it reports a high prevalence of multimorbidity. This result sets a challenge for our health care system, as it could imply an increase in the costs and use of services.[38] Thus, the time spent in consultations for each patient with these morbidities must be considered, which would require prior coordination with health managers for a comprehensive and appropriate evaluation of patients. In addition, the use of resources and the lack of them at the primary health care level should be taken into account.[14]

Sleep is currently considered an important health problem, especially because of its relationship with various pathologies. Thus, the results of the present study highlight the need to assess and monitor sleep patterns in people with chronic diseases and to devise multidisciplinary strategies for their appropriate management.[29] Finally, the presence of multimorbidity in young adults should be further investigated, and sleep and its disturbances should be considered an important issue in this age group.

The present study was based on a representative sample from a region in northern Peru, in a semi-urban area in Tumbes. Standard definitions were used for certain chronic conditions, as well as standardized questionnaires to assess sleep duration and quality; in addition, it is one of the few studies to report multimorbidity values.[35] There are also some limitations that should be highlighted. First, some of the twelve diseases used to define multimorbidity were only self-reported and not objectively measured; moreover, we were unable to determine the individual effect on sleep of each of the chronic conditions considered. Additionally, other conditions were not included in the definition of multimorbidity because these data were not collected. Secondly, the present study, being cross-sectional in nature, did not enable us to establish a causal relationship regarding the variables of interest, and only enabled us to determine their association. Therefore, reverse causality may exist,[39] meaning that having disturbed sleep may lead to an increased risk of developing multiple diseases. Thirdly, the cutoffs used to define short and prolonged sleep were based on international standards established in high-income countries. As a result, biases may have been introduced. Fourthly, our exclusion criteria may limit the generalization of our findings; nevertheless, the impact of that may be negligible. Finally, there is the possibility of selection bias, as 22.9% of the patients refused to participate, as well as recall bias, and being a secondary-based study, some data may have been subjected to recording errors.

In conclusion, multimorbidity was associated with prolonged sleep duration, but not with short sleep duration. In addition, multiple conditions were also associated with poor sleep quality. The results of the present study suggest the need to assess sleep patterns in people with two or more chronic conditions.

Conflict of Interests

The authors have no conflict of interests to declare.

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