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Evaluation of the Association between Medication Use and Sleep Quality among Shift Workers versus Day Workers

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Abstract

Objective Different factors, such as medication use and shift work, can influence sleep quality. We aimed to determine the association between medication use and sleep quality in shift workers versus daytime workers.

Materials and Methods We conducted a quantitative cross-sectional study with a convenience sample of active workers. Online questionnaires were applied to assess sleep quality, sleepiness, medication use, and sociodemographic characteristics.

Results A total of 296 participants were included: 124 (41.89%) daytime workers and 172 (58.11%) shift workers. In total, 130 (43.92%) participants worked in the healthcare sector, 116 (39.19%), in industry, and 50 (16.89%), in other sectors. After a bivariate analysis, poor sleep quality was associated with the presence of sleep disorders ($p < 0.001$), type of work (shift or day work) ($p < 0.001$), and the use of sleeping medication ($p < 0.001$). Although shift workers had worse sleep quality, no differences were found regarding the use of medications that act directly on the central nervous system or with proven effects on sleep. No association was found between medication use and sleep quality. When adjusted for the different variables that were individually associated with poor sleep quality, through a logistic regression model, none showed an increased risk of poor sleep quality.

Discussion In spite of the need for further research, our results have shown that sleep quality is influenced by many different factors whose impact must be evaluated in combination, and not just in a bivariate manner. There are many factors individually associated with poor sleep quality, but when adjusted to each other, they have shown no increased risk of having poor sleep quality.

Keywords
- sleep quality
- sleep disorders
- shift work
- medication use

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Introduction

Sleep is a physiological and biological process which is fundamental for human survival.[1] It performs a multiplicity of vital functions, such as the conservation and restoration of energy, the regulation of metabolic processes, among others.[2–4] Disturbances in sleep quality can trigger significant changes in the individual's physical, occupational, cognitive and social functioning, substantially compromising quality of life.[2] Low quality and/or quantity of sleep is considered a public health problem.[5] Sleep disorders are associated, among other pathologies, with an increased risk of acute myocardial infarction, stroke, and depression.[5]

Sleep quality can be influenced by different factors, such as previous medical conditions, use of medications and/or stimulant substances, working schedules, among others.[3]

In the labor context, there is an increasing number of workers performing their tasks in shifts in several activity sectors, as a consequence of technological changes and economic globalization, which require the availability of goods and services 24/7.[6,7] Those work conditions may enhance changes in the individual's endogenous biological rhythm, resulting in a temporal conflict between the biological clock and the externally-imposed social scheme.[8] The use of medication to relieve sleep disorders caused by working hours, such as insomnia, is common; however, if abused, without supervision and monitoring, it can trigger new pathological conditions.[9,10] On the other hand, the prescription of different medications for the treatment of several clinical conditions can have adverse effects in sleep.[10]

Therefore, it is of paramount importance to evaluate medication use in shift workers compared to daytime workers and its consequences on sleep quality, to promote the rational and safe use of medications.

The present work aims to determine the association between medication use and sleep quality in shift workers versus daytime workers.

Materials and Methods

Study Design and Study Population

We conducted a quantitative cross-sectional study using a convenience sample of active workers, regardless of the activity sector. The participants were divided in two groups: shift and daytime schedule workers. Individuals aged $\geq$ 18 years who had been holding a job for at least six months were included.

Data Collection

Data was collected using a combination of three questionnaires: the first one, which was developed for the present study to collect sociodemographic characteristics, associated comorbidities and medication use; the Epworth Sleepiness Scale (ESS) was used to assess the level of sleepiness; and the Pittsburgh Sleep Quality Index (PSQI), to assess the sleep quality. The questionnaires were available online between October and December 2021, and the link to access them was sent through e-mail and social media using the "snowball" method. Access to the questionnaires was only granted after agreement with a participant information document, which contained all the necessary information for participation in the study.

Data Analyses

The IBM SPSS Statistics for Windows (IBM Corp., Armonk, NY, United States) software, version 26.0, and the Microsoft Excel software (Microsoft Corp., Redmond, WA, United States) were used for the statistical analysis. Simple descriptive analysis (absolute and relative frequencies) was performed for the nominal and ordinal variables, as well as central tendency and dispersion measures for the quantitative variables. Bivariate associations between variables were determined using the Chi-squared statistical test, with a significance level of 5%. A logistic regression model was developed, in which all variables that showed an association with sleep quality were included, also adopting a significance level of 5%.

Ethical Considerations

The present study was approved by the Ethics Committee of Escola Superior de Tecnologia da Saúde de Lisboa under process number 41-2021. Anonymity and confidentiality of the data obtained were guaranteed. All participants could withdraw from the study, hide any information, or refuse to answer any question.

Results

Characterization of Study Participants

Of the 296 study participants, 109 individuals (36.82%) were male and 187 (63.18%), female, with a mean age of 36.03 ± 8.93 years, and 130 (43.92%) subjects worked in the health sector. The mean time of professional activity was of 11 ± 8.69 years. Most (58.11%) of the participants worked in shifts, and 51.7% had been working in their current shifts for five or more years.

No cardiovascular (CV) risk factors were reported by 182 (61.49%) participants; among those who did report risk factors, smoking had the highest prevalence. In total, 87 (29.39%) participants, mainly women, reported having some prediagnosed pathology, specially psychological ones.

In terms of sleep disorders, most participants (91.89%) reported having none. Of the 24 participants who reported having a sleep disorder, insomnia was the most mentioned. All data are shown in ►**Table 1**.

Medication Use

Daily use of medications was reported by 87 (29.39%) subjects and it was slightly higher among female participants (32.09%). Concerning the person who recommended the use of the last medication, there was an expressive value referring to self-initiative (41.22%), even though physician's recommendation had the higher frequency (50.34%). Regarding the last drug used, there were no considerable differences in terms of the frequencies of drugs acting or not in the central nervous system (CNS). Most drugs used had no proven effects

Table 1 Characteristics of the study participants.

	Male	Female	Total
Study participants	109 (36.82%)	187 (63.18%)	296 (100.00%)
Age (in years): mean ± standard deviation	38.50 ± 9.69	34.59 ± 8.12	36.03 ± 8.93
Professional sector: n (%)			
Health	27 (24.77%)	103 (55.08%)	130 (43.92%)
Industry	66 (60.55%)	50 (26.74%)	116 (39.19%)
Other	16 (14.68%)	34 (18.18%)	50 (16.89%)
Time of professional activity (in years): mean ± standard deviation	12 ± 9.96	10 ± 7.72	11 ± 8.69
Type of work: n (%)			
Day work	23 (21.10%)	101 (54.01%)	124 (41.89%)
Shift work	86 (78.90%)	86 (45.99%)	172 (58.11%)
Current shift time (in years): n (%)			
< 5	52 (47.7%)	91 (48.7%)	143 (48.3%)
≥ 5	57 (52.3%)	96 (51.3%)	153 (51.7%)
Known cardiovascular risk factor: n (%)			
Yes	51 (46.79%)	63 (33.69%)	114 (38.51%)
No	58 (53.21%)	124 (66.31%)	182 (61.49%)
Type of cardiovascular risk factor (n = 114): n (%)			
Diabetes	4 (7.84%)	2 (3.17%)	6 (5.26%)
Smoking	29 (56.86%)	36 (57.14%)	65 (57.02%)
Hypertension	16 (31.37%)	11 (17.46%)	27 (23.68%)
Dyslipidemia	2 (3.92%)	4 (6.35%)	6 (5.26%)
Obesity	13 (25.49%)	18 (28.57%)	31 (27.19%)
Other	22 (43,14%)	30 (47.62%)	52 (45.61%)
Diagnosed pathology (n = 87): n (%)			
Cardiovascular	4 (4.60%)	4 (4.60%)	8 (9.20%)
Psychological	24 (27.60%)	43 (49.43%)	67 (77.01%)
Other	2 (2.30%)	10 (11.49%)	12 (13.79%)
Sleep disorder: n (%)			
Yes	11 (10.09%)	13 (6.95%)	24 (8.11%)
No	98 (89.91%)	10 (76.92%)	272 (91.89%)
Type of sleep disorder (n = 24): n (%)			
Insomnia	7 (63.64%)	10 (76.92%)	17 (70.83%)
Restless legs syndrome	2 (18.18%)	2 (15.38%)	4 (16.67%)
Excessive sleepiness	5 (45.45%)	6 (46.15%)	4 (16.67%)
Obstructive sleep apnea syndrome	4 (36.36%)	2 (15.38%)	11 (45.83%)
Parasomnias	1 (9.09%)	1 (7.69%)	2 (8.33%)

on sleep (72.30%), and 66.22% of the study participants stated that they did not take sleep medications (►**Table 2**).

A higher use of CNS-acting drugs was found among respondents with sleep disorders, but it was not statistically significant ($p = 0.063$). Regarding drugs with proven effects on sleep, there was an association between their use and the presence of sleep disorders ($p < 0.001$) (►**Tables 3A** and **3B**).

Sleep Quality Assessment

Male participants reported worse sleep quality ($p = 0.005$), such as shift workers ($p < 0.001$), and those who had been on the current shift for less than 5 years ($p = 0.023$).

The presence of CV risk factors was also associated with poor sleep quality ($p < 0.001$). Participants with a previously-diagnosed phycological pathology reported worse sleep

Table 2 Characterization of medication use.

	Male: n (%)	Female n: (%)	Total: n (%)
Medication use			
Daily	27 (24.77%)	60 (32.09%)	87 (29.39%)
Daily (contraceptive)	0 (0.00%)	6 (3.21%)	6 (2.03%)
Sporadic	82 (75.23%)	121 (64.71%)	203 (68.58%)
Referring agent			
Family member	2 (1.83%)	0 (0.00%)	2 (0.68%)
Pharmacy professional	8 (7.34%)	11 (5.88%)	19 (6.42%)
Self-initiative	41 (37.61%)	81 (43.32%)	122 (41.22%)
Physician	55 (50.46%)	94 (50.27%)	149 (50.34%)
Friend	2 (1.83%)	0 (0.00%)	2 (0.68%)
Other	1 (0.92%)	1 (0.53%)	2 (0.68%)
Direct action in the central nervous system			
Yes	41 (37.62%)	77 (41.18%)	118 (39.87%)
No	49 (44.95%)	93 (49.73%)	142 (47.97%)
Not applicable	19 (17.43%)	17 (9.09%)	36 (12.16%)
Proven effects on sleep			
Yes	16 (14.68%)	30 (16.04%)	46 (15.54%)
No	74 (67.89%)	140 (74.87%)	214 (72.30%)
Not applicable	19 (17.43%)	17 (9.09%)	36 (12.16%)
Sleep medication			
Yes	41 (37.61%)	59 (31.55%)	100 (33.78%)
No	68 (62.39%)	128 (68.45%)	196 (66.22%)

Table 3A Use of drugs acting in the central nervous system.

	Direct action in the central nervous system			
	Yes: n (%)	No: n (%)	Not applicable: n (%)	*p*-value
Gender				
Male	41 (37.6%)	49 (45.0%)	19 (17.4%)	0.106
Female	77 (41.2%)	93 (49.7%)	17 (9.1%)	
Variables related to professional activity				
Sector of activity				
Health	53 (40.8%)	67 (51.5%)	10 (7.7%)	
Industry	41 (35.3%)	57 (49.1%)	18 (15.5%)	0.129
Other	24 (48.0%)	18 (36.0%)	8 (16.0%)	
Time of professional activity (in years)				
< 5	48 (43.6%)	46 (41.8%)	16 (14.5%)	0.244
≥ 5	70 (37.6%)	96 (51.6%)	20 (10.8%)	
Current type of work				
Day work	53 (42.7%)	61 (49.2%)	10 (8.1%)	0.178
Shift work	65 (37.8%)	81 (47.1%)	26 (15.1%)	
Time in the current work				
≤ 5 years	61 (42.7%)	67 (46.9%)	15 (10.5%)	0.535
> 5 years	57 (37.3%)	75 (49.0%)	21 (13.7%)	

(*Continued*)

Table 3A (*Continued*)

	Direct action in the central nervous system			
	Yes: n (%)	No: n (%)	Not applicable: n (%)	*p*-value
Variables related to comorbidities				
Cardiovascular risk factor				
Yes	38 (33.3%)	59 (51.8%)	17 (14.9%)	0.158
No	80 (44.0%)	83 (45.6%)	19 (10.4%)	
Sleep disorders				
Yes	14 (58.3%)	6 (25.0%)	4 (16.7%)	0.063
No	104 (38.2%)	136 (50.0%)	32 (11.8%)	
Epworth Sleepiness Scale				
Normal	53 (41.7%)	56 (44.1%)	18 (14.2%)	
Moderate sleepiness	18 (39.1%)	24 (52.2%)	4 (8.7%)	0.762
Abnormal sleepiness	47 (38.2%)	62 (50.4%)	14 (11.4%)	

Table 3B Use of drugs with proven effects on sleep.

	Drugs with proven effects on sleep			
	Yes: n (%)	No: n (%)	Not available: n (%)*	*p*-value
Gender				
Male	16 (14.7%)	74 (67.9%)	19 (17.4%)	0.106
Female	30 (16.0%)	140 (74.9%)	17 (9.1%)	
Variables related to professional activity				
Activity sector				
Health	23 (17.7%)	97 (74.6%)	10 (7.7%)	0.292
Industry	15 (12.9%)	83 (71.6%)	18 (15.5%)	
Other	8 (16.0%)	34 (68.0%)	8 (16.0%)	
Time of professional activity				
$<$ 5 years	13 (11.8%)	81 (73.6%)	16 (14.5%)	0.298
$\geq$ 5 years	33 (17.7%)	133 (71.5%)	20 (10.8%)	
Current work				
Day wok	20 (16.1%)	94 (75.8%)	10 (8.1%)	0.187
Shift work	26 (15.1%)	120 (69.8%)	26 (15.1%)	
Time in the current work				
$<$ 5 years	21 (14.7%)	107 (74.8%)	15 (10.5%)	0.603
$\geq$ 5 years	25 (16.3%)	107 (69.9%)	21 (13.7%)	
Variables related to comorbidities				
Cardiovascular risk factor				
Yes	18 (15.8%)	79 (69.3%)	17 (14.9%)	
No	28 (15.4%)	135 (74.2%)	19 (10.4%)	0.499
Sleep disorders				
Yes	14 (58.3%)	6 (25.0%)	4 (16.7%)	$<$ 0.001
No	32 (11.8%)	208 (76.5%)	32 (11.8%)	

Table 3B (*Continued*)

	Drugs with proven effects on sleep			
	Yes: n (%)	No: n (%)	Not available: n (%)*	*p*-value
Epworth Sleepiness Scale				
Normal	22 (17.3%)	87 (68.5%)	18 (14.2%)	
Moderate sleepiness	3 (6.5%)	39 (84.8%)	4 (8.7%)	0.283
Excessive sleepiness	21 (17.1%)	88 (71.5%)	14 (11.4%)	

Note: *Refers to named substances that are not actually considered medicines, such as multivitamins, for example.

Table 4 Sleep quality according to the Pittsburgh Sleep Quality Index.

	Sleep Quality		
	Good: n (%)	Poor: n (%)	*p*-value
Gender			
Male	31 (28.4%)	78 (71.6%)	0.005
Female	84 (44.9%)	103 (55.1%)	
Variables related to professional activity			
Activity sector			
Health	70 (53.8%)	60 (46.2%)	< 0.001
Industry	25 (21.6%)	91 (78.4%)	
Other	20 (40.0%)	30 (60.0%)	
Time of professional activity			
$<$ 5 years	36 (32.7%)	74 (67.3%)	0.096
$\geq$ 5 years	79 (42.5%)	107 (57.5%)	
Current work			
Day work	70 (56.5%)	54 (43.5%)	0.001
Shift work	45 (26.2%)	127 (73.8%)	
Time in the current work			
$<$5 years	46 (32.2%)	97 (67.8%)	0.023
$\geq$ 5 years	69 (45.1%)	84 (54.9%)	
Variables related to comorbidities and preexisting pathologies			
Cardiovascular risk factors			
Yes	27 (23.7%)	87 (76.3%)	< 0.001
No	88 (48.4%)	94 (51.6%)	
Previously diagnosed pathologies			
Cardiovascular			
Yes	2 (25.0%)	6 (75.0%)	0.415
No	113 (39.2%)	175 (60.8%)	
Psychological			
Yes	13 (19.4%)	54 (80.6%)	< 0.001
No	102 (44.5%)	127 (55.5%)	
Other			
Yes	4 (33.3%)	8 (66.7%)	0.689
No	111 (39.1%)	173 (60.9%)	
Existence of sleep disorders			
Yes	0 (0.0%)	24 (100.0%)	< 0.001
No	115 (42.3%)	157 (57.7%)	

(*Continued*)

Table 4 (*Continued*)

	Sleep Quality		
	Good: n (%)	Poor: n (%)	*p*-value
Type of sleep disorder			
Insomnia			
Yes	0 (0.0%)	17 (100.0%)	Not applicable
No	0 (0.0%)	7 (100.0%)	
Restless legs syndrome			
Yes	0 (0.0%)	4 (100.0%)	Not applicable
No	0 (0.0%)	20 (100.0%)	
Excessive sleepiness			
Yes	0 (0.0%)	11 (100.0%)	Not applicable
No	0 (0.0%)	13 (100.0%)	
Obstructive sleep apnea syndrome			
Yes	0 (0.0%)	6 (100.0%)	Not applicable
No	0 (0.0%)	18 (100.0%)	
Parasomnias			
Yes	0 (0.0%)	2 (100.0%)	Not applicable
No	0 (0.0%)	22 (100.0%)	

quality ($p < 0.001$). All participants with sleep disorders had poor sleep quality ($p < 0.001$) (►**Table 4**).

When analyzing the association between medication use and sleep quality, no association was found regarding the daily or sporadic use of drugs and sleep quality. Participants with insomnia, a chronic disease or a psychological problem had worse sleep quality ($p = 0.010$), and the participants who were using sleeping drugs also reported worse sleep quality ($p < 0.001$). No association was found between sleep quality and the use of drugs acting on the CNS, although there was a tendency for worse sleep quality in participants using drugs with proven effects on sleep ($p = 0.054$) (►**Table 5**).

The use of stimulant drinks ($p = 0.004$) and stimulant medication ($p = 0.044$) were associated with decreasing sleep quality: as the frequency of consumption increases, sleep quality decreases. Excessive sleepiness was also associated with worse sleep quality ($p < 0.001$): the greater the degree of sleepiness, the worse the sleep quality (►**Table 6**).

Finally, we developed a logistic regression model to adjust all the variables associated with sleep quality in the bivariate analysis, in order to determine the risk of having poor sleep quality. The model shows that, after adjustment, only time on current shift ($p = 0.003$) and the degree of excessive sleepiness ($p = 0.043$) are associated with sleep quality (►**Table 7**).

Discussion

Sleep is fundamental for health, and it is closely interconnected with other diseases. A sleep disorder compromises an individual's quality of life. The use of medications to mitigate the consequences of sleep deprivation is increasingly common; however, the impact caused is not always positive, since medication interferes directly (through neurotransmitters with an impact on sleep) or indirectly on sleep, and it may potentiate the opposite effect.[9] In addition, it is known that shift work has a negative impact on sleep quality and, consequently, on quality of life.[8]

The aim of the present study was to evaluate the association between medication use and sleep quality in shift workers versus daytime workers. Our results revealed that, overall, there is no difference in sleep quality in those taking medication on a daily basis compared to those who do so sporadically. In the study conducted by Kumar et al.,[11] almost a third of the participants (who were taking medications) presented very poor sleep quality, and the authors stated that the use of medications with sedative and anticholinergic effects can contribute to an effect that is the opposite of its purpose, since they can cause sedation and excessive sleepiness during the day. In another study, Karami et al.[12] reported that the use of sedative medications improved sleep quality. In the present study, when we take into consideration the specific medications that the workers were taking, when such medications had a proven effect on sleep, in fact, sleep quality was worse. Additionally, for those who already have taken sleeping medications, sleep quality was worse. Although the directionality of this association is unclear (is poor sleep quality the consequence of the use of such drugs or are those drugs being used to improve poor sleep quality?), the fact remains that there was an association found between the use of drugs with proven effects on sleep and

Table 5 Medication use and sleep quality.

	Sleep quality		
	Good: n (%)	Poor: n (%)	*p*-value
Medication use			
Daily	33 (35.5%)	60 (64.5%)	0.421
Sporadic	82 (40.4%)	121 (59.6%)	
Reason for last medication			
Unusual pain or symptoms	51 (42.1%)	70 (57.9%)	
Feeling weak	7 (36.8%)	12 (63.2%)	
Psychological problem	7 (35.0%)	13 (65.0%)	
Chronic disease	12 (34.3%)	23 (65.7%)	0.010
Insomnia	1 (4.3%)	22 (95.7%)	
Health problem	18 (40.9%)	26 (59.1%)	
Other	19 (55.9%)	15 (44.1%)	
Agent who indicated the last medication			
Familiar	0 (0.0%)	2 (100.0%)	
Pharmacy professional	4 (21.1%)	15 (78.9%)	
Self-initiative	53 (43.4%)	69 (56.6%)	0.280
Medical doctor	57 (38.3%)	92 (61.7%)	
Friend	0 (0.0%)	2 (100.0%)	
Other	1 (50.0%)	1 (50.0%)	
Sleeping medication			
Yes	14 (14.0%)	86 (86.0%)	< 0.001
No	101 (51.5%)	95 (48.5%)	
Drugs acting in the central nervous system			
Yes	49 (41.5%)	69 (58.5%)	
No	57 (40.1%)	85 (59.9%)	0.186
Not applicable	9 (25.0%)	27 (75.0%)	
Drugs with proven effects on sleep			
Yes	14 (30.4%)	32 (69.6%)	
No	92 (43.0%)	122 (57.0%)	0.054
Not applicable	9 (25.0%)	27 (75.0%)	

poor sleep quality. Fadhel[13] reported that individuals dependent on a medication presented more sleep problems, making this a two-way relationship, as each problem can be the cause and consequence of the other. Gordon[14] corroborates this idea, since in his study there was a higher prevalence of individuals who still experienced sleep disturbances a long time after they had stopped using medications with proven effects on sleep after other withdrawal symptoms had disappeared.

The use of substances such as stimulant drinks and stimulant medications have been associated with worse sleep quality, which worsens the more often those substances are consumed,[13] just like the results of the present study show. Some of these substances, such as coffee, alcohol, energy drinks and medications are often used by shift workers to improve the symptoms of sleepiness and poor sleep quality, as a consequence of the alteration in the circadian rhythm.[15]

Male workers presented worse sleep quality, which can be partially justified by the fact that, in the present study, men were older than women. Age has been described as a risk factor for poor sleep quality, with the occurrence of sleep disorders increasing with age, causing changes in sleep and affecting its quality.[10]

The preexistence of CV risk factors was also associated with poor sleep quality. This is also a two-way association, since sleep disorders can increase the risk of CV events,[16,17] obesity, type-2 diabetes, and atherosclerosis.[18]

For those who were previously diagnosed with a psychological disorder, sleep quality was worse, which is aligned with the findings of Slaven et al.,[19] Kumar et al.,[11] and Kalmbach et al.,[20] in which sleep quality was associated

Table 6 Use of substances that can affect sleep, sleepiness, and sleep quality.

	Sleep quality		
	Good: n (%)	Poor: n (%)	*p*-value
Coffee			
Never	13 (48.1%)	14 (51.9%)	
Rarely	9 (39.1%)	14 (60.9%)	0.107
Sometimes	15 (25.4%)	44 (74.6%)	
Often	78 (41.7%)	109 (58.3%)	
Alcohol			
Never	14 (31.1%)	31 (68.9%)	
Rarely	46 (38.0%)	75 (62.0%)	0.588
Sometimes	48 (42.9%)	64 (57.1%)	
Often	7 (38.9%)	11 (61.1%)	
Xanthines			
Never	12 (36.4%)	21 (63.6%)	
Rarely	36 (42.9%)	48 (57.1%)	0.797
Sometimes	43 (38.7%)	68 (61.3%)	
Often	24 (35.3%)	44 (64.7%)	
Stimulant drinks			
Never	71 (48.3%)	76 (51.7%)	
Rarely	39 (32.2%)	82 (67.8%)	0.004
Sometimes	5 (20.8%)	19 (79.2%)	
Often	0 (0.0%)	4 (100.0%)	
Stimulant medications			
Never	78 (44.6%)	97 (55.4%)	
Rarely	35 (33.0%)	71 (67.0%)	0.044
Sometimes	2 (14.3%)	12 (85.7%)	
Often	0 (0.0%)	1 (100.0%)	
Epworth Sleepiness Scale			
Normal	69 (54.3%)	58 (45.7%)	0.001
Moderate sleepiness	17 (37.0%)	29 (63.0%)	
Excessive sleepiness	29 (23.6%)	94 (76.4%)	

with depressive symptoms and even depression. In fact, in the present study, all workers who had been diagnosed with a sleep disorder had poor sleep quality.

The results of the present study support the published evidence of the association between type of work and sleep quality, with shift workers presenting worse sleep quality. Kerkhof[21] reported a higher prevalence of general sleep disturbances in shift workers compared to day workers. Shift work, particularly night work, can have a negative impact on health and well-being, increasing the risk of sleep disorders,[22,23] as well as that of various somatic and other psychological health conditions.[23] The impact of circadian rhythm disturbances (such as those caused by night work or shift work) on sleep quality is greater than that of non-modifiable factors such as age.[10] Shift time has also been described as an important risk factor for sleep disorders, since sustained or prolonged exposure to risk factors, whether biological, behavioral, individual or social, probably results in a higher risk of long-term adverse consequences compared to brief or short-term exposure.[24] However, the results of the present study showed that those who were working on the current shift for up to five years had worse sleep quality. This can imply some sort of adjustment in the sleeping habits of these workers, in which their experience helps them adjust their routines to reduce the impact that shift work can have on sleep quality, just like it was found by Costa.[25]

After adjusting all variables associated with sleep quality in the bivariate analysis, most variables did not increase the risk of having poor sleep quality, since the calculated odds ratio was not statistically significant, and this is the main finding and strength of the present study. The published

Table 7 Risk factors for poor sleep quality.

	Ajusted odds ratio[b]	*p*-value
Gender		**0.746**
Male	1.120 (0.563–2.227)	
Female	1	
Age group		0.558
< 45 years old)	0.558 (0.220–1.414)	
≥ 45 years old)	1	
Sector of activity		
Health	0.722 (0.298–1.751)	0.426
Industry	1.181 (0.417–3.342)	0.471
Other	1	0.754
Drugs with proven effect on sleep		0.954
No effect	0.971 (0.360–2.622)	
Effect	1	
Current work		0.064
Day work	0.518 (0.258–1.039)	
Shift work	1	
Time in current work		0.003
< 5 years	2.737 (1.422–5.268)	
≥ 5 years	1	
Cardiovascular risk factor		0.061
No	0.519 (0.262–1.030)	
Yes	1	
Diagnosed psychological pathology		0.775
No	0.866 (0.322–2.330)	
Yes	1	
Daily use of medication		0.743
No	1.133 (0.536–2.394)	
Yes	1	
Epworth Sleepiness Scale		0.043
Normal	0.527 (0.283–0.981)	
Excessive Sleepiness	1	

Notes: [a]Calculated with a 95% confidence interval; [b]logistic regression model, including all studied covariates; 1= ref.

literature on sleep quality mainly focuses on the individual effect of a specific variable on sleep, usually by conducting a bivariate analysis. But, since sleep quality is a multidimensional problem, influenced by multiple factors (related to the individual, to their working conditions, to the use of different substances, and others), it should be analyzed considering different factors, adjusted to one another, just we like did in the present study.

Of course, these results must be weighed against some limitations. First of all, the present was an observational study with no randomization of participants. Our results cannot be generalized to every activity sector. Secondly, the sampling method we used can lead to selection bias, since only those accessing their email or social media accounts could access the link to participate in the study. Also, the sample size may have influenced the results of our logistic model. Finally, in spite of the fact that the present study included a multiplicity of factors that can influence sleep quality, important factors, such as the time of exposure to light and/or the number of successive shifts without rest, and the use of light to stay awake were not addressed, since they were not collected for analysis.

Still, the current study presents some innovative features that should explored in other professional settings, with larger sample sizes and, preferably, under controlled conditions.

Conclusion

Sleep quality is such a complex issue that its analysis should be multifactorial, not restricted to a simple association between a single variable and sleep quality.

Although there were several factors that individually negatively influenced sleep quality, when adjusted to one another, by using a logistic regression model, they did not increase the risk of having poor sleep quality. No differences were found regarding medication use, type of work, and sleep quality.

Understanding and promoting sleep quality and its underlying factors is a key factor to avoid pharmacological sleep iatrogenesis, encourage the rational and safe use of medications, and thereby improve overall health. Further research is necessary to confirm our findings, since they are restrained by the limitations pf the present study.

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Conflict of Interests
The authors have no conflict of interests to declare.

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