

## The Prevalence of Excessive Daytime Sleepiness and its Determinants among Workers in Call Center in Fes City

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### Abstract

The extent of excessive daytime sleepiness (EDS) remains unknown in Morocco. The objectives of this study are to assess the prevalence of EDS, its determinants and performance impacts among workers at a call center in Fes.

This is a descriptive and analytical cross-sectional study of 322 workers of average age of 27.9 years and including a self-quiz on sleep disorders and working conditions with Epworth sleepiness scale (ESS) (Moroccan Arabic version), Pichot's fatigue scale, hospital anxiety depression (HAD) scale and Berlin scale. The total participation rate is 71.5%. The prevalence of EDS on the Epworth scale is 19.3%. Bivariate analysis shows that the prevalence of EDS is higher (between 24.9% and 56.2%) in case of: start of work before 8am AM, difficulty staying alert, fatigue at work, monotonous noise, degraded working conditions, poor performance, degraded family life, high anxiety score, high depression score, or pichot score  $\geq 22$ . A significantly higher EDS is found in snorers 39.4% and those with a positive Berlin score 42.9%.

The multivariate analysis shows that the main positive determinants of EDS are: difficulty in staying alert (OR = 3.63), fatigue at work (OR = 8.15), monotonous noise (OR = 2.20), snoring (OR = 2.87) and HAD score  $> 13$  (OR = 1.65). The negative determinants of the EDS are: the beginning working after 8 am (OR = 0.74), the performance higher than expected (OR = 0.30) and the work satisfactory performance (OR = 0.37).

Our study highlights the very high prevalence of EDS among call center workers, with working conditions as the main determinant. We have made recommendations based on comprehensive measures to improve working conditions and customized measures for sleepy workers.

**Keywords:** Shift Work; Excessive Daytime Sleepiness; Epworth Sleepiness Scale; Pichot's Fatigue Scale; Berlin Scale

### Abbreviations

EDS: Excessive Daytime Sleepiness; ESS: Excessive Sleepiness Scale; BMI: Body Mass Index; HAD: Hospital Anxiety Depression Scale; OSA: Obstructive Sleep Apnea

### Introduction

Excessive daytime sleepiness (EDS) is a symptom that occurs with a high prevalence in the general population ranging from 3,9 to 32% [1,2]. Some epidemiological studies have reported an association with work conditions [3].

Work-related EDS is a neglected symptom of both patients and physicians, but it can cause considerable discomfort in socio-professional activities and its causes are numerous.

EDS is implicated in many transport and work accidents. The relationship between sleep, sleepiness, and work is close. It can be

linked to sleep deprivation behaviors, sleep-fragmenting diseases, or conditions that produce hypersomnia [4].

Disturbances in alertness and sleep may impair the psychomotor performance of shift workers, particularly those working in call centers.

EDS can be evaluated subjectively at the interview with the analog visual scale, or by the Epworth Sleepiness scale (ESS) based on self-assessment of the frequency of falling asleep in everyday situations [5].

To study the relationship between shift work and the occurrence of EDS, this transversal study was conducted on the population of 322 workers at the WEB HELP call center in Fez. Our study is part of a series of epidemiological studies conducted by the Sleep Medicine University Center (SMUC) of Fez concerning sleep disorder-

ders. Our main objective is to assess the prevalence of EDS, its determinants and impact on performance among workers in this call center. Our secondary objectives are to assess sleep quality and the prevalence of other sleep disorders that can cause EDS.

**Materials and Methods**

**Study design and sample selection**

Of the 1977 workers at the Web Help Call Centre in Fez at its 3 sites, 322 were surveyed. Our survey uses a randomized sampling, without any criteria of inclusion or exclusion by using convenience sampling and standardized sample formula

$$N = k \times \pi \times (1 - \pi) \times (z_{\alpha} / p)^2.$$

This is a descriptive and analytical cross-sectional study of 322 workers of average age of 27.9 years and including a self-quiz on sleep disorders and working conditions. It included also 4 scales: ESS (Arabic version) Pichot Fatigue scale, Hospital Anxiety Depression scale (HAD) and Berlin test. The total participation rate of 71.5%. Anonymity was respected throughout the investigation. The questionnaire includes:

1. Sleep assessment questionnaire used at our Sleep Center in French and Arabic, which includes 5 topics: Lifestyle, global sleep quality assessment, sleep hygiene, snoring and apnea, sleep behavior disorders.
2. Working conditions: Inspired by the COPREV questionnaire (Association of Belgian Occupational Health and Safety Services) which assesses night and shift work and working conditions (French version) [6]. It includes these topics: health problems linked to work and working conditions.
3. Evolution of socio-professional life at work: This is an extract of the French Health Barometer 2010 questionnaire [7,8]. It assesses the performance and productivity at work and the evolution of emotional and family life and the evolution of working conditions since recruitment to the call center.
4. ESS [4]: It is a questionnaire to measure a person's risk of daytime sleepiness in daily life. It includes 8 items of everyday situations and 4 degrees of responses from 0 to 3, with a maximum score of 24. A score of 10 or higher indicates EDS. We used the Arabic version translated by our center according to the rules of transcultural translation.
5. The Hospital anxiety depression scale (HAD) [9]: The HAD is an instrument for detecting anxiety and depressive disorders. It has 14 items rated from 0 to 3. Seven questions relate to anxiety (total A) and seven others to the depressive dimension (total D). The maximum score is 21. Depression is questionable for a score between 8 and 13, and certain for a score of 13.
6. Pichot's fatigue scale [10]: Tiredness is a feeling of physical and mental weakening that usually occurs after a sustained effort and that consequently requires a period of rest. Pathological tiredness is referred to when people find it harder to carry out their daily activities than in their usual condition. Pichot's subjective scale has been proposed to assess

the importance of this handicap using. Of eight proposals, the subject determines which ones best correspond to its state by assigning each item a score between 0 and 4. A total of more than 22 is in favor of excessive fatigue for a maximum score of 32.

7. The Berlin Scale [11]: It is a self-quiz to assess the probability of having obstructive sleep syndrome (OSA) It consists of:
  - Category 1: Includes six questions, one question on anthropological measures (age, sex, weight, height) and 5 questions on snoring and apnea. Category 1 is positive with at least 2 positives responses to questions 2 to 6.
  - Category 2: Is interested in daytime sleepiness. Category 2 is positive with at least 2 positives responses to questions 7 to 9.
  - Category 3: Concerns high blood pressure and BMI. Category 3 is positive with at least 1 positive response and/or a BMI > 30.

At least 2 positive categories indicate a high probability of OSA.

**Statistical analysis**

All data collected was coded and entered on Excel (Microsoft office 2007). The data analysis was carried out by IBM SPSS software (version 20.0 Chicago IL, USA). The results were presented in the form of percentage and average-standard deviation. Comparisons of prevalence of sleepiness, were made between different groups of risk factors using bivariate analysis with conventional statistical tests (Chi2). The descending step-by-step logistic regression model was used to find the determinants of sleepiness in the study population by adjusting for the various confounding factors.

All variables, including p-value of 0.25 in the bi-varied analysis, were included in the original model. Only the variables for which  $p < 0.05$  What included in the final model. The results were presented in the form of Odds Ratio and 95% confidence interval. All tests of significance were performed at the 5% level of significance.

**Results**

**Characteristics of the population**

The average age of the study population is 27.9 +/- 5.46 (19 to 53 years). Women account for 52.8% and men 47.2%. It is noted that the representation of both sexes is relatively close. Among the workers, 46,8% have a body mass index (BMI) of less than 26 while 48,3% have a BMI between 25 and 30 and 4.6% have a BMI greater than 30 (Table 1 and 2).

Age	Number	%
≤ 30 years	238	73.9
> 30 years	84	26.1

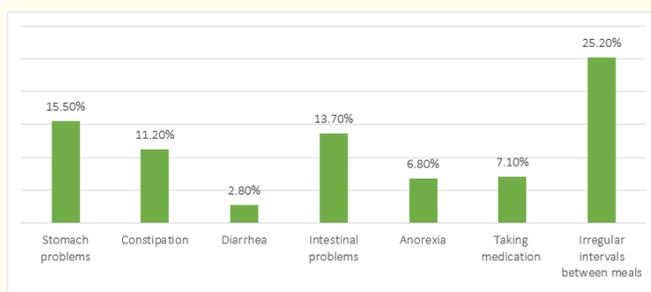
**Table 1:** Distribution by age group.

BMI	Number	%
16 - 20	12	4
21 - 25	139	46.4
26 - 30	145	48.3
> 30	4	1.3

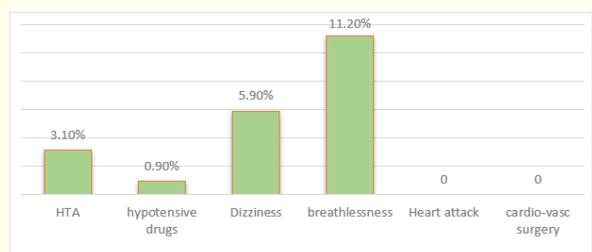
**Table 2:** Distribution of workers' BMI.

**Health and lifestyle**

Our study showed that 42.9% of workers have gastrointestinal problems (Graph 1), 17% have cardiovascular problems (Graph 2) and 1.6% had a head injury in the past. No case of epilepsy has been reported. Of the 322 surveyed, 1.9% are known to be diabetic and 1.9% are followed for hypothyroidism. 39.8% feel sometimes anxious, sad or depressed. 18% are chronic smokers with an average of 11.8 cigarettes per day and an average smoking time of 8.5 years. It is also noted that 1.5% of the workers report smoking cessation and they smoked an average of 15 cigarettes per day, after smoking an average smoking time of 10.4 years.



**Graph 1:** Distribution of recent gastrointestinal problems.

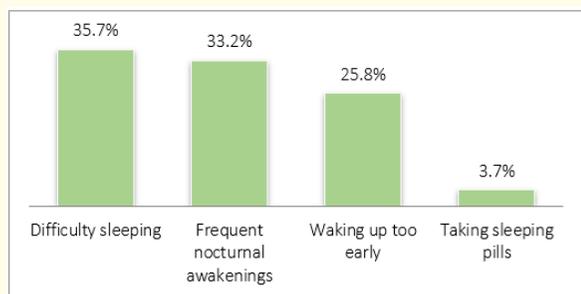


**Graph 2:** Distribution of cardiovascular problems.

Regarding the consumption of stimulants, 12.4% take stimulants in the evening. Tea consumption comes first with 85.7% then coffee with 69.3% and finally Cola beverage consumption 32.9%. Only 1.9% reported that they consume alcohol.

**Sleep quality assessment**

In graph 3, in the last 3 months, 35.7% complain of insomnia falling asleep, 33.2% of frequent nocturnal awakenings, and 25.8% of waking up too early. Our study also showed that 41.9% of workers rated their sleep as poor quality. 3.7% of workers take sleeping pills.



**Graph 3:** Distribution of sleep quality disorders reported by workers over the past 3 months.

In graph 4, sleep quality over the past three months is rated good by 39.8% of subjects, poor by 27.7% and intermediate by 32.3%.

**Graph 4:** Evaluation of sleep quality during the last 3 months by workers.

The estimated average sleep duration (Graph 5) per night over the past 3 months is less than 6 hours indicating a tendency to sleep deprivation in 7.8% of workers. 27% have a sleep duration between 6 and 7 hours and 65% have at least 7 hours of sleep.

**Graph 5:** Distribution of estimated sleep duration per night over the last 3 months.

It is noted that the sleep latency (Graph 6) is less than 30 minutes in 56% of workers, 30 to 60 minutes in 31%, and at least 60 minutes and therefore significantly extended in 13% of them. The average of sleep latency of workers is 26 minutes (5 to 120 minutes).

**Graph 6:** Distribution of sleep latency per night.

**Other sleep disorders**

In the last 3 months, snoring has been present in 10.2% of workers. The average period of evolution of snoring is 4 years (1 - 10

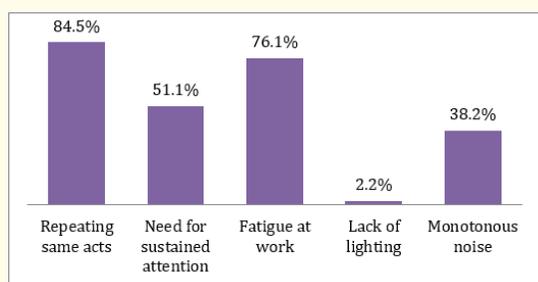
years). Respiratory breaks, which are the most important component of sleep apnea, are present in 5.9% of subjects. Restless leg syndrome is reported by 3.7% of workers. Other sleep disorders reported in the last 3 months are sleepwalking (3.1%), somniloquy (15.5%), bruxism (13.7%) and finally probable cataplexy (2%).

**Working conditions**

All workers work shifts at interrupted schedules, of which 63.8% have a variable schedule (modified each week) and 36.2% have a fixed schedule. 27.9% start their work at 7 am and the rest start after 8 am.

The average working time per week for workers is between 35 and 48 hours per week for 98.4% and more than 48 hours per week for 1.6%.

In graph 7, among the working conditions likely to affect the vigilance of call center workers are: repeating same acts, need for sustained attention, fatigue at work, lack of lighting and monotonous noise.



**Graph 7:** Distribution of working conditions that may impair alertness.

**Job performance (Graph 8)**

Work performance is rated excellent (with excellent creativity) by 15.5% of workers, up to expectations (and average creativity) in 25.8% of subjects. It is satisfactory and in line with expectations with minimal creativity for 34.2% of workers and in line with expectations, but a necessary improvement is needed and no creativity for 21.7%. 5% consider the performance unsatisfactory or unacceptable.

**Graph 8:** Distribution of levels of Job performance.

**Cognitive-behavioral and family impact**

In the last three months, 33.5% reported a change in mood, 24.8% reported a sharp decline in their memory, and 9.7% reported a decrease in interest in sex life. 30.7% report a deterioration in their emotional and family life, while only 16.5% report an improvement in their family situation. 52% do not report a change in their personal life. 14.6% think that their work causes them problems at the family level and 9.3% think that their work causes them problems as a couple.

**Scales analysis (Table 3)**

For ESS, a score of 10 or more defining excessive daytime sleepiness is present in 19.3% of workers. 1.5% have severe sleepiness with a score of 16.

Pichot's score was positive (> 22) indicating excessive fatigue in 8.1%. For the HAD scale, 34% have a questionable depression with a score between 8 and 13. 26.7% suffer from a certain depressive state with HAD score > 13 and 38.5% have no signs of depression. Among those with depression, there was a major depressive state (score of 19) in 9% of workers. For the Berlin scale, 4.3% have a high probability of obstructive sleep apnea (OSA) with at least two positive categories.

	N	%
Epworth ≥ 10	62	19,3
Pichot ≥ 22	26	8,1
HAD > 13	86	26,7
Berlin (2 positive criteria)	14	4,3

**Table 3:** Distribution of positive scores in Epworth, Pichot, HAD and Berlin scales.

**Analysis of excessive daytime sleepiness**

The analysis of anthropological data does not objectively differ significantly from EDS.

	ESS ≥ 10	p
Age ≤ 30	17,6% (42)	0,21
Age > 30	23,8% (20)	
Women	19,4% (33)	0,94
Men	19,1% (29)	
BMI < 25	17,3% (33)	0,27
BMI ≥ 25	22,1% (29)	

**Table 4:** Comparison of EDS prevalences by age, gender and BMI of workers.

In table 5, subjects with digestive, cardiovascular, neurological and psychological health problems are significantly sleepier than people who do not have these problems.

The analysis did not show a significant difference in the EDS between workers with fixed-schedule shift work and those with shift work with variable schedules. Also, there is no difference between

Health problems		ESS ≤ 10	ESS ≥ 10	p
Digestive	Yes	73,0% (102)	26,1% (36)	0,007
	No	85,9% (158)	14,1% (26)	
Cardiovascular	Yes	65,5% (36)	34,5% (19)	0,002
	No	83,9% (224)	16,1% (43)	
Neurological	Yes	40% (2)	60% (3)	0,02
	No	81,4% (258)	18,6% (59)	
Endocrine	Yes	66,7% (8)	33,3% (4)	0,2
	No	81,3% (252)	18,7% (58)	
Psychic	Yes	70,1% (94)	29,9% (40)	0,0001
	No	88,3% (166)	11,7% (22)	

**Table 5:** Distribution of EDS prevalence based on current health problems of workers.

	ESS ≤ 10	ESS ≥ 10	p
Fixed planning	80,2% (89)	19,8% (22)	0,84
Variable planning	81,1% (159)	18,9% (37)	
Starting work before 8 am	75,6% (68)	24,4% (22)	0,12
Starting work after 8 am	83,1% (192)	16,9% (39)	

**Table 6:** Comparing the prevalence of EDS by working hours.

workers who start work before 8 am and those who start work after 8 am.

Workers exposed to conditions that can reduce alertness, especially monotonous noise, fatigue and difficulty remaining alert are significantly sleeper (Table 7).

Conditions that may reduce alertness		ESS ≤ 10	ESS ≥ 10	p
Repetitions of acts	Yes	79,4% (216)	20,6% (56)	0,15
	No	88% (44)	12% (6)	
Need for sustained attention	Yes	70,2 (120)	29,8% (51)	0,0001
	No	92,7% (140)	7,3% (11)	
Fatigue at work	Yes	75,1% (184)	24,9% (61)	0,0001
	No	98,7% (76)	1,3% (1)	
Monotonous noise	Yes	69,9% (86)	30,1% (37)	0,0001
	No	87,4% (174)	12,6% (25)	

**Table 7:** Analysis of EDS based on exposure to working conditions that may reduce alertness.

Regarding the impact of the EDS on job performance, workers who find their performance unsatisfactory or unacceptable are significantly sleeper than others.

The analysis shows that subjects with family life that have deteriorated or who believe that working conditions have deteriorated since the beginning of work at the center are significantly more sleepy than others (Table 9).

Job performance		ESS ≤ 10	ESS ≥ 10	p
Excellent, and excellent creativity	Yes	86% (43)	14% (7)	0,30
	No	79,8% (217)	20,2% (55)	
Higher than expected and average creativity	Yes	88,8% (71)	11,2% (9)	0,036
	No	78,1% (189)	21,9% (53)	
Satisfactory and in line with expectations, minimal creativity	Yes	85,5% (94)	14,5% (16)	0,12
	No	78,3% (166)	21,7% (46)	
In line with expectations, a necessary improvement, no creativity	Yes	70% (49)	30% (21)	0,10
	No	83,7% (211)	16,3% (41)	
Unsatisfactory or unacceptable	Yes	43,8% (7)	56,2% (9)	0,0001
	No	88,7% (253)	17,3% (53)	

**Table 8:** Analysis of EDS based on workers' job performance.

		ESS ≤ 10	ESS ≥ 10	p
Degraded family life	Yes	68,7% (68)	31,3% (31)	0,0001
	No	86,1% (192)	13,9% (31)	
Degraded working conditions	Yes	70,6% (36)	29,4% (15)	0,045
	No	82,7% (224)	17,3% (47)	

**Table 9:** Analysis of EDS as family and working conditions change.

It is noted that there is no significant relationship between EDS and sleep duration and there does not appear to be a relationship between EDS and sleep latency (Table 10).

		ESS ≤ 10	ESS ≥ 10	p
Sleep duration	≤ 6h	76,8% (86)	23,2% (26)	0,18
	> 6h	82,9% (174)	17,1% (36)	
Sleeping latency	< 30 min	82,9% (145)	17,1% (30)	0,20
	≥ 30 min	77,1% (108)	22,9% (32)	

**Table 10:** Analysis of EDS based on sleep duration and sleep latency.

EDS is significantly higher in snorers and workers with breathing breaks during sleep (Table 11).

		ESS ≤ 10	ESS ≥ 10	p
Snoring	Yes	60,6% (20)	39,4% (13)	0,002
	No	83% (240)	17% (49)	
Respiratory breaks	Yes	57,9% (11)	42,1% (8)	0,009
	No	82,2% (249)	17,8% (54)	

**Table 11:** Analysis of EDS based on snoring and breathing pauses during sleep.

Table 12 analyzes EDS based on data from the Pichot, HAD and Berlin scales. Excessive fatigue (pichot ≥ 22), depression (HAD > 13) and the likelihood of having OSA (Berlin with 2 positive categories) are significantly related to EDS.

Scales		ESS ≤ 10	ESS ≥ 10	p
Pichot	< 22	82,1% (243)	17,9% (53)	0,03
	≥ 22	65,4% (17)	34,6% (9)	
HAD	< 8	91,9% (114)	8,1% (10)	0,0001
	8 - 13	78,6% (88)	21,4% (24)	
	> 13	67,4% (58)	32,6% (28)	
Berlin	Positive	57,1% (8)	42,9% (6)	0,02
	Negative	81,8% (251)	18,2% (56)	

**Table 12:** Analysis of the EDS based on data from the Pichot, HAD and Berlin scales.

**Multivariate analysis (Table 13)**

The bivariate analysis shows that the possible determinants of EDS defined by an ESS > 10 are: Age, BMI, health problems, working conditions, starting work before 8 am, job performance deterioration of family life and working conditions, sleep duration, sleep latency, snoring, sleep breathing breaks, and positive scales of Pichot, HAD and Berlin.

By adjusting for the confounding factors, the multivariate analysis shows that the risk of EDS is present in workers who need for sustained attention (OR = 3.63), among those presenting fatigue at work (OR = 8.15), those who are exposed to monotonous noise (OR = 2.20), those who snore (OR = 2.87), and those having depression with a HAD score > 13 (OR = 1.65). The risk of sleepiness is reduced in those who start work after 8 a.m. (OR = 0.74), those with job performance higher than expected with average creativity (OR = 0.30) and those with satisfactory performance and in line with expectations and minimal creativity (OR = 0.37).

	Odd ratio	Intervalle de confiance		p
		Inf.	Sup.	
Start time at work ≥ 8 a.m.	0,75	0,56	1,00	,044
Need for sustained attention	3,63	1,59	8,27	,002
Fatigue at work	8,15	1,02	65,05	,048
Monotonous noise	2,20	1,14	4,27	,019
Job performance higher than expected and average creativity	0,30	0,12	0,73	,008
Job performance satisfactory and in line with expectations, minimal creativity	0,37	0,18	0,77	,007
Ronflement	2,87	1,17	6,99	,021
Depression (HAD scale > 13)	1,65	1,07	2,54	,022

**Table 13:** Multivariate analysis of the determinants of excessive daytime sleepiness.

**Discussion**

In order to assess the prevalence of EDS among workers at the Fez call center and its determinants, we carried out this cross-sectional study using a comprehensive, self-administered, and anonymous questionnaire among workers. The sample is statistically representative of all workers at the center. Participation in this study can be considered satisfactory with a response rate of 71.5%.

EDS is evaluated in the survey based on the ESS scale established by M.W. Johns of Epworth Hospital in Melbourne in 1990. This scale selected the diagnosis of EDS at a score of 10 or more after reproducible and consistent questionnaire results with the measurement of multiple sleep latency tests latency [5].

In addition, it has the advantage of being fast, easy to fill and inexpensive. This questionnaire was translated into Arabic Moroccan dialect validated by our sleep center according to the rules of trans-cultural translation. This version was used in our investigation.

According to definition based on ESS, the prevalence of excessive daytime sleepiness in our study is 19.3%. Similar prevalence was found in two large studies that used multiple sleep latency test (MSLT) and ESS to explore EDS. From a large Southeastern Michigan random sample (n = 1648) representative of the U.S. population, in a subsample (n = 259), the prevalence of excessive sleepiness, defined as a MSLT average sleep latency of less than 6 minutes, was 13% [12]. In another sample of 6947 Wisconsin state employees, a subsample (n = 632), twenty-five percent had an average sleep latency of less than 5 minutes [13]. For results of ESS, in the Michigan study 20% had ESS scores higher than 10 and in the Wisconsin study 25% had scores higher than 11. In Australian study, the prevalence of excessive daytime sleepiness among Australian workers prevalence of EDS was 16.0% [14]. The prevalence of pathological sleepiness was 14.4% in survey among 112 emergency medical staff [15]. In France, the prevalence was very high (26%) among 2,700 Franco-German employees [16].

We analyzed the determinants of EDS by including other issues related to sleep hygiene, lifestyle, working conditions, and different scales.

36% of workers are overweight with a BMI between 25 and 30 but only 4.6% have a BMI above 30. There is not a significant relationship between BMI and excessive daytime sleepiness.

In our survey, there is no difference in the prevalence of EDS between women and men. In a study representative of the Finnish population, 11% of women and 7% of men reported daytime sleepiness almost every day [17].

Some epidemiological studies have reported an association with psychiatric disorders [18-21] and physical illnesses [20-22]. In our study, workers have various gastrointestinal, cardiovascular, neurological and psychological health disorders. Bivariate analysis shows a higher prevalence of EDS among workers reporting these health problems, but these factors does not emerge as a determinant of EDS in the multivariate analysis.

Psychologically, the analysis shows that subjects with depression assessed by a score of HAD (32.6%) are significantly more sleepy than non-depressants. Multivariate analysis shows that

depression is closely related to EDS with an odd ratio of 1.6. One question remains: Is depression a cause or consequence of the EDS?

Sleepiness is known to affect mood with an increase in sleepiness correlated with worsened mood. In the study of Dinges, et al. when sleep was restricted in healthy males from an average of 7.4 hours to 5 hours, sleepiness was noted along with increased complaints of anxiety, mood disturbances, and fatigue [23]. On the other hand, in this study, the prevalence of severe ESD was higher in individuals with a major depressive disorder, a bipolar disorder, an anxiety disorder, or alcohol dependence. The prevalence of moderate ESD was higher in individuals with a major depressive disorder or an anxiety disorder [24].

The time of start of work before 8 a.m. is a determining factor in the EDS. In a Swedish study of train drivers the prevalence of severe sleepiness was especially high for the very early morning shift [25]. A study that explored sleep disorders and alertness among German and French employees (2001 - 2003) shows different hourly rhythms with later shift times (6 hours) in Germans [16]. According to the investigators, most French shift workers take their morning shifts at 4 a.m. French employees surveyed complained more about their than the German employees. In fact, workers who start their work very early are more exposed to a reduction in their night sleep duration. Which exposes them more to the SDE.

Regarding working conditions, call center workers exposed to conditions that can reduce alertness, especially monotonous noise, fatigue at work and need for sustained attention are significantly sleepier. The multi-variance analysis individualized these 3 factors as determinants of the SDE with an OR of 2.2 for monotonous noise, 8,15 for fatigue at work and 3.63 for need for sustained attention.

Multivariate analysis also shows the adverse impact of EDS on work performance. There is a strong link between the two good levels of performance and the negative risk of having an EDS: higher than expected performance (OR = 0.3) and satisfactory performance (OR = 0.37).

In the study of Mulgrew, et al. there were strong associations between subjective sleepiness assessed by the ESS and three of the four scales of work limitation. That is, patients with an ESS of  $\leq 5$  had much less work limitation compared to those with an ESS  $\geq 18$  in terms of time management (19.7% vs. 38.6 %,  $p < 0.001$ ), mental-interpersonal relationships (15.5% vs. 36.0%,  $p < 0.001$ ) and work output (16.8% vs. 36.0%;  $p < 0.001$ ) [26]. Similarly, Grunstein and colleagues documented an increased odds ratio for work disturbance in patients complaining of frequent sleepiness in a study of obese Swedish subjects [27].

We also analyzed the evolution of family life and working conditions since the recruitment of workers. Subjects with family life

that have deteriorated or who think that the working conditions have deteriorated since the beginning of work at the center are significantly sleepier than the others, but this link is not significant in the multivariate analysis.

ESD can be an essential or an associated symptom of obstructive or central sleep apnea syndrome. In our study, EDS is significantly higher in snorers and workers with breathing breaks during sleep. Multivariate analysis shows that only snoring is a determining factor in EDS with an odd ratio of 2.9. Workers with a high probability of OSA assessed by the Berlin score have a high prevalence of EDS (42.9%), but this score do not appear as a determining factor in the multivariate analysis. This would be explained by the young age of our population and the small proportion of obese people thus reducing the risk of OSA.

Our study gives prevalence of other sleep disorders in the last 3 months such as insomnia (22.3%), poor sleep (27.5%), restless leg syndrome (3.7%), sleepwalking (3.1%), sleeping pills (15.5%), bruxism (13.7%) and finally probable cataplexy (2%).

## Conclusions

EDS remains underestimated among workers and particularly in shift work. Our study shows the high prevalence of EDS among these workers. Working conditions would play a decisive role in its installation. Our study also shows the individual health and social consequences and the collective consequences, and in particular the impact on performance and productivity at work. EDS should be systematically evaluated among workers to adapt working conditions and prevent its individual and collective adverse consequences.

Other studies on sleep disorders in other occupational categories have been conducted and are being analyzed in our Sleep Medicine Center.

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## Conflict of Interest

We declare no conflict of interest and financial assistance has not been received for this study.

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