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Original Article

Quality of sleep among social media users during the lockdown period due to COVID-19 in Spain



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ABSTRACT

Aims: To analyse the quality of sleep of the Spanish population during the lockdown due to COVID-19. **Design:** Cross-sectional descriptive study using a web based survey design.

Methods: Pittsburgh Sleep Quality Index questionnaire and sociodemographic, occupational, health and sleep quality variables were used to collect data during the first month of the lockdown period due to COVID-19 (March–April 2020). A snowball sampling was carried out, where participants were asked to disseminate and distribute the questionnaire among their own profiles in social networks.

Results: A representative sample of 5220 participants aged ≥ 18 years old took part in the study. The global PSQI score was 8.17 points (SD 4.43). A statistical association was found between the global PSQI score and several of the variables collected. Findings show that the quality of sleep was worse among women ($p < 0.001$), single participants ($p < 0.02$), those working in rotating shifts ($p < 0.001$), on-site workers ($p < 0.001$), and people diagnosed with COVID-19 or who had someone in their environment diagnosed with the virus ($p < 0.001$).

Conclusion: Findings show that the Spanish population has experienced poor quality of sleep during the lockdown period. Being a woman, working in rotating shifts, having suffered from COVID-19 or having someone close suffering from COVID-19, being unemployed or being affected by a Temporary Redundancy Scheme, as well as spending long hours in bed were associated with poorer sleep quality. On the contrary, being older and sleeping longer hours were associated with a better sleep quality.

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Impact

- What problem did the study address?

Sleep is a key factor that determines people's quality of life and it can have a negative effect in their wellbeing and mental health. Poor sleep hygiene is linked to the development of cardiovascular diseases and mental health disorders. There are different studies that show a decrease in the quality of sleep during emergencies or disaster situations among the general population.

- What were the main findings?

There is a negative impact on the quality of sleep among the Spanish population during the lockdown period due COVID-19. This study found evidence that being a woman, working in rotating shifts, having suffered from COVID-19 or having someone close suffering from it, as well as spending long hours in bed are related to poorer sleep quality. On the other hand, older people, those who are employed but do not work in rotating shifts, and those who sleep longer hours are associated with better sleep quality.

- Where and on whom will the research have impact?

These results should be considered if an upturn of COVID-19 disease or another pandemic occurs which would require confinement measurements put back in place. This study shows there was a decrease in sleep quality during the lockdown period, making it

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necessary to develop prevention plans (campaigns promoting healthy lifestyles) and to act upon these new situations, placing special emphasis on the social groups experiencing the greatest decrease in their sleep quality.

1. Introduction

Sleep has proven to be a determinant factor in people's quality of life since childhood [1] and the lack of it may negatively affect the well-being and mental health of an organism [2]. Sleep disturbances can be observed from a two-way perspective, given the fact that sleep-related alterations produce stress, and in turn, stress generates changes in the sleep–wake cycle. Similarly, sleep is related to the development and exacerbation of diseases such as major depression [3], anxiety [4], stress [4,5], posttraumatic stress disorder [6,7], diabetes mellitus [8], sleep apnoea and restless leg syndrome [9].

2. Background

Sleep quality is a complex phenomenon that comprises quantitative aspects (duration, latency, number of night-time awakenings), and self-perceived subjective aspects (depth, reparability) that bear different meanings for each person [10]. It is a determining factor in physical and mental well-being. Sleep deprivation and poor sleep quality have been proven to be associated with numerous health conditions, such as lapses in attention and perceptual processing, lack of interest, memory errors and irritability [11–13].

On the other hand, the disease caused by the new coronavirus (COVID-19) was first identified in December 2019 in the city of Wuhan in China's central region, and it rapidly spread to Italy and later to Spain [14].

Due to the increasing number of confirmed cases, the Spanish Government imposed a national lockdown as the main course of action, which came into force on 15 March 2020. The decree forced the entire population to stay at home except for specific cases, such as buying food and medicines, going to work or in cases of emergency [15]. The subsequent extensions of the lockdown period caused economic and employment consequences, as many companies were forced to shut down temporarily and suspend workers' contracts [16].

The Spanish Ministry of Health [17] and the European Academy for Cognitive Behavioural Therapy for Insomnia (CBT-I Academy) [18] have provided some key recommendations to improve the quality of sleep, specifically during the lockdown period: keeping a regular night time and wake-up time schedule, using social networks to keep distracted with positive information, exercising, and limiting the amount of time exposed to news about the COVID-19. These recommendations can help the population to experience an improvement in both the quality and quantity of sleep. There are many studies which analyse the effectiveness of different non-pharmacological strategies that can improve sleep quality and that may also be useful in this context. These measures include: exercise, which has proven to have a positive impact for different study groups [19,20], as well as other interventions based on alternative methods such as music [21,22].

Several researches have analysed the consequences of COVID-19 and the mandatory lockdown on the physical and mental well-being of the population, and have found evidence that it affects anxiety, stress and sleep quality [23–25]. At the same time, it must be taken into account that 20% of the adult Spanish population has difficulty falling asleep or staying asleep, that 6.4% suffer from insomnia [26] and that currently Spain is one of the most affected

countries in the world by COVID-19, with more than 20,000 deaths [27].

3. The study

3.1. Aim

To analyse the quality of sleep of the Spanish population during the lockdown period enforced due to the COVID-19 outbreak.

3.2. Design

A cross-sectional descriptive study was carried out using data collected during the week that marked the first month of lockdown.

3.3. Participants

The study was conducted among the entire Spanish available population, those who were of legal age, used social networks and agreed to participate. After obtaining authorisation from the Research Ethics Committee of the Principality of Asturias, the link to the questionnaire was shared via WhatsApp, Facebook and Twitter (used by more than 30 million people in our country). After this initial dissemination, a snowball sampling methodology was used, where participants were asked to disseminate and distribute the questionnaire among their own profiles in these social networks.

3.4. Data collection

We designed a data collection sheet using Google Forms and we disseminated it through the main social networks. This instrument collected socio-demographic variables (age, sex, relationship status, living arrangements, and dependents), employment variables (employment status and job characteristics), health variables (COVID-19 diagnosis) and the Spanish version of the Pittsburgh Sleep Quality Index (PSQI) [28,29].

3.5. Ethical considerations

This study has been designed in accordance with the principles set forth in the Declaration of Helsinki, the Belmont Report, the CIOMS Guidelines and the provisions of Organic Law 3/2018 of 5 December 2018 on Personal Data Protection and Digital Rights Guarantee. Authorisation from the Research Ethics Committee of the Principality of Asturias (Register number: 2020.201) was procured, which waived the need of signed informed consent forms due to the fact that the anonymous fulfilment and submission of the questionnaire was considered as the acceptance and consent to participate in the study.

3.6. Data analysis

A descriptive analysis of each variable was conducted to describe demographic characteristics. Quantitative variables between two groups were compared using the Student's *t*-test (with Welch correlation if variances were different), and the Wilcoxon test for independent samples, depending on whether the assumption of normality was verified. Quantitative variables between three categories were compared using the ANOVA test and the Tukey's post hoc test or the Kruskal–Wallis test and the Dunn's post hoc test, depending on whether the previous assumptions of normality (Shapiro–Wilk test) and homoscedasticity (Bartlett test and Ansari–Bradley test) were met. The Pearson or Spearman

correlation coefficient and the corresponding hypothesis contrast were used to assess the linear relationship between continuous variables depending on whether the assumption of normality was met. A multivariate analysis was carried out based on a complete model including predictor or independent variables that had obtained a significance level of <0.10 in the bivariate analysis. The model was then simplified using a step-by-step selection algorithm, for which the goodness-of-fit was evaluated. First, the absence of collinearity was checked by calculating the variance inflation factors, obtaining values below 2. A significance level of 0.05 was used. The statistical analysis was performed using R Software (R Development Core Team), version 3.4.3.

3.7. Validity and reliability/Rigour

The PSQI is a self-administered instrument with adequate psychometric properties to measure sleep quality, validated in several languages and contexts, including the Spanish population [30]. It consists of 24 items, although only 19 are taken into account for correction. Furthermore, it is divided into seven components: subjective sleep quality, latency, duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction. It is answered using a Likert-type scale ranging from 0 to 3. For correction, a sleep profile is obtained for each of the components ranging from 0 to 3 and a global score ranging from 0 to 21. A higher score indicates poorer sleep quality. In addition, the PSQI included the key variables related to sleep quality: loud snoring, breathing pauses during sleep, involuntary muscle twitching or jerking during sleep and confusion and disorientation. It also included an open-ended question regarding the presence of other factors that could contribute to poorer sleep quality.

4. Results/findings

A total of 5220 questionnaires were received. Participant's average age was 39.48 years (SD 12.49). As shown in Table 1, the gender distribution was predominantly female (73.93%). The most common socio-demographic variables were: having a partner (70.36%), living in the same household with family members during lockdown (83.81%), not having dependents (57.47%) and being employed (56.19%). In total, 34.69% of the participants who were employed reported that they were working in rotating shifts, and 30.95% of them reported they were working from home. Also, 2.15% of the participants stated that they had been diagnosed with COVID-19; while in 16.34% of the cases, a family member or someone close to them had been diagnosed with COVID-19 (Table 1).

Participants reported staying an average of 8.48 h in bed (SD 1.42) and being asleep for 6.55 h (SD 1.5).

The global PSQI score was 8.17 (SD 4.43). The component with the worst score was the one related to sleep latency (mean 1.69; SD 1.02), followed in ascending order by subjective sleep quality (mean 1.55; SD 1.20), sleep disturbances (mean 1.30; SD 0.56); usual sleep efficiency (mean 1.20; SD 1.15), daytime dysfunction (mean 1.08; SD 0.88), sleep duration (mean 0.84; SD 0.99) and use of sleeping medication (mean 0.50; SD 0.6).

Regarding sleep quality-related factors during the previous four weeks, the participants' partners reported mainly: snoring (45.98%) and leg twitches or spasms (44.53%) (Table 2). All factors, including disorientation and apneas, were associated with poorer quality of sleep (p < 0.01). In addition, 308 participants confirmed suffering from other related problems, being the most frequent: nightmares (19.16%), pain (17.56%), the existence of noise and/or lights (13.64%), anxiety (12.99%) and parenthood (10.06%). None of the participants reported any other problems that could lead to poorer sleep quality during the lockdown period.

Table 1
Participants' demography, laboral and disease related information.

	Mean (SD)	Min/Max n (%)
Age	39.48 (12.49)	18/79
Gender		
Male		1361 (26.07)
Female		3859 (73.93)
Civil Status		
Partner		3673 (70.36)
Single		1547 (29.64)
Type of household		
Family		4375 (83.81)
Alone		690 (13.22)
Friends ^a		155 (2.97)
Dependents		
No		3000 (57.47)
Yes		2220 (42.53)
Employment		
Active ^b		2933 (56.19)
Student/unemployment		1199 (22.97)
TRS ^c		1088 (20.84)
Rotating work shifts ^d		
No		2732 (65.31)
Yes		1451 (34.69)
Homeworking		
No		3066 (69.05)
Yes		1374 (30.95)
COVID-19 diagnostic		
No		5108 (97.85)
Yes		112 (2.15)
COVID diagnosed in close family/friends		
No		4367 (83.66)
Yes		853 (16.34)

^a Friends: Flatmates.

^b Active: currently working in a company.

^c TRS: Temporary Redundancy Scheme.

^d Participants without a job were excluded.

A statistical association was found between the global PSQI score and several of the variables collected. The poorest quality of sleep was identified in women (p < 0.001), single participants (p 0.02), those working in rotating shifts (p < 0.001), on-site workers (p < 0.001), and people diagnosed with COVID-19 or who had someone in their environment diagnosed with the virus (p < 0.001) (Table 3).

A linear model was created to predict sleep quality. The model was able to explain 68.42% of the variability in sleep quality, which was significant (p < 0.001). Being a woman, working in rotating shifts, having suffered from COVID-19 or having someone close suffering from COVID-19, being unemployed or being affected by a Temporary Redundancy Scheme, as well as spending long hours in bed were associated with poorer sleep quality. On the contrary, being older and sleeping longer hours, were associated with a better sleep quality (Table 4).

5. Discussion

The aim of the study was to analyse the quality of sleep in the Spanish population during the lockdown period ordered due to the COVID-19 pandemic, which has proven to be of lower quality than in other countries in similar circumstances. The average score obtained in the PSQI in our study was slightly lower (which results in better sleep quality) than the results obtained by two researches carried out in China during the lockdown period enforced there due to the same circumstances [25,31], but it was higher (poorer sleep quality) than a study conducted in Italy [32]. Similar studies, although they are not totally comparable, show a worsening of the quality of sleep in countries like Italy [33], Morocco [34] or China [35,36] during COVID-19 pandemic.

Table 2
Sleep Quality related factors referred by participant's partner.

	Loud snoring n (%)	Long pauses between breaths while asleep n (%)	Legs twitching or jerking while asleep n (%)	Disorientation/Confusion n (%)
Not during the past month	1722 (54.02)	2576 (82.90)	1763 (55.77)	2595 (82.33)
Less than once a week	635 (19.92)	302 (9.62)	735 (23.25)	343 (10.88)
Once or twice a week	525 (16.47)	180 (5.74)	459 (14.52)	151 (4.79)
Three or more times a week	306 (9.60)	80 (2.55)	204 (6.45)	63 (2.0)

Table 3
Bivariate analysis of sleep quality (Pittsburgh Sleep Quality Index).

	PSQI Total Score		Subjective sleep quality		Sleep latency		Sleep duration		Habitual sleep efficiency		Sleep disturbances		Use of sleeping medications		Daytime dysfunction	
	Mean	p	Mean	p	Mean	p	Mean	p	Mean	p	Mean	p	Mean	p	Mean	p
Gender																
Male	6.74	<0.001	1.26	<0.001	1.41	<0.001	0.73	<0.001	0.95	<0.001	1.15	<0.001	0.37	<0.001	0.86	<0.001
Female	8.66		1.64		1.79		0.88		1.28		1.35		0.54		1.16	
Civil Status																
Partner	8.07	0.02	1.53	0.13	1.66	<0.001	0.84	0.59	1.19	0.92	1.32	<0.001	0.48	0.03	1.05	<0.001
Single	8.34		1.58		1.76		0.85		1.20		1.26		0.54		1.17	
Type of household																
Family	8.11	0.16	1.54	0.24	1.69	0.67	0.82	0.004	1.20	0.98	1.31	0.09	0.47	<0.001	1.06	<0.001
Alone	8.43		1.55		1.68		0.96		1.20		1.27		0.63		1.14	
Friends	8.51		1.70		1.75		0.79		1.21		1.25		0.51		1.32	
Dependents																
No	8.13	0.97	1.56	0.17	1.76	<0.001	0.78	<0.001	1.16	0.02	1.27	<0.001	0.44	<0.001	1.13	<0.001
Yes	8.20		1.52		1.65		0.92		1.24		1.34		0.57		1.01	
Employment																
Active	8.08	0.10	1.53	0.27	1.61	<0.001	0.92	<0.001	1.18	0.31	1.28	<0.001	0.48	0.77	1.08	<0.001
Student/unemployment	8.37		1.59		1.87		0.72		1.19		1.30		0.52		1.16	
TRS ^a	8.15		1.53		1.71		0.77		1.24		1.36		0.52		1.00	
Rotating work shifts ^b																
No	7.73	<0.001	1.45	<0.001	1.61	<0.001	0.81	<0.001	1.11	<0.001	1.28	<0.001	0.46	<0.001	1.01	<0.001
Yes	8.91		1.71		1.78		0.98		1.36		1.36		0.56		1.19	
Homeworking ^b																
No	8.54	<0.001	1.60	<0.001	1.75	<0.001	0.91	<0.001	1.29	<0.001	1.34	<0.001	0.54	<0.001	1.12	<0.001
Yes	7.23		1.38		1.50		0.75		0.98		1.22		0.40		0.97	<0.001
COVID-19 diagnostic																
No	8.12	<0.001	1.54	0.018	1.69	0.02	0.84	0.89	1.19	0.02	1.30	<0.001	0.49	<0.001	1.08	<0.001
Yes	10		1.81		1.91		0.87		1.43		1.65		1		1.33	
COVID-19 diagnostic in close family/friends																
No	7.94	<0.001	1.51	<0.001	1.66	<0.001	0.81	<0.001	1.16	<0.001	1.28	<0.001	0.46	<0.001	1.08	<0.001
Yes	9.32		1.73		1.83		0.99		1.36		1.42		0.71		1.33	
Age	r -0.09	<0.001	r-0.13	<0.001	r-0.19	<0.001	r 0.06	<0.001	r-0.15	0.27	r-0.01	0.21	r 0.09	<0.001	r-0.20	<0.001
Hours stayed in bed	r 0.03	0.01	r-0.01	0.78	r 0.12	<0.001	r-0.35	<0.001	r 0.29	<0.001	r0.02	0.14	r 0.02	0.03	r-0.02	0.04
Hours asleep	r -0.7	<0.001	r-0.43	<0.001	r-0.37	<0.001	r-0.93	<0.001	r-0.66	<0.001	r-0.29	<0.001	r-0.15	<0.001	r-0.25	<0.001

^a TRS: Temporary Redundancy Scheme.

^b Participants without a job were excluded.

Table 4
Sleep Quality Linear model.

Coefficients	Estimate	Std. error	t value	Pr (> t)
(Intercept)	15.60	0.35	44.33	<0.001
Gender: Female	1.17	0.1	11.76	<0.001
Age	-0.03	0.003	-8.32	<0.001
Employment: Unemployed	0.65	0.15	4.44	<0.001
Employment: TRS ^a	0.54	0.13	4.25	<0.001
Rotating Work shifts: Yes	0.53	0.11	4.81	<0.001
Homeworking: Yes	-0.19	0.11	-1.78	0.07
COVID diagnostic: Yes	0.91	0.29	3.14	0.001
COVID diagnosed in close family/friends: Yes	0.67	0.12	5.55	<0.001
Hours asleep	-2.46	0.03	-76.31	<0.001
Hours stayed in bed	1.01	0.03	30.03	<0.001

R-squared: 0.6194, p-value: <0.001.

^a TRS: Temporary Redundancy Scheme.

Considering PSQI dimensions, this research obtained higher scores in all of the areas (subjective sleep quality, latency, duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction) when compared to the only

existing study that used PSQI during this pandemic, which was carried out in Italy [26]. In comparison, the results show that the Spanish population had poorer quality of sleep. It is worth mentioning that our study was carried out one month after the

extraordinary measures were put in place by the Spanish Government whereas the Italian research was undertaken out in the first ten days. This data may indicate that the quality of sleep gets worse the longer people are in lockdown, which makes it interesting for future studies to carry out a prospective longitudinal analysis on the evolution of those same individuals, in order to confirm this hypothesis.

Although the difference observed between our study and the studies carried out in China is minimal (global PSQI score of 8.48 and 8.58 vs 8.17 in our research) [25,31], the data was collected during the weeks of maximum prevalence of COVID-19 in both countries, which suggests a slightly better quality of sleep for the Spanish population. On the other hand, it is true that the authors associate better sleep quality of the general population with social capital [25], it seems that social support does not have the same influence in health workers [31]. It would be interesting to investigate the reasons that could explain these results through the analysis of participant's individual characteristics, with regards to their personality traits and resilience.

Furthermore, other studies on sleep quality in disaster situations, such as the L'Aquila earthquake in Italy in 2009 [37] or the Kermanshah earthquake in Iran in 2017 [38], have obtained a lower score than the one in our study. While the threat status is not comparable, the impact of sleep on people has proven to be higher during this pandemic, probably due to a greater perception of the problem.

Regarding quantitative aspects of sleep, participant's average hours of sleep per day (6.55 h) was found to be lower than the Spanish average before COVID-19, set at 7.27 h [39]. The number of hours slept is thus below the national official recommendations, which state a minimum of 7 h of sleep for adults between 18 and 64 years of age [40].

Our study has also shown poorer sleep quality in women and people who work in rotating shifts, thus corroborating the results of other recent studies [26–28,41–44] which identify work distribution as a determinant (and modifiable) factor for sleep quality in times of pandemic, for women in particular. In addition, our study showed that people who slept accompanied obtained better results regarding quality of sleep. These results are in line with other studies conducted in Hong Kong [29] and Italy [27], in which people who stayed alone during the enclosure period showed a poorer quality of sleep. Our study has also shown that elderly population had a better quality of sleep than younger adults; results that are in accordance with the studies carried out in Italy [26,27]. This finding seems to suggest that older population has adapted better to the pandemic, and it would be interesting to analyse the possible reasons that can explain and confirm this. Perhaps individual resilience derived from previous life experiences is a determining factor in this case.

Another one of the variables that has been associated with sleep quality has been the one related to working conditions. Many companies whose activity has been considered essential by the Spanish government have needed to adapt their procedures in order to avoid face-to-face contact with consumers; this includes the education and health care sectors. Our study has confirmed that people who have to work on site have a poorer quality of sleep than people who work from home. This result may be related to the fear of contagion or to the stress caused by organisational changes in their companies [45]. This study has also shown that being unemployed or affected by a Temporary Redundancy Scheme was related to poorer sleep quality. This fact is in line with the results obtained by Casagrande et al. [26] and Gualano et al. [27] where survey participants with no working issues during lockdown slept better. The results of this study support that the lockdown may have possible consequences on the quality of sleep, as suggested by the CBT-I Academy [18] and

confirmed by studies in Hubei [45], which showed that working status and health condition may lead to poorer sleep quality. We did not find any other studies analysing the presence of symptoms associated with poorer sleep quality during the COVID-19 pandemic, nevertheless these are usually associated with an alteration in sleep quality [46].

The coronavirus crisis has had a great impact on health, causing stress and anxiety both among the general population [23,32,33] and among health professionals [24,45,47]. Therefore, it is important to establish prevention measures focussing on the mental health of frontline workers; measures that have already been proven effective with nurses who treated patients diagnosed with SARS in the 2003 SARS outbreak [48].

The outcome of this research confirms there is a relationship between COVID-19 disease (either being infected, or having a family member or acquaintance infected or deceased) and a worse quality of sleep. These results are also in accordance with other researches undertaken in Italy and China [26,48] which suggest a possible relationship between the clinical aspect of the disease and the anxiety caused by not knowing the consequences the illness may have in oneself, friends and family. Finally, the explanatory power of the model constructed in this study indicates that there are other variables that could be evaluated in the future in order to assess factors related to the quality of sleep, such as physical activity or social relationships.

This study shows a decrease in sleep quality during the lockdown period, making it necessary to develop prevention plans (campaigns promoting healthy lifestyles) and to act upon these new situations, placing special emphasis on the social groups that showed the greatest decrease in their sleep quality.

5.1. Limitations

The limitations of this research derive mainly from its design, as the study serves better to identify predictions for potential causal inferences rather than associations. First of all, it has not been possible to follow up the evolution of the participants: it would be interesting to carry out a longitudinal examination of sleep quality, in a way that allows measuring possible variations according to specific moments in time during lockdown. Secondly, although the sampling strategy used allowed us to recruit hard-to-reach population, it is possible that we were not able to reach users without access to social media. On the other hand, it would have been interesting to study other variables such as medical history, usual medication, physical exercise, music or the participants' individual characteristics and personality traits.

6. Conclusion

We were able to confirm that the Spanish population has experienced poor quality of sleep during the lockdown period. Being a woman, working in rotating shifts, having suffered from COVID-19 or having someone close suffering from COVID-19, being unemployed or being affected by a Temporary Redundancy Scheme, as well as spending long hours in bed were associated with poorer sleep quality. On the contrary, being older and sleeping longer hours were associated with a better sleep quality.

CRediT authorship contribution statement

Alba Maestro-Gonzalez: Conceptualization, Methodology, Software, Writing - original draft. **Marta Sánchez-Zaballos:** Data curation, Writing - original draft. **María Pilar Mosteiro-Díaz:** Writing - review & editing. **David Zuazua-Rico:** Visualization, Investigation, Software, Validation, Supervision.

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Conflict of interest

No conflict of interest has been declared by the authors.

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