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Original Article

Sleep quality in times of Covid-19 pandemic

Josué Pinto ^{a,*,1}, Mafalda van Zeller ^{a,b}, Pedro Amorim ^{a,b}, Ana Pimentel ^{a,b},
 Patrícia Dantas ^a, Ermelinda Eusébio ^a, Andreia Neves ^a, Joana Pipa ^a,
 Elisabete Santa Clara ^a, Teresa Santiago ^a, Paulo Viana ^a, Marta Drummond ^{a,b}

^a Department of Pulmonology, Centro Hospitalar Universitário de São João, Porto, Portugal

^b Faculty of Medicine of Porto University, Portugal



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ABSTRACT

Background: Due to the 2019 novel coronavirus (COVID-19) disease outbreak, social distancing measures were imposed to control the spread of the pandemic. However, isolation may affect negatively the psychological well-being and impair sleep quality. Our aim was to evaluate the sleep quality of respiratory patients during the COVID-19 pandemic lockdown.

Methods: All patients who underwent a telemedicine appointment from March 30 to April 30 of 2020 were asked to participate in the survey. Sleep difficulties were measured using Jenkins Sleep Scale.

Results: The study population consisted of 365 patients (mean age 63.9 years, 55.6% male, 50.1% with sleep-disordered breathing [SDB]). During the lockdown, 78.9% of participants were confined at home without working. Most patients (69.6%) reported at least one sleep difficulty and frequent awakenings was the most prevalent problem. Reporting at least one sleep difficulty was associated with home confinement without working, female gender and diagnosed or suspected SDB, after adjustment for cohabitation status and use of anxiolytics. Home confinement without working was associated with difficulties falling asleep and waking up too early in the morning. Older age was a protective factor for difficulties falling asleep, waking up too early and non-restorative sleep. Notably, SDB patients with good compliance to positive airway pressure therapy were less likely to report sleep difficulties.

Conclusions: Home confinement without working, female gender and SDB may predict a higher risk of reporting sleep difficulties. Medical support during major disasters should be strengthened and potentially delivered through telemedicine, as this comprehensive approach could reduce psychological distress and improve sleep quality.

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1. Introduction

On January 30, 2020, World Health Organization declared the global 2019 novel coronavirus (COVID-19) disease outbreak a public health emergency of international concern [1]. The lockdown was declared in Portugal at March 18 and it was a reality until May 3 [2].

The awareness of human-to-human SARS-Cov-2 transmission [3,4] associated with high morbidity and potential mortality rate has caused serious threats to people's physical health and lives. Dubious or even false information about factors related to virus infection, the absence of effective therapy and lack of a vaccine has led to insecurity and fear in the population.

In addition, changes in family organization and working routines, social isolation and domiciliary confinement can induce feelings of helplessness, abandonment, loneliness, insomnia and anger [5].

Fear is an adaptive defense mechanism that is fundamental for survival and involves several biological processes of preparation for a response to potentially threatening events. However, when it is disproportionate, it becomes harmful and can induce several psychiatric disorders [6,7]. In a pandemic, fear increases anxiety, stress levels and insomnia in healthy individuals and intensifies the symptoms of those with pre-existing psychiatric disorders [5]. In previous epidemic situations, the number of those whose mental health was affected tended to be greater than the number of people infected by the disease [8].

Thus, it is of extreme importance to implement public health policies, including assistance protocols concerning individual and collective mental health in conjunction with pandemic response strategies during and after the event.

* Corresponding author.

E-mail address: josue.mpinto@gmail.com (J. Pinto).

¹ Permanent address: Centro Hospitalar Universitário de São João, Alameda Professor Hérnani Monteiro, 4200-319 Porto, Portugal.

To our knowledge, there is no research data regarding sleep quality in the general Portuguese population during COVID-19 pandemic. Therefore, the aim of the present study was to evaluate the sleep quality of respiratory patients who underwent a telemedicine appointment during the Portuguese lockdown.

2. Material and methods

2.1. Study population

During the COVID-19 pandemic lockdown, all medical appointments in the Pulmonology Department were performed using telemedicine. This survey was conducted from March 30 to April 30 of 2020 and all patients were asked to participate. This study was approved by the ethics committee of Hospital São João.

2.2. Instruments

Sleep quality was evaluated using the Jenkins Sleep Scale (JSS) [9], already translated and validated to the Portuguese language [10]. This 4-item questionnaire was administered during a phone medical appointment, in which patients were inquired about the frequency of each of the following problems during the previous four weeks: difficulties falling asleep, frequent awakenings during the night, waking up too early in the morning and non-restorative sleep. There were six response alternatives: never (0), 1–3 days (1), 4–7 days (2), 8–14 days (3), 15–21 days (4), and 22–31 days (5). The participant was considered to have a sleep difficulty if the frequency was equal or higher than 8 to 14 nights in the previous 4 weeks. Both having any sleep difficulties and the specific sleep difficulties were dichotomized.

We further inquired about cohabitation status (living alone or not) and working situation (at the workplace, telework or not working). Additional data was collected, namely demographics, current medication, respiratory diseases and diagnosis of sleep-disordered breathing (SDB). If the latter was present, Epworth Sleepiness Scale (ESS) was assessed and, if under positive airway pressure (PAP) therapy, treatment efficacy was evaluated by means of residual Apnea-Hypopnea Index (AHI) and compliance. The severity of sleep apnea syndromes was defined using AHI. In chronic obstructive pulmonary disease (COPD) patients, airflow limitation was classified according to Global Initiative for Chronic Obstructive Lung Disease (GOLD) report [11]. In asthmatics, the ongoing treatment was categorized according to the Global Initiative for Asthma (GINA) guidelines [12]. The various drugs were classified according to the Anatomical Therapeutic Chemical classification system [13].

2.3. Statistical analysis

Categorical variables are presented as frequencies and percentages, and continuous variables as means and standard deviations (SD) or medians and interquartile ranges (IQR) for variables with skewed distributions.

Univariate effects were evaluated by simple logistic regression models. Multiple logistic regression modelling was used to identify the simultaneous effects of potential risk factors for sleep disturbances as measured by the JSS. Additionally, separate logistic regression models were used to compare differences in predictor variables between each specific sleep difficulty. Selection of the final model was based on backwards elimination algorithm combined with the results from univariate analysis. These variables were selected *a priori* based on several known predictors of sleep disturbance, such as sociodemographic characteristics [14,15] and health-related conditions [16,17].

We computed JSS responses to yield a mean score and used Spearman's correlation to assess the correlation between mean JSS score and data regarding treatment efficacy.

Statistical analysis was performed using SPSS Statistics version 26.

3. Results

A total of 365 patients were surveyed, whose clinical characteristics and isolation status are summarized in Table 1. During the lockdown, 78.9% of patients were confined at home without working, of which 58% were already retired. The remaining patients were working as usual at their workplace (16.4%) or working remotely from home (4.7%). Approximately half of the patients had a confirmed diagnosis of SDB, namely obstructive sleep apnea (18.6% mild, 44.8% moderate and 36.6% severe), OSA with obesity hypoventilation syndrome (OHS), OSA and CPOD overlap syndrome, and central sleep apnea (CSA). Of these, 80.3% were under PAP treatment. Among patients without SDB, the majority had obstructive lung disease: COPD (39%), asthma (39%), asthma-COPD overlap (12.2%) and bronchiectasis (9.8%). Airflow limitation was classified as severe and very severe in 40.6% and 12.5% of COPD patients, respectively. In asthmatics, 43.8% and 15.6% were on GINA treatment steps 4 and 5, respectively.

Female sex was associated with living alone (OR 2.19, $p = 0.016$) and with use of antidepressants and anxiolytics (OR 2.76 and 2.19, $p < 0.001$, respectively). Patients that lived alone and were confined at home without working were older ($p = 0.002$ and $p < 0.001$, respectively). Patients with sleep-disordered breathing were more likely to be male (OR 1.73, $p = 0.010$) and to use hypnotics (OR 2.76, $p = 0.010$).

Altogether, 69.6% of the participants reported at least one sleep difficulty and frequent awakenings was found to be the most prevalent difficulty ($n = 200$, 54.8%). Remarkably, 11% of patients reported difficulties in all of the evaluated sleep problems. The variables associated with reported sleep disturbances are presented in Table 2. Participants reporting at least one sleep difficulty were more likely to be confined at home without working, female and with suspected SDB or objectively diagnosed SDB under PAP

Table 1
Characteristics of study population.

Age (years)	63.9 ± 13.1	
Male sex	203	(55.6)
Sleep disordered breathing		
OSA	134	(36.7)
OSA and OHS	36	(9.9)
Overlap syndrome	8	(2.2)
CSA	5	(1.3)
no SDB	151	(41.4)
suspected SDB	31	(8.5)
Respiratory disease		
obstructive lung disease	82	(22.5)
respiratory infections	21	(5.6)
interstitial lung disease	4	(1.1)
other diseases	44	(12.1)
Prescription drugs		
anxiolytics	88	(24.1)
antidepressants	80	(21.9)
hypnotics and sedatives	32	(8.8)
Living alone	44	(12.1)
Working situation		
home confinement without working	288	(78.9)
working remotely from home	17	(4.7)
workplace	60	(16.4)

Notes: Data is presented as n (%) or mean ± SD; SD: standard deviation; OSA: obstructive sleep apnea; OHS: obesity hypoventilation syndrome; CSA: central sleep apnea; SDB: sleep-disordered breathing.

therapy, when compared to those without any sleep difficulty, after adjustment for cohabitation status and use of anxiolytics.

The variables associated with each type of sleep difficulties are presented in Table 3. Home confinement without working was associated with both difficulties falling asleep and waking up too early in the morning and showed a positive tendency for frequent awakenings. On the other hand, those who continued to work as usual were more likely to complain about non-restorative sleep. Likewise, patients with suspected SDB were also more likely to report non-restorative sleep. Female gender was associated with complaints of difficulties falling asleep and non-restorative sleep. Hypnotics use was negatively associated with difficulties falling asleep but was positively related with non-restorative sleep. Interestingly, patients over 65 years old were less likely to complain about difficulties falling asleep, waking up too early and non-restorative sleep.

Among patients with previously diagnosed SDB and under PAP therapy, those with adequate minimal use (at least 4 h per night for at least 70% of nights) were less likely to report any sleep difficulty (OR 0.40; $p = 0.054$) or complain about non-restorative sleep (OR 0.39; $p = 0.013$). Additionally, PAP adherence showed a moderate negative correlation with the JSS mean score ($r = -0.313$, $p < 0.001$). There were no statistically significant differences regarding residual AHI and ESS.

In patients without SDB, none of the remaining respiratory disorders was associated with sleep difficulties. Furthermore, there was no relationship between reported sleep difficulties and disease severity in COPD and asthma patients.

4. Discussion

This study assessed the sleep difficulties of respiratory patients during the lockdown caused by the coronavirus pandemic. The authors decided to apply the JSS as it is a brief instrument that can be administered through a phone interview and has been shown to possess good predictive value in previous studies [9,18]. The selection of the cut-off point for sleep difficulty was based on criteria from the Diagnostic and Statistical Manual of Mental Disorder, Fourth Edition (DSM-IV) [19], which stipulate that problems maintaining/initiating sleep or nonrestorative sleep should be present for 3 or more nights per week for at least one month. A similar cut-off point for sleep disturbance was used in other studies [18,20].

Overall, the majority of participants reported having at least one sleep difficulty. Home confinement without working was found to be the main predictor variable for reporting sleep difficulties, after adjustment for confounding variables. Moreover, working situation was associated with each of the inquired sleep

difficulties, as those who are confined at home without working have a higher risk of reporting difficulties falling asleep, frequent awakenings during the night and waking up too early in the morning, while those who are working as usual are more likely to report non-restorative sleep. Such findings are similar to previous observations that unemployment is associated with poorer sleep quality [21–23], which can be more evident in individuals without mental illness [21].

In our study, 4.7% of participants worked remotely from home, which is less than we would expect since it was a measure forced on many during the lockdown.

The study population had a slight predominance of male gender, which is expectable attending that OSA and chronic respiratory diseases in general are more prevalent in men [24,25]. Nevertheless, sleep difficulties were reported more frequently by women, as described in literature [26,27]. Also, women are more likely to take antidepressants and anxiolytics, as depression and anxiety disorders are more prevalent in women [28,29]. Depressive episodes are often accompanied by a pattern of early waking [17] and, in the present study, use of antidepressants was a risk factor for waking up too early in the morning. These results address the complex relationship between gender and sleep health, which has been taken in consideration in the multivariate models.

Older age (specifically over 65 years old) was a protective factor for reporting difficulties falling asleep, waking up too early and non-restorative sleep. This suggests a worse response to the lockdown in younger patients, which may be explained given that lifestyle changes were more pronounced in this group, while simultaneously facing employment and economic insecurity.

Patients with confirmed or suspected SDB were more likely to report sleep difficulties, specifically frequent awakenings during the night, which is comprehensible since nocturnal symptoms are typical of sleep disorders such as OSA [16]. Remarkably, we observed that SDB patients with adequate use of PAP therapy (in terms of compliance) were less likely to report any sleep difficulty, in particular non-restorative sleep, which is supported by the negative correlation between adherence to treatment and JSS score. Overall, these results suggest that an effective control of SDB greatly minimizes its symptoms.

To our knowledge, this is the first study to evaluate the sleep quality of Portuguese population during the lockdown caused by COVID-19 pandemic. However, there are some limitations that need to be addressed. First, the reported sleep difficulties were subjective and not objectively measured by actigraphy or polysomnography, attending to the imposed social distancing. Second, all subjects had respiratory diseases that might affect sleep quality

Table 2
Univariate and multivariate logistic regression analysis for reporting at least one sleep difficulty.

Variable	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Female	2.17 (1.36–3.47)	0.001	2.46 (1.49–4.07)	<0.001
Age (>65 years)	0.94 (0.60–1.47)	0.790		
Lives alone	2.13 (0.95–4.74)	0.065	2.03 (0.88–4.70)	0.098
Home confinement	1.88 (1.12–3.17)	0.018	2.15 (1.23–3.78)	0.008
Workplace	0.51 (0.27–0.89)	0.019		
Working from home	0.79 (0.29–2.20)	0.655		
Anxiolytics	0.80 (0.48–1.33)	0.390	0.58 (0.34–1.01)	0.055
Antidepressants	1.82 (1.01–3.29)	0.046		
Hypnotics	0.82 (0.38–1.76)	0.610		
No SDB	0.81 (0.51–1.26)	0.346		
Suspected SDB	1.91 (0.76–4.80)	0.168	3.08 (1.14–8.35)	0.027
SDB without PAP	0.66 (0.32–1.34)	0.247		
SDB under PAP	1.22 (0.77–1.93)	0.390	1.79 (1.08–2.97)	0.024

Notes: OR: odds ratio; CI: confidence interval; SDB: sleep-disordered breathing; PAP: positive airway pressure.

Table 3
Multiple logistic regression models for reporting each specific sleep difficulty.

Difficulty falling asleep			Non-restorative sleep		
Variable	p-value	aOR (95% CI)	Variable	p-value	aOR (95% CI)
Home confinement	<0.001	5.21 (2.45–11.11)	Female	<0.001	3.21 (1.98–5.20)
Female	<0.001	2.45 (1.51–3.96)	Hypnotic	0.068	2.06 (0.95–4.46)
Hypnotic	0.044	0.39 (0.16–0.98)	Workplace	0.032	4.24 (1.13–15.88)
Antidepressant	0.091	1.62 (0.93–2.82)	Suspected SDB	0.005	3.23 (1.43–7.29)
Age (>65 y)	0.014	0.54 (0.33–0.88)	Age (>65 y)	0.032	0.57 (0.35–0.95)
Waking up too early in the morning			Frequent awakenings		
Variable	p-value	aOR (95% CI)	Variable	p-value	aOR (95% CI)
Home confinement	0.003	2.57 (1.37–4.80)	No SDB	0.009	0.56 (0.36–0.87)
Antidepressant	0.039	1.73 (1.03–2.93)	Home confinement	0.064	1.64 (0.97–2.76)
Age (>65 y)	<0.001	0.41 (0.26–0.67)			

Notes: aOR: adjusted odds ratio; CI: confidence interval; SDB: sleep-disordered breathing.

and thus these results cannot be extrapolated to the general population.

In conclusion, our findings suggest that more attention should be paid to vulnerable groups such as women, home bounded, not working and presenting with SDB. Accessibility to medical resources for psychological first aid during major disasters should be further strengthened and potentially delivered through telemedicine. Recognizing and treating insomnia is especially important during stressful times like COVID-19 pandemic and doctors should be trained to assess and treat sleep disturbances, as this comprehensive approach could reduce psychological distress and prevent further mental health problems.

CRedit authorship contribution statement

Josué Pinto: Investigation, Data curation, Formal analysis, Writing - original draft, Visualization. **Mafalda van Zeller:** Visualization, Writing - review & editing. **Pedro Amorim:** Investigation. **Ana Pimentel:** Investigation. **Patrícia Dantas:** Investigation. **Ermelinda Eusébio:** Investigation. **Andreia Neves:** Investigation. **Joana Pipa:** Investigation. **Elisabete Santa Clara:** Investigation. **Teresa Santiago:** Investigation. **Paulo Viana:** Investigation. **Marta Drummond:** Conceptualization, Methodology, Investigation, Supervision, Writing - review & editing.

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Conflict of interest

None.

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: <https://doi.org/10.1016/j.sleep.2020.07.012>.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.sleep.2020.07.012>.

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