

SCIENTIFIC INVESTIGATIONS

Impact of the novel coronavirus disease on treatment adherence and sleep duration in patients with obstructive sleep apnea treated with positive airway pressure

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Study Objectives: The study objective was to examine the effect of coronavirus disease on treatment adherence and self-reported sleep duration among patients with obstructive sleep apnea (OSA) treated with positive airway pressure therapy.

Methods: This was a retrospective review of medical records of patients seen in the Sleep and Circadian Clinic at Brigham Health during the immediate period of 1 month after the national lockdown was announced on March 15, 2020. Patients with OSA were included only if positive airway pressure adherence data were available in the 12 months before and in the month after the lockdown. Patients with other sleep disorders and patients with OSA without adherence data were excluded.

Results: The mean age of the patients was 63.5 ± 13.9 years, 55% of the participants were men, and the mean body mass index was 31.8 ± 7.9 kg/m². Severe OSA was noted among 59.5% compared with 29.3% with moderate OSA, and 11.2% with mild OSA. An increased number of patients reported insomnia after the lockdown (41% vs 48%, $P = .02$). Sex stratification showed worsening insomnia only among women. There was no significant difference in positive airway pressure adherence as measured by hours of use, self-reported sleep duration, or use of sleep medications.

Conclusions: Post–coronavirus disease lockdown had a negative impact on sleep as evidenced by increased reporting of insomnia, particularly among women, but no impact on positive airway pressure adherence or self-reported sleep duration.

Keywords: obstructive sleep apnea; COVID-19; positive airway pressure; insomnia; sleep duration

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BRIEF SUMMARY

Current Knowledge/Study Rationale: The coronavirus disease pandemic in the United States resulted in a voluntary national lockdown on March 15, 2020. The impact on sleep duration and positive airway pressure use has not been well studied.

Study Impact: The post–coronavirus disease lockdown negatively affected sleep, resulting in an increase in insomnia without changes in positive airway pressure use and self-reported sleep duration. Further studies should be performed to assess the impact of the coronavirus disease pandemic on sleep.

INTRODUCTION

In December 2019, a severe and lethal respiratory infection appeared in Wuhan, China, and subsequently was found to be caused by a novel coronavirus: SARS-CoV-2.¹ The worldwide pandemic of coronavirus disease (COVID-19) rapidly ensued. The first case of COVID-19 in the United States occurred in January 2020² and quickly spread across the country. California issued the first order to avoid non-essential outdoor activities in mid-March. The Massachusetts governor declared a state of emergency on March 10, 2020. This was followed on March 15 by closure of all schools, restriction of gatherings to 25 or fewer persons, and prohibiting onsite consumption of food and beverage. However, he did not announce a forced shelter in place and only urged residents to obey guidelines regarding social distancing.

Also, on March 15, the federal government announced a voluntary national shut down with recommendations that schools close, gatherings be limited to 10 or fewer persons, and avoidance of discretionary travel and use of bars and restaurants. Several states subsequently enforced social distancing and adopted more comprehensive and restrictive policies including statewide mandatory quarantine. As a result, most of the US population confined themselves to their residence and were unemployed or working from home.

A well-functioning sleep-wake cycle is vital to our health, immune system, and prevention of chronic diseases. At least 7 hours of sleep is recommended for optimal health by the American Academy of Sleep Medicine.³ During reports of previous natural disasters and other crises where the general population was under severe psychologic stress, sleep disturbances, particularly insomnia, increased.^{4–6}

Moreover, during the 2003 SARS outbreak, sleep difficulties were common among family members of patients.⁷ Similarly, initial reports from China during the current COVID-19 pandemic have documented increased rates of insomnia and anxiety.⁸ However, despite the relative frequency of such disasters and crises, there are few reports of their impact on sleep duration. A review of disaster medical records after the 2011 Great East Japan earthquake noted an increase in sleep deprivation especially among women, but hours of sleep were not reported.⁵

Obstructive sleep apnea (OSA) may affect as many as 26% of adults.⁹ Positive airway pressure (PAP) is the most common form of treatment and improves the poor sleep quality and daytime sleepiness associated with OSA. However, PAP adherence is sometimes difficult to achieve; comorbid insomnia and anxiety maybe factors that are important in limiting use.¹⁰ In this study, we hypothesized that hours of objective PAP adherence and self-reported sleep duration would be adversely affected by the stress and anxiety caused by COVID-19 and home confinement.

METHODS

Design

A retrospective review of medical records was conducted of patients who attended the Sleep and Circadian Disorder clinics at Brigham Health before and after the announcement of the COVID-19 lockdown. The study was approved by the Institutional Review Board at Mass General Brigham.

Study population

The study population consisted of patients with OSA seen in the clinic during the immediate period of 1 month after the national lockdown was announced on March 15, 2020. A total of 588 clinic encounters were reviewed, of which 30 patients had in person clinic visits, and 558 were done virtually. Patients with OSA were included in this study if continuous PAP adherence data were available in the 12 months before and in the month after the COVID-19 lockdown. Patients with other sleep disorders such as restless legs syndrome, narcolepsy/idiopathic hypersomnolence, and insomnia without OSA were excluded. Although many elective medical visits and procedures were deferred in the aftermath of the lockdown, our clinic rapidly converted to telemedicine, and patients seen were not urgent but those who already had visits scheduled. Additionally, patients with OSA on alternative treatments were also excluded. This resulted in 123 patients with data from both time periods who were included in the analytic cohort.

Data collected

Using the electronic medical records, information on age, sex, and body mass index (kg/m^2) was collected. Using clinician documentation, we collected data on OSA severity, self-reported sleep duration, self-reported complaints of insomnia and anxiety, and the use of sedative-hypnotic medications. Mean hours of PAP use was obtained from the 30-day

Table 1—Effects of COVID-19 lockdown.

	n	Before COVID-19	After COVID-19
PAP use, hr (standard deviation)	123	5.97 ± 1.9	5.87 ± 2.1
Anxiety, n (%)	73	28 (38)	30 (41)
Insomnia, n (%)*	98	40 (41)	47 (48)
Sleep duration, hr (standard deviation)	123	6.5 ± 2.3	6.7 ± 1.4
Use of sleep medication, n (%)	98	32 (33)	35 (36)

* $P < .02$.

compliance report downloaded from the PAP device that was scanned into the patient's electronic medical records.

Statistics

All statistical analyses were done using STATA version 11 (StataCorp, LLC, College Station, TX). For baseline characteristics, mean (standard deviation) for continuous variables and number and percentages for categorical variables were calculated. To test for differences in variables before and after the COVID-19-imposed lockdown, a Student paired *t* test was used for continuous variables (self-reported sleep duration and objective PAP use), and McNemar's χ^2 test was used for binary paired data (anxiety, insomnia, and use of medications). Statistical significance was set at $P < .05$, 2-tailed.

RESULTS

The mean age of the cohort was 63.5 ± 13.9 years; more than half were men (55%). Mean body mass index was $31.8 \pm 7.9 \text{ kg}/\text{m}^2$; mild, moderate, and severe OSA were present in 11.2%, 29.3%, and 59.5%, respectively.

As shown in **Table 1**, there were no differences in hours of PAP use or self-reported sleep duration. Stratification by OSA severity did not materially change the results (data not shown). Data were available for the presence of insomnia, anxiety, and sedative-hypnotic medications in 98, 73, and 98 patients, respectively. After the lockdown, there was an increase in the number of patients with insomnia (41% vs 48%, $P = .02$). Further stratification by sex demonstrated worsening insomnia only among women (data not shown). There also was no difference in the use of sleep medications after COVID-19.

DISCUSSION

Global crises including pandemics, natural disasters, and wars are a known source of psychologic stress and may exacerbate anxiety and insomnia and adversely impact sleep quality in vulnerable populations.⁴⁻⁶ Furthermore, sleep deficiency is common among American adults. According to the Centers for

Disease Control and Prevention, 35% report less than the recommended 7 hours of sleep per night (https://www.cdc.gov/sleep/data_statistics.html). Although the presence of the lockdown and home confinement provided the opportunity to increase sleep duration, we did not observe any change in this small cohort. This is similar to reports of unchanged sleep duration among Israelis during Scud missile attacks on nights without missile attacks.⁶ However, it stands in contrast to a prior study that reported evidence of sleep deprivation after an earthquake.⁵

We also did not find a significant difference in the recorded hours of PAP use before and after the lockdown. This is in contrast to the findings of a recent study that reported an increase in PAP use in France after their lockdown.¹¹ Importantly for clinicians, however, it appears that living in an area with a large number of COVID-19 cases does not decrease PAP adherence.

Although self-reported and objective sleep duration were not different before and after the lockdown, we noted a higher prevalence in insomnia in the month after the lockdown was announced. This indicates that the patients in this cohort had an insomnia phenotype without objective short sleep duration. Insomnia is a known consequence of acute stress and is often mediated via anxiety related to ongoing stressful life events. Insomnia may present as difficulty with initiating or maintaining sleep with or without short sleep duration or perceived poor sleep quality.¹² Prior studies have documented increased insomnia symptoms during times of crises such as war,¹³ epidemics,¹⁴ and natural disasters.¹⁵ Thus, our finding is consistent with a recent study also performed during the current pandemic.¹⁶ Sex stratification showed that the observed increase in insomnia symptoms after the lockdown occurred in women. This is similar to findings of a study done during the Gulf war⁶ and consistent with the known higher prevalence in women.¹⁷

Anxiety is commonly comorbid with insomnia,¹⁸ but we did not observe any change in prevalence after the lockdown. However, our study did not examine whether there was any exacerbation of chronic anxiety symptoms after the lockdown in those who were already afflicted.

To our knowledge this is the first study examining the effect of the COVID-19–related lockdown on self-reported sleep duration for patients using PAP. However, we acknowledge some limitations. First, we reviewed medical records of patients seen in the sleep clinic and did not have a healthy control group. However, our primary goal was to identify changes in sleep duration and hours of PAP use after the onset of the pandemic. A second limitation is that we only included patients if PAP use was available. It is possible that patients with older PAP devices where PAP adherence data were not available were missed and therefore affected the interpretation of this study.

Another limitation is the short duration of the study and the limited cohort size, because only records of patients seen immediately after the lockdown were reviewed. It is possible that psychosocial stress and worsening mental health in the face of lockdown and economic downturn prevented some individuals from seeking medical help. In addition, it is likely that some patients did not have access to telemedicine or were unaware of its availability. This may have disproportionately affected

patients who had low socioeconomic status or were a racial/ethnic minority. It could have caused sampling bias and skewed the interpretation of our data. However, we think this is a small number because patients without video capabilities had their visits performed by telephone, and interpreters were available for those with a language barrier. Last, we acknowledge that the information on insomnia and anxiety was solely dependent on self-reports and provider documentation. It is well known that self-reports are influenced by participants' mood on a particular day. Therefore, larger studies with systematic documentation of insomnia and anxiety symptoms are needed to replicate the findings of this study.

In conclusion, the post–COVID-19 lockdown negatively affected sleep, resulting in an increase in insomnia without changes in PAP use and self-reported sleep duration. Future long-term studies are needed to assess the effect of COVID-19–related stress on sleep duration and hours of PAP use.

ABBREVIATIONS

COVID-19, coronavirus disease 2019

OSA, obstructive sleep apnea

PAP, positive airway pressure

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DISCLOSURE STATEMENT

All authors have seen and approved the manuscript. Dr. Quan is a consultant for Jazz Pharmaceuticals, Whispersom, and Best Doctors and serves as the chair of the American Academy of Sleep Medicine Scoring Manual Committee and as a member of the American Academy of Sleep Medicine Hypopnea Taskforce. Dr. Batool serves as a consultant for Cardinal Health. Dr. Omobomi reports no conflicts of interest. A preliminary version of the paper has been posted on Medrxiv: <https://medrxiv.org/cgi/content/short/2020.06.28.20141994v1>