



## Early View

# CPAP-treated patients' behaviours during the COVID-19 crisis

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## CPAP-treated patients' behaviours during the COVID-19 crisis

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### Conflict of Interest

None of the authors has a direct conflict of interest with respect to this study.

## **Take-home message**

The COVID-19 pandemic has had limited impact on CPAP use by obstructive sleep apnoea patients. Mainly only those with suspected or proven COVID-19 stopped CPAP use, sometimes without a physician's advice, and were more likely to move to a separate bedroom.

To the Editor,

Obstructive sleep apnoea (OSA) is one of the most prevalent chronic diseases affecting nearly one billion people worldwide [1]. Continuous positive airway pressure (CPAP) is the first-line therapy for obstructive sleep apnoea (OSA) [2] being currently used by over one million people throughout France. A focus on the OSA population during the COVID-19 outbreak is of particular interest for two main reasons: (i) OSA is a multi-morbid disease with up to 70% of patients being obese [3] and exhibiting a high prevalence of cardio-metabolic comorbidities. Such a clinical context is expected to be associated with a higher risk of severe forms of COVID-19 and a higher mortality rate [4]; (ii) CPAP treatment is considered as a high-risk aerosol-generating procedure potentially facilitating viral dispersion into the environment and transmission of infection [5-7]. As a result, CPAP-treated patients have often received contradictory information regarding their individual level of risk during the pandemic and ambiguous instructions as whether to continue or stop CPAP. The objective of the current study was to describe CPAP-treated patient's beliefs and attitudes during the COVID-19 health crisis, to find out which health care workers had informed and supported them and to identify changes in their CPAP treatment behaviours.

A cross-sectional online survey was sent by a non-profit organization dedicated to quality of care and education in sleep apnoea (“Alliance apnées”) and a consortium of health care providers (Agiradom, Bastide, Elivie, Isis, La Poste (ASTEN), SOS Oxygène, Vitalaire), to approximately 110,000 CPAP-treated patients. The survey was filled out anonymously, and access to the data was restricted to study investigators only. The survey was conducted between 27 April and 17 May 2020, close to the end of lockdown and during the rapid decline of the burden of COVID-19 in France [8]. The survey contained questions on age, gender, geographic location (departments (counties in France)), family unit, and self-reported OSA severity (mild, moderate, severe). The survey questionnaire consisted of items on attitudes regarding CPAP treatment including discontinuation and changes in life habits with bedpartners. Participants also reported whether they had been diagnosed with COVID-19 by healthcare professionals with or without a confirmatory PCR test. Participants with COVID-19 diagnosis also reported about existing chronic health conditions, body mass index (BMI), and number of persons inside the family unit infected before or after the CPAP treated patient. Descriptive statistics, chi-square tests and Wilcoxon tests were conducted for comparisons.

A total of 15,306 individuals from 93 metropolitan ‘départements’ covering the majority of French counties with differing burdens of COVID-19 outbreaks participated in the study with data analysable for 13,994 (Figure 1). Patients self-reported moderate (20.7%) to severe (46%) OSA with 99.3% of included subjects being treated by CPAP and 0.7% by oral appliances. The overall population consisted of predominately men (67.1%) with 22.6% aged 51 to 60 years and 61.9% older than 60 years. 464 (3.3%) indicated suspected or proven (53/464, 11.4%) COVID-19 infection. During the COVID-19 outbreak only a small percentage (15.2%) of CPAP-treated patients received specific advice regarding the COVID-19 outbreak

and CPAP usage. Information mainly came from homecare providers (84.9 %) and respiratory physician prescribers (6.6%). Only 11.8% have benefited from teleconsultations with respiratory physicians during the crisis.

During the COVID-19 health crisis, 590 (4.4%) have stopped CPAP treatment. Discontinuing CPAP treatment followed a physician's request (n=21, 3.8%) after confirmation or suspicion of COVID-19 infection (15 patients) and during hospitalization for COVID-19 infection (6 patients). Also, patients stopped their treatment without medical advice, 174 (31.5%), as a precaution and on their own initiative because they were experiencing symptoms evoking COVID-19 (73 patients) or free of symptoms but not willing of taking a risk of contamination of household members (101 patients), and 64.7 % ticked the answer "other", some adding a free text explanation. Of patients discontinuing CPAP, respectively 33% and 42% of those stopping at their own initiative were living either alone or with one or more persons.

Regarding sleeping arrangements, only 4.5% have started to sleep in separate rooms since the beginning of the outbreak, 69.8% were still sleeping in the same room and 14.5% continued their previous behaviour of sleeping in two separate rooms.

The CPAP-treated subgroup infected with COVID-19 (median BMI [IQR]: 30.7 [27 ; 35] kg/m<sup>2</sup>; type 2 diabetes: 14%, hypertension: 38%, asthma: 15.6%) reported essentially moderate disease with only 24 (5.2%) requiring hospitalization including 6 ICU admissions. A higher percentage of infected patients discontinued CPAP (21.8 versus 4%: infected versus non-infected patients respectively, p<0.01). To minimize risks to household members, a higher percentage of infected patients moved to a separate bedroom (17.7 versus 4.2%: infected versus non infected patients respectively, p<0.01). The rate of household members

infected after diagnosis in a CPAP-treated patient was similar to the rate of contamination before diagnosis in the CPAP-treated patient.

This survey is the first to assess knowledge, attitudes and behaviours of CPAP-treated patients in response to the COVID-19 pandemic. The prevalence rate of CPAP-treated patients suspected or with proven infection with COVID-19 was 3.3%. This is equivalent to the proportion of the French population infected during the same period of time [8]. The burden of COVID-19 marginally affected CPAP treatment behaviours with only 4.4 and 4.5% of patients respectively discontinuing CPAP or starting to sleep in separate rooms. These percentages went-up to around 20% in cases of suspected or proven COVID-19 infection suggesting that the CPAP associated risk for household members was unknown or underappreciated. An admitted recommendation in this situation is not only self-isolation but also implementation by homecare providers of non-vented masks with a viral filter, reducing the spread significantly during CPAP treatment [5-7].

We found that 28/464 (6%) of CPAP-treated patients with suspected or proven infection were hospitalized which again is consistent with the 3.9% and 8% respectively reported in a representative male French population in the range of 50-59 and 60-69 years [8]. Once hospitalized, on average in France for the same subgroups, 33 and 37% patients entered ICU [8] compared to 6/28 (21.4%) in our survey. Overall, our data do not suggest any obvious increase in risk associated with sleep apnoea. The majority of survey responders were regular CPAP users and for a large majority continued treatment during the COVID-19 outbreak potentially limiting the negative impact of untreated OSA. However, there is a possibility of bias as subgroups with long-lasting hospitalizations or early death were not included in the survey. The percentage of survey responders was low and we cannot exclude a selection bias; nevertheless the responding population was nearly 14,000. Moreover, in

open text replies nearly 65% of those who stopped reported the usual reasons leading to CPAP discontinuation outside a pandemic period i.e. psychological reasons, discomfort and side effects. These potential limitations to the representativeness of the sample must be addressed by designing exhaustive sampling methods of administrative databases combining OSA diagnosis and hospitalizations for COVID-19.

This large national survey highlights the limited impact of the COVID-19 pandemic on CPAP use behaviours; in agreement with limited changes in CPAP adherence objectively assessed by telemonitoring and probably related to sleep habits during lockdown [9]. Such a health crisis underlines the importance of coordinating management and patient education among all caregivers involved in CPAP long-term home treatment.

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## References.

1. Benjafield AV, Pepin JL, Valentine K, Cistulli PA, Woehrle H, Nunez CM, Armitstead J, Malhotra A. Compliance after switching from CPAP to bilevel for patients with non-compliant OSA: big data analysis. *BMJ Open Respir Res* 2019; 6: e000380 doi: 10.1136/bmjresp-2018-000380
2. Levy P, Kohler M, McNicholas WT, Barbé F, McEvoy RD, Somers VK, Lavie L, Pépin JL. Obstructive sleep apnoea syndrome. *Nat Rev Dis Primers* 2015; 1: 15015 doi: 10.1038/nrdp.2015.15
3. Pepin JL, Timsit JF, Tamisier R, Borel JC, Levy P, Jaber S. Prevention and care of respiratory failure in obese patients. *Lancet Respir Med* 2016; 4: 407-418.
4. McSharry D, Malhotra A. Potential influences of obstructive sleep apnea and obesity on COVID-19 severity. *J Clin Sleep Med* 2020. doi: 10.5664/jcsm.8538
5. Baker JG, Sovani M. Case for continuing community NIV and CPAP during the COVID-19 epidemic. *Thorax* 2020; 75: 368. doi: 10.1136/thoraxjnl-2020-214913.
6. Barker J, Oyefeso O, Koeckerling D, Mudalige NL, Pan D. COVID-19: community CPAP and NIV should be stopped unless medically necessary to support life. *Thorax* 2020 75:367. doi: 10.1136/thoraxjnl-2020-214890
7. Krishnan V. COVID-19 and Home Positive Airway Pressure (PAP) Therapy. *Am J Respir Crit Care Med* 2020; 201: 28-29. doi: 10.1164/rccm.2020C6
8. Salje H, Tran Kiem C, Lefrancq N, Courtejoie N, Bosetti P, Paireau J, Andronico A, Hozé N, Richet J, Dubost CL, Le Strat Y, Lessler J, Levy-Bruhl D, Fontanet A, Opatowski L, Boelle PY, Cauchemez S. Estimating the burden of SARS-CoV-2 in France. *Science* 2020; eabc3517. doi: 10.1126/science.abc3517.
9. Attias D, Pepin JL, Pathak A. Impact of COVID-19 lockdown on adherence to continuous positive airway pressure (CPAP) by obstructive sleep apnoea patients. *Eur Respir J* 2020; 2001607. doi: 10.1183/13993003.01607-2020.



**Figure.**

**Figure 1.** Distribution throughout France of OSA patients on CPAP treatment who responded to the online survey. The inset is the Paris region. The departments (counties) with the largest numbers of patients include other large agglomerations: Bordeaux in the south-west and Lyon in the south-east.

