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**DOI**

[10.1016/j.sleep.2020.09.029](https://doi.org/10.1016/j.sleep.2020.09.029)

**Publication date**

2020

**Document Version**

Final published version

**Published in**

Sleep Medicine

**License**

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[Link to publication](#)

**Citation for published version (APA):**

Kocevska, D., Blanken, T. F., Van Someren, E. J. W., & Rösler, L. (2020). Sleep quality during the COVID-19 pandemic: not one size fits all. *Sleep Medicine*, 76, 86-88. <https://doi.org/10.1016/j.sleep.2020.09.029>

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## Brief Communication

## Sleep quality during the COVID-19 pandemic: not one size fits all

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## ARTICLE INFO

## Article history:

Received 13 July 2020

Received in revised form

3 September 2020

Accepted 29 September 2020

Available online 8 October 2020

## Keywords:

Insomnia

Sleep quality

COVID-19

Affect

Worry

## ABSTRACT

**Background:** The COVID-19 pandemic imposes a long period of stress on people worldwide and has been shown to significantly affect sleep duration across different populations. However, decreases in sleep quality rather than duration are associated with adverse mental health effects. Additionally, the one third of the general population suffering from poor sleep quality was underrepresented in previous studies. The current study aimed to elucidate effects of the COVID -19 pandemic on sleep quality across different levels of pre-pandemic sleep complaints and as a function of affect and worry.

**Method:** Participants (n = 667) of the Netherlands Sleep Registry (NSR) were invited for weekly online assessment of the subjective severity of major stressors, insomnia, sleep times, distress, depression, and anxiety using validated scales.

**Analysis:** To investigate the overall impact of the COVID-19 pandemic on the sleep quality of people with and without a history of insomnia, we performed a mixed model analysis using pre-pandemic insomnia severity, negative affect, and worry as predictors.

**Results:** The effect of COVID -19 on sleep quality differs critically across participants, and depends on the pre-pandemic sleep quality. Interestingly, a quarter of people with pre-pandemic (clinical) insomnia experienced a meaningful improvement in sleep quality, whereas 20% of pre-pandemic good sleepers experienced worse sleep during the lockdown measures. Additionally, changes in sleep quality throughout the pandemic were associated with negative affect and worry.

**Conclusion:** Our data suggests that there is no uniform effect of the lockdown on sleep quality. COVID-19 lockdown measures more often worsened sleep complaints in pre-pandemic good sleepers, whereas a subset of people with pre-pandemic severe insomnia symptoms underwent a clinically meaningful alleviation of symptoms in our sample.

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The lockdown measures in response to the COVID-19 pandemic have caused unprecedented changes in human behavior worldwide. Sleep is a physiological process which highly depends on environmental and social cues, and varies substantially with levels of stress [1]. Conceivably, environmental and social changes introduced by the pandemic were shown to affect sleep timing and duration in several recent studies across different populations [2–5]. However, self-reported poor sleep quality rather than short sleep duration carries the strongest risk for adverse health

consequences [6]. Moreover, most sleep studies on lockdown consequences included populations with few pre-pandemic sleep complaints, and underrepresent approximately one third of the general population with poor sleep quality, and 10% who fulfill the criteria of persistent insomnia disorder. In the current large-scale study, we therefore recruited a population with a balanced representation of good and poor sleepers, and focused on perceived sleep quality [as indicated by the insomnia severity index (ISI) [7], where higher scores indicate worse sleep quality]. We collected weekly logs of sleep and mood during an average of  $3.3 \pm 1.7$  weeks of the lockdown. Participants further retrospectively indicated their sleep quality prior to the pandemic (retrospectively assessed for February 2020). A subset of participants (n = 413, 61.9%) completed reports on their self-perceived sleep quality prior to the pandemic (data collected between May 2012 and December 2019). We found that there is no uniform effect of the lockdown on perceived sleep

The work was funded by NWA Startimpuls Royal Netherlands Academy of Arts and Sciences 2017 Grant (AZ/3137) and by the European Research Council grant ERC-2014-AdG-671084 INSOMNIA.

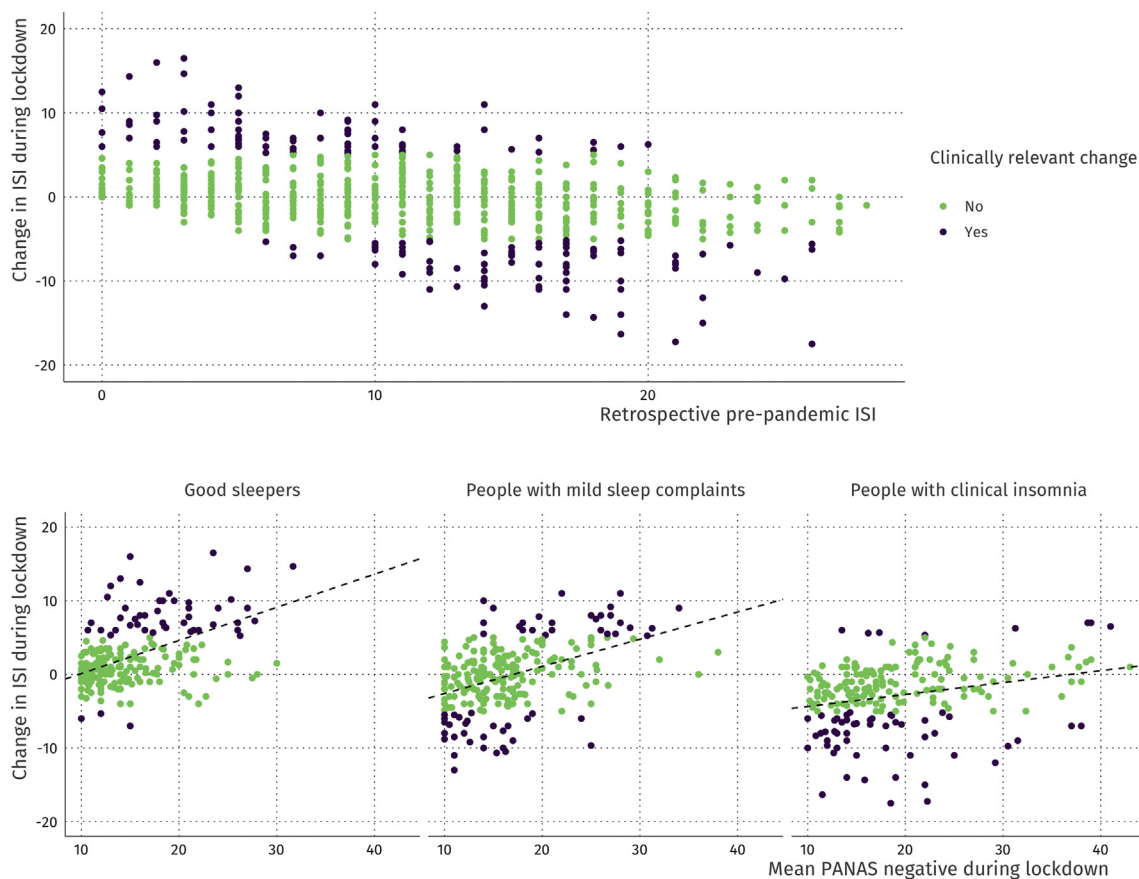
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<https://doi.org/10.1016/j.sleep.2020.09.029>

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**Fig. 1. Association between retrospective pre-pandemic insomnia severity and changes in sleep during the COVID-19 pandemic.** Clinically meaningful changes absolute difference  $\geq 6$  points [7]; are shown in dark purple, whereas non-meaningful changes are coloured green. The lower panel shows the relationship between the mean negative affect during the pandemic and changes in sleep separately for pre-pandemic good sleepers, people with mild sleep complaints, and people with (clinical) insomnia. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

quality. Marked individual differences in individual response to the lockdown would have been overlooked by simply calculating a whole-sample mean change. The lockdown on average worsened sleep in people that were previously good sleepers. In contrast, one out of four people with pre-pandemic clinical insomnia experienced a meaningful sleep improvement. Additionally, we observed that variability in self-reported sleep quality during lockdown was associated with changes in negative affect and worry.

Participants completed the Insomnia Severity Index (ISI; range 0–28) on their perceived sleep quality. Of the 667 participants in the current study, 221 (33.1%) were good sleepers (ISI scores 0–7), 233 (34.9%) had mild sleep complaints (ISI scores 8–14), and 213 (31.9%) had clinical insomnia (ISI scores 15–28) before the pandemic [7]. We inspected whether self-reported sleep quality changed meaningfully during the lockdown, where we defined meaningful change as a minimum of six-point absolute change as suggested by Yang et al. [8]. Weekly assessments during the lockdown (March 15th 2020 onwards) revealed a meaningful change in 169 (25.3%) of the participants, which occurred equally often in all three groups [ie, 51, 57, and 61, respectively;  $\chi^2(2) = 1.92, p = 0.38$ ; Fig. 1A]. However, the direction of change differed [ $\chi^2(2) = 73.03, p < 0.001$ ], such that the majority of changing pre-pandemic good sleepers experienced worsening of sleep quality, whereas the majority of people with prepandemic clinical insomnia who experienced sleep changes most often experienced sleep improvement. In interpreting the direction of change it is important to highlight that following our definition of meaningful change, people that already

slept good before the pandemic (ie, an ISI score below six) or people that slept very poorly before the pandemic (ie, an ISI score above 22) could only experience meaningful change in one direction. Nevertheless, 84% of the people with pre-pandemic clinical insomnia had a pre-pandemic ISI score of 22 or less, allowing them to have meaningful change in sleep quality in both directions (See Fig. 1). Despite the possibility to either worsen or improve in sleep quality, of the people with pre-pandemic clinical insomnia who changed meaningfully, 86.9% showed an improvement in sleep quality.

Overall, the COVID-19 pandemic has been reported to negatively affect mental health [9–11]. It was therefore surprising to find that the lockdown elicited a clinically meaningful sleep improvement in a quarter of the people that suffered from insomnia prior to the lockdown whereas previous studies reported no changes [4,12] or a slight decrease [2,3] in sleep quality during the COVID-19 pandemic. However, the implications of the lockdown are not the same for everyone and differential emotional responses, including attenuation of negative affect [13], towards the pandemic have been reported [2,14]. Since individual differences in experiences and attitudes throughout the pandemic might be best captured in negative affect (eg “irritable”, “nervous”, “distressed”) and worry, we investigated whether these are related to the observed changes in sleep. In our sample, negative affect and worry significantly predicted sleep quality throughout the pandemic. Specifically, pre-pandemic good sleepers who had experienced a stronger worsening of sleep also experienced more negative affect during the

lockdown (Fig. 1, lower panel left). Likewise, people with pre-pandemic clinical insomnia who experienced a stronger amelioration of insomnia experienced less negative affect during the lockdown (Fig. 1, lower panel right).

In conclusion, we found profound individual differences in the effect of the lockdown measures on perceived sleep quality. Importantly, this effect could go both ways: some people experienced improved sleep quality whereas others experienced worsened sleep quality during the pandemic. We further observed that the severity of negative affect and worry experienced during the “intelligent lockdown” was related to the change in perceived sleep quality. An improved understanding of this interplay may ultimately inform strategies to alleviate sleep problems and deteriorating mental health.

#### CRediT authorship contribution statement

**Desana Kocavska:** Conceptualization, Data curation, Writing - original draft. **Tessa F. Blanken:** Conceptualization, Data curation, Formal analysis, Writing - original draft. **Eus J.W. Van Someren:** Conceptualization, Writing - review & editing, Supervision. **Lara Rösler:** Conceptualization, Data curation, Formal analysis, Writing - review & editing.

#### Acknowledgments

We would like to thank Tom Bresser, Oti Lakbila-Kamal, Stefanie Hölsken, Glenn van der Lande, Jeanne Leerssen, Joyce Reessen and Laura Vergeer for their help with the study preparation.

#### Conflict of interest

The authors have no conflicts of interest to disclose.

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.2020.09.029>.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.sleep.2020.09.029>.

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