Poor sleep increases severity of viral respiratory infections including COVID-19

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A new study posted to the preprint server *medRxiv** explores the risk of respiratory infection with poor sleep in the context of the ongoing coronavirus disease 2019 (COVID-19) pandemic.

Study: The Public Health Impact of Poor Sleep on Severe COVID19, Influenza and Upper Respiratory Infections. Image Credit: SB Arts Media / Shutterstock.com

Introduction

Earlier studies have shown that poor sleep is linked to many different conditions, including inflammation and viral infections. With the acute loss of sleep, the levels of circulating cytokines such as interleukin-6 (IL-6) and C-reactive protein (CRP) are increased. Vaccine responses may also be delayed by

insomnia; however, this may be a transient effect.

Chronic sleep loss has been linked with more serious effects, including higher all-cause death rates and viral infections, as well as up to a 30% increased risk of respiratory infections. These effects of sleep loss could be due to chronic inflammation induced by long-term insomnia, thus leading to a lower immune response and, as a result, increased severity of infections.

During the COVID-19 pandemic, several reports have suggested that some people experienced even less sleep, had nightmares and changes in their body rhythms as a result of quarantines, altered life and work routines, and higher stress levels. Post-COVID sequelae are also associated with poor sleep.

Some researchers suggested that shift work disrupts daily rhythms of sleep and activity, as well as metabolic rhythms, causing an increased susceptibility to COVID-19. The current study focuses on the causal association between sleep and respiratory infections.

Study findings

In two large population-based cohorts, a diagnosis of insomnia was associated with a significantly increased risk of either influenza or upper respiratory infection (URI). These results come from a follow-up of over 25 years and should, therefore, not be dismissed.

In the FinnGen group, the risk of developing a URI or the flu was almost three and five times higher, respectively, after a diagnosis of insomnia in the past. COVID-19 incidence was not significantly increased, however. With the U.K. Biobank data, the risk of URI and flu was increased by about half after an insomnia diagnosis.

The significant discrepancy in risk increase between the two studies could be due to the difference in the way the records were maintained. With FinnGen, only hospital records were used, which implies more severe cases of insomnia. In contrast, the U.K. Biobank data included both primary care and hospital inpatient diagnoses.

The Mendelian randomization (MR) analysis is a form of genetic epidemiology that is used to provide information about how a given exposure is causally

related to an outcome through genetic variants that are already known to be linked to the exposure. Using this valuable tool, the researchers of the current study found a strong causal link between the risk of influenza, URI, and COVID-19 hospitalization and severity, as well as a smaller increase in the risk of being infected with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

Insomnia was found to be a risk factor for severe COVID-19 symptoms, with a 64% increase in risk and an approximately 50% greater risk of hospitalization for COVID-19. A history of insomnia also increased the risk of influenza and URI by about 70% each. However, some confounding factors may also contribute to COVID-19 severity and hospitalization and were not evaluated by the analysis.

Habitually sleeping less than six hours a night was also a risk factor for COVID-19 but not for hospitalization risk, influenza, or URI. The current study was underpowered, which means that only a doubling of the risk for severe COVID-19, or an increase by 60% in COVID-19 hospitalization risk, could have been detected with these numbers.

Similarly, increases in the risk of COVID-19, influenza, and URIs by over 25%, 135%, and 57%, respectively, would be detectable. Thus, there could be a significant association that must be further analyzed in studies that are adequately powered for these outcomes.

Implications

The findings from the current study are similar to previous reports, thereby suggesting that sleep affects immune function and, as a result, reduces the antiviral response and promotes more severe infection. Some of the observed changes in this study that occurred as a result of sleep deprivation included increased levels of inflammatory chemicals and markers.

In contrast to simply observing associations between sleep disruption and respiratory infections, which could be bidirectional, the current study showed that chronic insomnia is indeed a contributory cause for infections. However, the strongest degree of association was with severe COVID-19, rather than with SARS-CoV-2 infection, despite the fact that the study was powered for the latter.

The scientists attributed this observation to the modulatory effect of sleep in increasing the severity of infection rather than causing infection. Notably, other factors associated with the respiratory infection including body mass index, obstructive sleep apnea, and hyperglycemia were also not considered in the current study. This agrees with the increased levels of inflammatory markers in severe COVID-19 patients, rather than those experiencing mild COVID-19.

Secondly, insomnia and COVID-19 incidence/severity are increased in poor populations, certain ethnic groups, specific occupations, and with age, as well as in males. Thus, the uneven distribution of these factors could reflect the increased severity of infection in this group.

Finally, the factors that affect insomnia may themselves also affect the risk of respiratory infection. Since low oxygen levels in the blood and short sleep duration are potential risk factors for inflammation that are also linked to insomnia and obstructive sleep apnea, these factors could also have separate biological effects that increase the risk of respiratory infections.

> *“These findings highlight the role of sleep in maintaining sufficient immune response against pathogens. As the current COVID-19 pandemic has increased the number of people suffering from poor sleep, safe interventions such as sleep management and treating insomnia could reduce infections and save lives.”*

*Important notice

medRxiv publishes preliminary scientific reports that are not peer-reviewed and, therefore, should not be regarded as conclusive, guide clinical practice/health-related behavior, or treated as established information.

Journal reference:

- Jones, S. E., Maisha, F. I., Strausz, S. J., *et al.* (2022). The Public Health Impact of Poor Sleep on Severe COVID19, Influenza and Upper Respiratory Infections. *medRxiv.* doi:10.1101/2022.02.16.22271055. https://www.medrxiv.org/content/10.1101/2022.02.16.22271055v1.

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