



Does Viral Anxiety Influence the Insomnia Severity Among Patients With Insomnia Disorder During COVID-19 Pandemic?

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Background and Objective We aimed to investigate whether viral anxiety affects insomnia severity in patients with insomnia disorder during the coronavirus disease 2019 (COVID-19) pandemic. In addition, we examined whether viral anxiety mediates the influence of dysfunctional beliefs about sleep on insomnia severity.

Methods The medical records of 111 patients who visit the sleep clinic from September 2021 to May 2022 were reviewed. Patients' symptoms were rated with rating scales including Insomnia Severity Index (ISI), Stress and Anxiety to Viral Epidemics-6 items (SAVE-6), Dysfunctional Beliefs and Attitudes about Sleep-16 items (DBAS-16), Patient Health Questionnaire-9 items (PHQ-9), Epworth Sleepiness Scale, and discrepancy between desired time in bed and desired total sleep time (the DBST index).

Results The SAVE-6 score was not significantly correlated with ISI score among insomnia patients. Linear regression analysis showed that the ISI score was expected by PHQ-9 ($\beta = 0.21$, $p = 0.038$) and DBAS-16 ($\beta = 0.42$, $p < 0.001$). Mediation analysis showed that viral anxiety did not mediate the influence of dysfunctional beliefs about sleep on insomnia severity.

Conclusions We could not observe the mediating effect of viral anxiety on the association between dysfunctional beliefs about sleep on insomnia severity. Though COVID-somnia was one of big issues in this COVID-19 pandemic, the influence of virus on the severity of insomnia among insomnia patients needs to be interpreted cautiously.

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Keywords COVID-19; Insomnia; Anxiety; Stress; Sleep.

INTRODUCTION

Coronaviruses are a large family of viruses that can cause acute respiratory tract infections [1]. So far, 3 coronaviruses have caused pandemics in the 21 century: severe acute respiratory syndrome coronavirus (SARS-CoV-1), Middle East respiratory syndrome-related coronavirus (MERS-CoV), and SARS-CoV-2 which causes coronavirus disease 2019 (COVID-19) [1]. COVID-19 initially emerged in Wuhan, China in December 2019, and WHO declared it a pandemic [2]. Since then, it has created a plethora of challenges ranging from virus confinement, detection, and prevention to vaccine development [3].

Insomnia and Viral Anxiety During COVID-19 Pandemic

Insomnia is a major sleep disorder that may impact people's quality of life. COVID-19 pandemic has influenced the lifestyle behavior of people worldwide and thus can impose stress on many aspects of health including sleep hygiene [4]. Sleep disturbances during the COVID-19 pandemic are referred to as COVID-somnia [5]. There have been health and mental health problems associated with this ongoing virulent pandemic, as well as depression and anxiety due to the fear of contamination at societal levels as well as economic, financial, and health crises. As a result, uncontrollable cognitive arousal is one of the major causes of anxiety, as well as disruptions in circadian rhythm [6].

During the COVID-19 pandemic, a relation between insomnia and viral anxiety has been explored by a number of conducted studies [7-9]. Anxiety and depression, as known, are related to insomnia symptoms, and according to that fact, experiments and studies had been done during the pandemic and ended up finding that viral anxiety is an important predictor of insomnia. Due to the COVID-19 pandemic, more people are likely to suffer from sleep disturbances, especially those who fear direct contact with COVID-19-infected people or are uncertain whether they will contract the virus.

This leads to a higher level of stress, anxiety and depression in those individuals. Higher levels of insomnia and anxiety have been reported in distinct categories of people: university students [10], healthcare workers [11], and cancer patients [12]. Notably, cancer patients exhibited a greater degree of functional impairment resulting from anxiety, which was compounded by their dysfunctional beliefs about sleep [13]. Given the link between anxiety, sleep disorders, and increased susceptibility to infections during the pandemic, it is crucial to comprehend the mediating effect of insomnia on anxiety symptoms.

Dysfunctional Beliefs About Sleep, Viral Anxiety, Insomnia During COVID-19 Pandemic

Dysfunctional beliefs about sleep are exaggerated perceptions and negative thoughts in people that worry excessively about getting enough sleep and how their sleep disturbance will affect their health and/or daytime functioning [14]. Various studies have delved into the relationship between sleep-related dysfunctional beliefs and insomnia and speculated that these beliefs contribute to the severity of insomnia symptoms [15]. These sleep-related cognitions tend to generate emotional distress that enhances arousal and the perpetuation of the insomnia cycle [16]. This mediating role of the dysfunctional beliefs shed the light on the importance of cognitive behavioral therapy as a component of psychological interventions for insomnia.

COVID-19 pandemic had a lot of impact on the general population's lifestyle. The restrictions due to the lockdown had increased the sedentary behavior and gave rise to a typical lifestyle that might be stressful to some people and thus affected their

sleeping patterns. Therefore, it is no wonder that COVID-19 pandemic changed several qualities of sleep such as lower sleep efficiency, more trouble sleeping, or sleep disturbances. And also influenced people's perceptions of these qualities [17]. The increase in concern about sleep qualities lead to the exacerbation of dysfunctional beliefs towards sleep which, as expected, correlated strongly with a higher level of disordered sleep. These unhelpful beliefs and unrealistic expectations about how much sleep they need and the impact of their sleeping on their daytime functioning and their health played a significant role in worsening their sleep during the lockdown and contributed to maintaining the vicious cycle of insomnia.

We aimed, in this study, to explore whether viral anxiety affects insomnia severity in patients with insomnia disorder during the COVID-19 pandemic. Furthermore, we tried to explore whether viral anxiety mediates the association between dysfunctional beliefs about sleep and insomnia severity. We hypothesized that 1) viral anxiety will be positively related to insomnia severity, 2) dysfunctional beliefs about sleep will be positively associated with insomnia severity, and 3) viral anxiety will at least partially mediate the influence of dysfunctional beliefs about sleep on insomnia severity among patients with insomnia disorder.

METHODS

We conducted this study based on a retrospective medical record review among patients who visited the Sleep Clinic in Asan Medical Center for insomnia complaints. We reviewed medical records of all 111 patients from September 2021 to May 2022. From subjects' medical records, participants' age, sex, comorbid sleep complaints, and comorbid psychiatric diagnoses were collected. In addition, symptom rating scales scores and sleep indexes such as desired total sleep time and desired time in bed were collected. The study protocol was approved by Asan Medical Center's Institutional Review Board (2022-0746), and the obtaining of the written informed consent was waived.

Symptoms Assessment

Insomnia Severity Index

The Insomnia Severity Index (ISI) is a self-rating scale that can assess insomnia severity [18]. A higher total score of 7 items of ISI reflects a severe degree of insomnia. We applied the Korean version of ISI [19] in this study, and Cronbach's alpha among this sample was 0.885.

Stress and Anxiety to Viral Epidemics-6 items

The Stress and Anxiety to Viral Epidemics-6 items (SAVE-6) is a self-rating scale that can assess an individual's severity of viral anxiety [20], which was derived from the SAVE-9 scale [21]. It consists of 6 items that can be rated on a 5-point Likert scale

ranging from 0 (never) to 4 (always). The higher total score reflects a high level of viral anxiety. The original Korean version of the scale was applied in this study, and Cronbach's alpha among this sample was 0.802.

Dysfunctional Beliefs and Attitudes about Sleep-16 items

The Dysfunctional Beliefs and Attitudes about Sleep-16 items (DBAS-16) is a self-rating scale that can assess an individual's level of dysfunctional beliefs about sleep [16]. The higher mean score of the DBAS-16 reflects a higher level of dysfunctional beliefs about sleep. The Korean version of the DBAS-16 was applied in this study [22], and Cronbach's alpha among this sample was 0.890.

Patient Health Questionnaire-9 items

The Patient Health Questionnaire-9 items (PHQ-9) is a self-rating scale that can assess the severity of depression [23]. It consists of 9 items which can be rated on a 4 point Likert scale ranging from 0 (not at all) to 3 (nearly every day). A higher total score reflects a severe degree of depression. In this study, the Korean version of PHQ-9 (www.phqscreener.com) was applied, and Cronbach's alpha among this sample was 0.882.

Epworth Sleepiness Scale

The Epworth Sleepiness Scale (ESS) was a self-rating scale that can measure one's severity of daytime somnolence [24]. It consists of 8 items which can be rated on a 4-point Likert scale ranging from 0 (would never doze) to 3 (high chance of dozing). A higher total score of the ESS reflects a severe degree of daytime somnolence. The Korean version of the ESS [25] was applied in this study, and Cronbach's alpha among this sample was 0.845.

Discrepancy between desired time in bed and desired total sleep time; the DBST index

We collected the information on desired total sleep time (TST) estimated based on the responses to the question "For what hours do you want to sleep a day?" and the desired time in bed (TIB) estimated based on the responses to the question "From what time to what time do you want to sleep?" The DBST index was calculated as [desired hours of TIB] - [desired hours of TST] [26].

Statistical Analysis

Demographic characteristics and rating scale scores are summarized as the mean and standard deviation. Two-tailed significance level was defined by a p-value of 0.05. Pearson's correlation coefficients were examined to explore the correlations among variables. Linear regression analysis was conducted to explore variables predicting insomnia severity. Finally, the bootstrap method with 2000 resamples was implemented to examine whether viral anxiety or other variables mediates the influence of dysfunctional beliefs about sleep on insomnia severity. The SPSS version 21.0, AMOS version 27 (IBM Corp., Armonk, NY,

USA), and Jamovi ver 1.6.23 (<https://www.jamovi.org>) software were used for statistical analysis.

RESULTS

All 111 clinical samples of insomnia patients' medical records were reviewed in this study. Among subjects, two-thirds (64.9%) were female, mean age was 58.7 ± 13.4 years old. Comorbid sleep complaints and psychiatric diagnosis were presented in Table 1.

The results of Pearson's correlation analysis showed that ISI was significantly correlated with PHQ-9 ($r = 0.45, p < 0.01$), DBAS-16 ($r = 0.49, p < 0.01$), and DBST index ($r = 0.21, p < 0.05$) (Table 2). The SAVE-6 score was significantly correlated with

Table 1. Clinical characteristics of the patients with insomnia disorder during COVID-19 pandemic

Variable	Value (n = 111)
Female sex	72 (64.9)
Age (yr)	58.7 ± 13.4
Comorbid sleep complaints	
Initiation insomnia	94 (84.7)
Maintenance insomnia	74 (66.7)
Insomnia & snoring or sleep apnea	19 (17.1)
Insomnia & restless legs syndrome	13 (11.7)
Insomnia & parasomnia	8 (7.2)
Comorbid psychiatric disease	
Insomnia disorder	80 (72.1)
Insomnia disorder & depression	18 (16.2)
Insomnia disorder & anxiety disorder	7 (6.3)
Insomnia disorder & adjustment disorder	4 (3.6)
Insomnia disorder & somatic symptom disorder	2 (1.8)
Symptoms rating	
ISI	16.6 ± 6.7
DBAS-16	5.2 ± 2.0
PHQ-9	9.6 ± 6.8
SAVE-6	10.5 ± 4.8
ESS	7.4 ± 5.1
Sleep indices	
Desired total sleep time (hr)	6.8 ± 1.2 (3.0–10.0)
Desired time in bed (hr)	7.4 ± 1.1 (5.0–11.0)
DBST index (hr)	0.6 ± 1.0 (-2.0–4.0)

Values are presented as number (%), mean \pm SD, or mean \pm SD (range).

ISI, Insomnia Severity Index; DBAS-16, Dysfunctional Beliefs and Attitudes about Sleep-16 items; PHQ-9, Patient Health Questionnaire-9 items; SAVE-6, Stress and Anxiety to Viral Epidemic-6 items; ESS, Epworth Sleepiness Scale; DBST index, discrepancy between desired time in bed and desired total sleep time.

DBAS-16 ($r = 0.21, p < 0.05$), and PHQ-9 score was significantly correlated with DBAS-16 ($r = 0.37, p < 0.01$).

Linear regression analysis with enter methods, conducted to explore which variables were associated with insomnia severity,

Table 2. Correlation coefficients of each variables in all participants

Variables	Age	ISI	SAVE-6	PHQ-9	DBAS-16	ESS
ISI	-0.16					
SAVE-6	0.17	0.12				
PHQ-9	-0.29 [†]	0.45 [†]	0.12			
DBAS-16	-0.10	0.49 [†]	0.21 [*]	0.37 [†]		
ESS	0.03	-0.06	-0.10	0.03	0.05	
DBST index	0.12	0.21 [*]	0.18	0.02	0.09	-0.02

* $p < 0.05$; [†] $p < 0.01$.

ISI, Insomnia Severity Index; SAVE-6, Stress and Anxiety to Viral Epidemic-6 items; PHQ-9, Patient Health Questionnaire-9 items; DBAS-16, Dysfunctional Beliefs and Attitude about Sleep-16 items; ESS, Epworth Sleepiness Scale; DBST index, discrepancy between desired time in bed and desired total sleep time

Table 3. Linear regression analysis predicting preoccupation with COVID-19

Dependent variables	Included parameters	β	p-value	Adjusted R ²	F, p-value
ISI	Age	-0.15	0.371	0.35	F = 9.21, p < 0.001
	SAVE-6	0.02	0.863		
	PHQ-9	0.21	0.038		
	DBAS-16	0.42	< 0.001		
	DBST index	0.17	0.061		
	ESS	-0.03	0.700		

ISI, Insomnia Severity Index; SAVE-6, Stress and Anxiety to Viral Epidemic-6 items; PHQ-9, Patient Health Questionnaire-9 items; DBAS-16, Dysfunctional Beliefs and Attitude about Sleep-16 items; ESS, Epworth Sleepiness Scale; DBST index, discrepancy between desired time in bed and desired total sleep time

showed that the ISI score was expected by PHQ-9 ($\beta = 0.21, p = 0.038$) and DBAS-16 ($\beta = 0.42, p < 0.001$) (Table 3).

Mediation analysis showed that dysfunctional beliefs about sleep directly influenced insomnia severity, and depression partially mediated the association. However, viral anxiety did not mediate the association (Table 4 and Fig. 1).

DISCUSSION

We observed that insomnia severity was significantly correlated with depression, dysfunctional beliefs about sleep, and the DBST index. Viral anxiety and depression were significantly correlated with dysfunctional beliefs about sleep. Linear regression predicted that insomnia severity was expected by depression and dysfunctional beliefs about sleep, but not by viral anxiety. Dysfunctional beliefs about sleep directly influenced insomnia severity, and depression partially mediated the association. However, viral anxiety did not mediate the association.

We hypothesized that viral anxiety will be positively related to insomnia severity among clinical samples of insomnia disorder patients. Sleep disorders as a result of the COVID-19 pandemic are described as “coronasomnia” [27] or “COVID-somnia” [5]. However, we could not observe the association between insomnia severity and viral anxiety among patients with insomnia disorder. First, the severity of insomnia was already high in this sample regardless of viral anxiety. In our previous study which was conducted among the general population [26], the mean score of ISI was 10.5 ± 5.7 and ISI score was significantly correlated with SAVE-6 score ($\rho = 0.31, p < 0.01$). However, the mean score of the current study was 16.6 ± 6.7 . Insomnia patients complained of severe degree of insomnia symptoms regardless of their viral anxiety level, and it may result in the lack of association. Another possible explanation is that we can consider that patients might adjust to viral anxiety, as pandemic

Table 4. The results of direct, indirect, and total effects on mediation analysis

Effect	Standardized estimator	S.E.	Z-value	p-value	95% CI
Direct effect					
DBAS-16 → ISI	0.37	0.02	4.18	< 0.001	0.04 to 0.11
Indirect effect					
DBAS-16 → PHQ-9 → ISI	0.12	0.01	2.74	0.006	0.01 to 0.04
DBAS-16 → SAVE-6 → ISI	0.01	< 0.001	0.24	0.808	-0.01 to 0.01
Component					
DBAS-16 → PHQ-9	0.37	0.02	4.04	< 0.001	0.04 to 0.12
PHQ-9 → ISI	0.32	0.09	3.74	< 0.010	0.15 to 0.49
DBAS-16 → SAVE-6	0.21	0.01	2.19	0.029	0.01 to 0.06
SAVE-6 → ISI	0.02	0.12	0.25	0.807	-0.20 to 0.26
Total effect					
DBAS-16 → ISI	0.49	0.02	5.72	< 0.001	0.07 to 0.14

S.E., standard error; CI, confidence interval; ISI, Insomnia Severity Index; SAVE-6, Stress and Anxiety to Viral Epidemic-6 items; PHQ-9, Patient Health Questionnaire-9 items; DBAS-16, Dysfunctional Beliefs and Attitude about Sleep-16 items

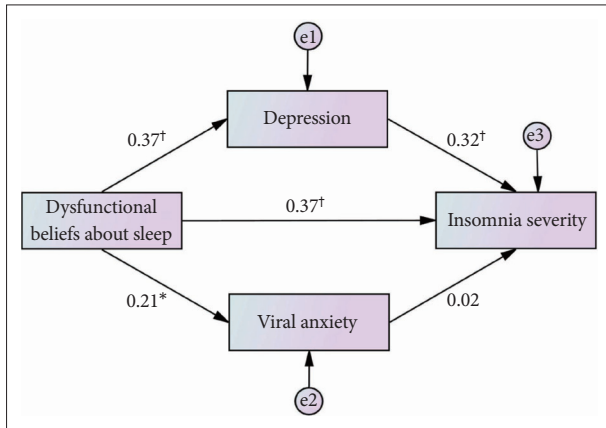


Fig. 1. Mediation model showing that the effect of dysfunctional beliefs about sleep (independent variables) on insomnia severity (outcome) is mediated by depression but not by viral anxiety (mediator). * $p < 0.05$; [†] $p < 0.01$.

goes by. It was reported that people reported better sleep quality in the second wave of the pandemic compared to the first wave [28]. In a prospective cohort study, the prevalence of insomnia was significantly decreased from 52.8% at baseline to 32.2% at follow-up [29].

We also hypothesized that viral anxiety will at least partially mediate the influence of dysfunctional beliefs about sleep on insomnia severity. In our previous study, we observed a clue for the relationship between viral anxiety and dysfunctional beliefs about sleep [30]. Among cancer patients, cancer-related dysfunctional beliefs about sleep mediated the association between viral anxiety and fear of progression [30]. And also, we observed that the effects of viral anxiety on functional impairment of cancer patients were mediated by cancer-related dysfunctional beliefs about sleep [13]. Based on the results, we hypothesized that viral anxiety may influence the effect of dysfunctional beliefs about sleep of insomnia patients on their insomnia severity. However, we could not observe the mediation effect of viral anxiety on the association among patients with insomnia disorder.

In our previous study, we observed that viral anxiety was not one of main expecting variables for insomnia severity among the general population [26]. And also, a study reported that infection anxiety did not affect sleep problems among adolescents. It might come from that other factors such as dysfunctional beliefs about sleep or depression rather than viral anxiety were important factors for insomnia severity. In this pandemic, viral anxiety definitely influenced sleep problem among various population. However, it needs to be considered that other psychological factors (for example, depression [31]) are also important contributing symptom for insomnia.

This study has several limitations. First, this study was a retrospective medical records review study, and the data were collected over a long time; September 2021 to May 2022. In South Korea, the infected cases abruptly increased from January to June 2022 up to 400000 cases per day compared to less than 10000

cases per day from September to December 2021. The timeframe and difference in infected cases between 2021 and 2022 should be considered when we interpret this results of study. Second, we applied the SAVE-6 scale as a viral anxiety assessment tool in this study, and we should consider that selecting a certain rating scale may influence the lack of relationship between viral anxiety and insomnia severity. We confirmed that the SAVE-6 scale can be applied to the general population with a good reliability and validity [20]. However, the reliability and validity of the SAVE-6 were not confirmed among clinical sample of insomnia patients. Third, sample size was small, and the result cannot be generalizable to whole population.

In conclusion, we tried to examine the mediating effect of viral anxiety on the influence of dysfunctional beliefs about sleep on insomnia severity among insomnia patients, but we could not observe it. Though COVID-somnia was one of big issues in this COVID-19 pandemic [5], the influence of virus on the severity of insomnia among insomnia patients needs to be interpreted cautiously.

Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Author Contributions

Conceptualization: Jana Sleiman, Seockhoon Chung, Omer Faruk Uygur. Data curation: Eulah Cho, Dongin Lee, Inn-Kyu Cho, Seockhoon Chung. Formal analysis: Jana Sleiman, Seockhoon Chung. Methodology: Seockhoon Chung. Project administration: Seockhoon Chung. Writing—original draft: all authors. Writing—review & editing: all authors.

Conflicts of Interest

Seockhoon Chung, a contributing editor of the *Sleep Medicine Research*, was not involved in the editorial evaluation or decision to publish this article. All remaining authors have declared no conflicts of interest.

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